UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

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PREFACE

TO THE SERIES OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

Information and scientific knowledge are the most important strategic resources of mankind progress on the eve of the third millenium. Informatization of education is a key condition for increasing the role and the influence of intellectual activities in transition of the world society from industrial to information era. This explains attention that is being given in the last years by governments, national and international organizations to the use of new information and communication technologies (NITs) in education.

In accordance with resolution 1.18 of the 27th Session of the General Conference (October-November 1993), the 2nd International Congress on Education and Informatics was organized and held by the UNESCO in cooperation with the Government of the Russian Federation. The key topic in the work of this Congress was *policy in the educational area and new technologies.*

The 1st UNESCO Congress "Education and Informatics", held in Paris in 1989 and focused on *Strengthening of international cooperation* in this field, underlined the need for *"using collective experience and joint exploitation of limited resources in the sphere of new information tecnologies in education".* As a consequence, expansion of international cooperation was recommended in this area.

In the letter about the 2nd Congress, disseminated by the UNESCO head-quarter in January 1996, the UNESCO General Director F. Mayor pointed out that considerable progress achieved in the last few years in information and communication technologies resulted in a quick change of computer hardware and software generations and their merging, in an innovatory manner, with other technologies. As a result, unprecedented combinations of information facilities have emerged, which have led to the formation of "information community". The appearance of "information supermains" calls for the critical revision of the state of the art and perspectives of development of education systems, which is particularly needed due to the leading development of technologies as compared to the possibilities of their application in education of all levels.

No country, even that with the most advanced education system, is able alone to cope effectively with problems involved in education at the threshold of the 21st century. The UNESCO Congress contributed to the development of international contacts in the education sphere, as well as correction and coordination of national education systems. The main topic of the Congress was *the problem of national and international policy in the field of education based on new information technologies and the choice of organizational and technological forms of implementation of this policy.*

The modern strategy in education is being built with regard for new educational technologies and legal and legislative principles which form the basis for particular decisions and results. As a consequence, the word "education" in the Congress name was put at the first place.

Since the organizers of the Congress proceeded from the priority of education, it is not by accident that Russia, with its internationally recognized achievements in education, was chosen as a country to hold the Congress. At the Moscow Congress Russia represented not only the country-organizer of this global meeting, but also one of the most advanced countries in the field of education and application of new technologies for education development.

The Moscow Congress was preceded by great organizational work related, in particular, to the determination of the team of participants and observers, invited lecturers to appear at plenary sessions and commission meetings, and preparation of reports and abstracts.

The Congress became an extraordinary event in the life of the world society, an international forum for discussing and solving the problems of education and informatics, which will determine in many respects the pathways of mankind in the 21st century. At the same time, it became a marked event in the life of Russia and the Russian education system and an important step on the road to integration of the world education systems.

More than 1200 representatives of governments, science and business from many countries, specialized UN institutions, government and non-government international organizations took part in the Congress. Researchers, professors and lecturers from educational institutions, representatives of industry, experts on informatics and communications engaged in using NITs in education were among the participants of the Congress.

The plenary sessions, commission meetings, and seminars of practical education were devoted to analysis of national, regional, and international achievements and experience in introducing and using NITs in education systems. New developments in the sphere of NITs and their use in education systems were examined; international, regional and national policies in the use of NITs in the education sphere were discussed, and recommendations for international cooperation were given. Success of the Moscow Congress helped to reach the agreement between the UNESCO and Russia on joint work in organization and development of two important institutions - the World Technological University and the UNESCO Institute for Information Technologies in Education.

The work of the Congress was conducted under the program and along the lines suggested by the International Program Committee (IPC) and the Russian Organizing Committee (ROC).

Each day of the Congress work started with a plenary session at which the invited lecturer made the main report on the predetermined theme. This main report was followed by other reports in three Commissions where the following basic themes were discussed:

- *Commission I:* Trends and experiences in the introduction and application of ICTs in education systems;
- *Commission II:* Latest developments in ICTs in education;
- *Commission III:* Cooperation for the use ICTs in education.

Outstanding scientists - experts in education and informatics - were chosen by the UNESCO as the Chiefs of Commissions: Director of Higher School of Foreign Languages Katerina Martcheva (Bulgaria); President of the French National Commission on Intergovernment Programs on Informatics Pierre Mathelot (France); Coordinator of the UNDP/UNESCO project, representative of the Computerized Information Systems Co., Dr. Mohamed Noor Burhan (Syria). Prominent scientists and specialists from many countries were invited to participate in discussions.

The following topics were discussed at the Commission meetings:

- *Policy:* Development of national plans, strategies for changes on the level of educational institutions, strategies for developing perspective plans and programs;
- *Technologies:* Informatics, computerized education, and "traditional" education technologies, multimedia and telematics;
- *Teachers:* Modern practice in using new technologies, training and improvement of professional skill of teachers, their new role in education;
- *Students:* Educational facilities, new role of students, new education methods in educational institutions;
- *Social, economic, and cultural aspects* of using new information technologies;
- *Through themes:* Permanent, open, and distant education; estimation of the influence of NITs; the UNESCO and international cooperation.

It should be noted that the priorities of the above-listed topics have been changed in the course of discussion of these topics: the problems of using NITs by students and teachers were put at the first positions; the second place was given to the development and application of education technologies; social, economical, and cultural aspects of the problem moved to the third place; and the fourth position was given to strategy in the sphere of education and new technologies. Of all through themes only those relating to international cooperation were left because the remaining questions could be effectively treated as part of other themes. As a result, in the Congress Recommendations the themes were arranged in the following order:

- *Theme 1:* Students;
- *Theme 2:* Teachers;
- *Theme 3:* Technologies;
- *Theme 4:* Social, economic, and cultural issues;
- *Theme 5*: Educational Policies;
- *Theme 6:* International Cooperation.

This order was also followed in preparation of the Congress Proceedings for publication.

Along with plenary sessions and commission meetings, 12 seminars of practical education were held at the Congress. Their participants discussed the following topics:

- Information super high way and education (*Part I:* Perspectives and issues of development of worldwide and regional unified information systems for education; *Part II:* From information literacy toward information culture);
- Psychological and pedagogical effects and medical implications of using modern information and communication technologies;
- Program environment: perspectives of active use;
- Knowledge and experience transfer with the use of information and telecommunication technologies;
- National policies in the sphere of technological transfer;
- Individual distant education;
- Analysis of UNESCO/IFIP (International Federation for Information Processing) documents published in 1994-1995 (*Part I:* Informatics for secondary education; *Part II:* Module educational program on informatics);
- Logic, informatics, and education;
- Information technologies and humanitarian education;
- Development of primary and secondary education with the use of modern information technologies and distant education methods;
- Medicine: new approach to gaining and improving knowledge;
- Formation of integrated worldwide database systems and knowledge on planets of the Solar system and their use in research works and education.

The chiefs of seminars were well-known scientists, teachers, and organizers of education. Among them were: David Walker (Great Britain), adviser; Peter Waker (South Africa), adviser in the Interware Co.; Alain Meyer (France), Director of the Teleeducation Center of the National Conservatorium of Arts and Skill; Tom van Weert (the Netherlands), Director of the School of Informatics at the Mathematics and Informatics Department of the University of Nijmegen; Harald Schütz (Germany), researcher in the Deutsche Welle Internet Co.; K.K. Kolin (Russia), First Vice-Director on Science in the Institute of Informatics, RAS; Yu.N. Afanasiev (Russia), Rector of the Russian State University of Humanities; A.L. Semenov (Russia), Vice-Chairman of the Moscow Education Department, Head of the Moscow Institute for Improvement of Professional Skill of Education Specialists; N.N. Evtikhiev (Russia), Rector of the Moscow Staten Institute of Radio Engineering, Electronics and Automation; Yu.I. Ivlev (Russia), Head of the Logic Department of the Philosophical Faculty of the Moscow State University.

The directions of work of the Moscow Congress and topics listed above show how extensive and diverse was the spectrum of problems examined at the Congress, while the names of the Commission and Seminar Chiefs and participants of discussions indicate its high scientific, political and organizational level.

In parallel to the Congress, the International Exhibition - Fair was organized where the most recent exhibits in the area of new information technologies were shown: training systems, education and methodical complexes, multimedia technologies, programs and courses for distant education, telecommunication facilities and technologies of global computer networks, information filling of servers, etc. 80 educational organizations and 24 firms, including leading computer companies such as IBM, Apple, Novell, Oracle, Informix, took part in the exhibition. It demonstrated the efficiency of using NITs in education and high rate of NIT development in Russian institutes of higher education.

The 2nd International Conference on Distant Education (under the title "Open and Distant Education - Strategy of Development" was confined to the Moscow UNESCO Congress. It was organized by the International Education Association and the International Council on Distant Education and supported by the Higher Education State Committee and the Russian Ministry of Science and Technoly Policy. The main objective was to discuss the role of distant education in modern society and the main trends in its development.

The time of the Congress work coincided with the 50-year anniversary of manufacturing the first computer. The international symposium "50 years of information era" held simultaneously with the Moscow Congress was devoted to this remarkable event. This symposium was organized by the Pennsylvania university (the USA), The International Trustee Foundation of the Tsiolkovskii State University of Aviation Technology, the Russian Academy of Sciences, the State Committee for Higher Education, and the Information Policy Committee with the President of the Russian Federation. Participants of this symposium discussed a 50-year history of informatization and the use of information systems in education, industry, aerospace technology, and in the life of various countries.

All above-listed undertakings allowed participants of the Congress, in spite of rather dense schedule, to become acquainted with latest achievements of various countries, including Russia, in the fields to which the Congress was devoted - education and informatics in their interplay.

A great many documents, reports, communications, abstracts, and other materials worked out and obtained as a result of the Congress work are of prime importance for the world community. It was recognized necessary to issue these materials as a series of the Congress Proceedings.

The Russian Organizing Committee, in accord with the UNESCO Secretariat, entrusted analysis, selection, and preparation of the Congress materials for publication to the International Center of Systems Analysis of Higher Education and Science Problems (the UNESCO associated center), the head organization on the Russian side, which provided preparation and work of the Moscow Congress. The result of the Congress work will be the volumes of the Congress proceedings prepared in the three official Congress languages of the Congress- English, French, and Russian. These volumes will include the following materials:

- Volume I. *GENERAL DOCUMENTS OF THE CONGRESS;*
- Volume II. *NATIONAL REPORTS;*
- Volume III. *REPORTS AND SPEECHES;*
- Volume IV. *REPORTS' THESES .*

The arrangement of materials in these volumes will comply with the above basic topics of the Congress.

Because materials of these volumes had initially a different degree of readiness for publication, each volume will be issued as the work on particular volume is completed.

I express my conviction that the materials published will be of great interest for all persons engaged in the education sphere and in the use of information and communication technologies.

I would like to underline the importance of the publication of these materials in view of the fact that the Moscow Congress is by no means the last one and all the materials will therefore provide a good basis for organizing the next UNESCO congresses.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE
FOR THE 2nd INTERNATIONAL CONGRESS
"EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION
OF THE RUSSIAN FEDERATION,

V. G. KINELEV

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

VOLUME I

GENERAL DOCUMENTS OF THE CONGRESS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 1st VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 1st volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics", held in Moscow, on July 1-5, 1996.

This volume includes, first, the main documents prepared by the Congress organizers before the onset of the Congress, which served as a basis for its organization. These documents were then distributed among the Congress participants and formed the basis for discussion and decision making. Second, the volume incorporates two main documents: Declaration and Recommendations worked out by the Congress *as a result* of its work. And third, the volume contains the UNESCO Final Report in which *the content and main results* of the Congress work are presented in the concentrated form.

The Final Report on the Congress work, prepared in the complete form by the UNESCO Secretariat and published as an independent document, consists of two parts: (1) the main part (preface, introduction, brief account of the content and results of the work of Commisions and seminars, appearances at the Opening and Closing Ceremonies and at the first and final plenary sessions); (2) 12 Appendices including the aforementioned materials prepared before the Congress onset and adopted as a result of its work, as well as the lists of participants and observers.

The editors considered it necessary to include in the 1st volume only the main part, without Appendices, because the latter entered the volume as independent documents.

The lists of participants are given in this volume in the same form as in the Final Report: separately presented is the list of participants from all countries except Russia and separately the list of Russian participants and observers.

When forming these lists, we met with certain problems in translating names and surnames of participants and titles of organizations from one language to another. To simplify the edition, the lists of participants in the French version of the volume are given in the English language.

The significance of the Moscow Congress as a representative international forum called to outline the pathways for education development and to find the possibilities of using new information technologies in this area was underlined in the greetings to the Congress participants received from the UNESCO General Director F. Mayor and the President of the Russian Federation B.N. Yeltsin.

Two basic documents - the Main Working Document and the Congress Program - constituted the system-forming basis for preparation and work of the Moscow Congress. Both documents were prepared by the International Program Committee which included outstanding experts in the field of education and informatics from various countries and continents (The list of the members of this Committee is given in this volume.) These documents have been discussed at four regional meetings of experts: at Austin (Texas, USA) for countries of North and South America and Caribbean region; for European countries at St. Petersburg and for Asian and Pacific Ocean countries at Vladivostok (Russia), and at Dakar (Senegal) for African countries. Also, six subregional meetings were held from 1991 to 1996: at Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (the Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russia, 1991 and 1996).

Participants of these forums put forward their suggestions concerning the organization and work of the Congress and the content of the Main Working Document and the Congress Program. These documents represent, therefore, the result of cooperative effort of many researchers, professors and lecturers, teachers and specialists in information and communication, and representatives from industry.

In the opinion of compilers of this volume, the Report on Basic Lines in the UNESCO activity in the field of education and information in the time elapsed from the First International Congress on Informatics and Education held in Paris in 1989 is of special interest. This report summarizes the work performed by the UNESCO in collaboration with relevant national and international organizations, agencies and professional associations along the following lines:

- Introduction of information technologies in schools, universities, and institutes of informal education;

• Information technologies and the role of teachers;

• Progress of informatics in education;

• Information technologies as a means of education control;

• Information technologies for developing distant and open education.

This Report is of interest, first of all, because its content is in full agreement with some lines in the work of the Moscow Congress and because it enables one to estimate progress achieved by the world society over the period between the two congresses.

The volume also incorporates the "Analytical Review of the Problem "Education and Informatics (Concepts, Current State, Perspectives)" prepared for organizers and participants of the Congress by the group of independent experts - specialists from Russia in this field. This review presents different views of the problems discussed at the Congress. It follows logic in constructing the theme of the Congress and examines the current state of the subject in Russia as compared to other countries in the directions corresponding to the theme of this international forum. Based on their own experience and taking into account the available native achievements, the authors of this review put forth their viewpoint on each line in the work of the Congress.

Proceeding from common principles in forming the volumes of the Congress Proceedings, the compilers and editors attempted to preserve, where possible, original texts and avoided, as a rule, editorial corrections and, moreover, corrections in the content. At the same time, some lingual nuances, which were difficult to circumvent, are possible in the issue of materials in the three official Congress of the languages - English, French, and Russian.

The editors will be grateful to authors and readers for amendments and suggestions. Your references will help to continue the discussion started at the Congress, to unify terminology and concepts, and to increase exchange of information in this area. The importance of publication of these materials is also determined by the fact that this Congress is by no means the last one and all materials will serve as a good basis for organizing future UNESCO congresses on education and informatics. They can be a great help in the build-up of the UNESCO Institute for Information Technologies organized in Moscow in accord with the Congress recommendations.

Analysis, selection, and preparation of this volume for publication were carried out by the UNESCO Institute for Information Technologies in Education and by the International Center of Systems Analysis of Higher Education and Science Problems (The UNESCO associated center). References, notices and suggestions from our readers will be accepted with thanks by the Editorial Board. They should be sent to the Center's address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, The Center's General Director, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2nd INTERNATIONAL CONGRESS "EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION,

V. G. KINELEV

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

BY **COLIN N. POWER**
ASSISTANT DIRECTOR-GENERAL
FOR EDUCATION, UNESCO

Mr. Kinelev,
Mr. Sadovnichy,
Professor Bauknecht.
Distinguished Participants,
Ladies and Gentlemen,

It is a great pleasure for me to welcome you to this Congress, the Second International Congress on "Education and Informatics", on behalf of the Director-General of UNESCO, Mr. Federico Mayor.

Very sadly he is unable to be here and so I am now filling in for him. Yesterday in Guatemala and El Salvador he became ill and, unfortunately, cannot be with you. He very much wanted to show his solidarity with the people of Russia at this historic point in their history and also his solidarity with the countries and the organizations represented here.

As you know, he has a deep interest in the theme of this Conference and is committed to ensure that all have access to knowledge and information, scientific, technological, for the benefit of all. UNESCO is devoted to the promotion of the sharing of expertise and knowledge.

It is indicative of the worldwide interest in the new information and communication technologies that we have approximately 1,000 participants and observers at this conference, representing 70 Member States of UNESCO, many UN organizations, intergovernmental and nongovernmental organizations and the private sector which produces the hardware and the educational software we need to make our dreams of an enriched learning environment for all a reality.

As you know, the first International Congress on 'Education and Informatics' was organized in 1989 at UNESCO's Headquarters, in Paris. It was one of my first duties as Assistant Director-General for Education to oversee the planning and development of that Congress. In the seven years that have passed, tremendous developments have taken place in the information and communication technologies. Indeed, it is a measure of the rapidity of these changes that terms such as the Internet and the World Wide Web were not even mentioned during the first Congress.

The function of this morning's session is to open this conference, so I will not give a long speech. But I do want to suggest that the new information technologies present us with a formidable challenge to our sense of equity, justice and of solidarity around the world. It is important to note that UNESCO's international congresses are truly international, that is, they include representation from the poorest countries in the world as well as the richest, those who do not have access to the technologies as well as those who are at their cutting edge. It provides us, then, with an unrealized opportunity for the sharing of knowledge and for promotion of understanding between peoples and of cultures.

It is appropriate that this Congress should be taking place in Russia with its long and distinguished tradition of scientific and technological development and of education. In this connection, I would wish to reiterate the tribute which the Director-General paid to the Government of the Russian Federation at the ceremony in Moscow, last April, on the centenary of the birth of the chemical physicist Nikolai Semenov, and assure the Russian Federation of UNESCO's continuing support for its efforts to preserve and to develop Russia's outstanding scientific, technological and intellectual heritage. The Director-General asked me to inform you that he is following with great admiration the process of democratization here in Russia, which is liberating the moral and intellectual potential necessary for the development of the country and of a culture of peace throughout this world. Education is essential to this democratization process, to development and to peace. The new information technologies, equitably shared and properly employed, can enhance the potential of education to shape a broader future for us all.

I wish to conclude by expressing once again our gratitude to the host country for its leadership and for the impeccable preparation of this conference, and to the Moscow State University for generously agreeing to host it. I should pay tribute as well to the International and the Russian Organizing Committees of the Congress, and especially to you, Mr. Kinelev, for the enormous efforts which you personally have put into the preparation of this very large and complex conference. It is now up to us, Ladies and Gentlemen, to ensure that the Congress does provide us with guidelines for the policies and the actions needed in order to ensure that the new information technologies serve the cause of lifelong education for all, which is the central platform of UNESCO's programme.

Thank you.

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

I warmly welcome the participants to UNESCO's Second International Congress on Education and Informatics, which is now opening in Moscow.

You represent the governments and scientific and business communities of many countries, United Nations Specialized Agencies and other international organizations. I am convinced that such a representative forum will be able to indicate how to develop education and identify opportunities for using new information technologies in this field.

The Congress has particular resonance because it is taking place on the cusp of two centuries and two millennia. The decisions taken today will influence the lot of humanity in the future.

It is significant that your intellectual forum is working under the auspices of UNESCO. This international organization has rightly earned respect for its substantial contribution to consolidating the efforts of education, science and culture professionals and creating the conditions for the sustained development of the world community.

I would like to wish the participants in the Congress good luck and success in their valuable work, and peace and prosperity to their countries and peoples!

BORIS YELTSIN

PRESIDENT
OF THE RUSSIAN FEDERATION

GENERAL INFORMATION

ON THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

INTRODUCTION

In accordance with Resolution 1.18 of the twenty-seventh Session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, will organize its Second International Congress on ***Education and Informatics*** *- Educational Policies and New Technologies (EI'96) to be held in Moscow from 1 to 5 July 1996. The first Congress, which was held in 1989 at the UNESCO Headquarters, stressed the need 'to benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation be strengthened.*

Today co-operation is even more needed than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby hardware and software 'generations' have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to shape the 'information society' and to challenge those living in it. In the midst of the 'information superhighways', education is challenged to re-examine its position critically, especially since technologies seem to develop faster than education has capacity to make use of them.

OBJECTIVES

The Congress, which offers an international forum to discuss the future of education and informatics, will *analyse* national, regional and international trends and experiences in the introduction and use of NITs in educational systems, *review* the latest developments in NITs and *examine* their application in education; *discuss* international, regional and national policies for the use of NITs in education; and *make recommendations* for international co-operation.

OUTPUTS

As results of its work, the Congress is expected to produce:

- a general declaration or manifesto;
- recommendations to Member States and to the Director-General of UNESCO;
- proposals for regional and international co-operation.

PROGRAMME AND THEMES

The Congress will pursue its objectives through the following programme and themes proposed by the International Programme Committee (I PC) in co-operation with the Russian Organizing Committee (ROC).

Each Congress day will begin with a *plenary session* in which a *keynote speaker* makes the main presentation on the chosen theme, followed by presentations and discussions in three commissions with the following general orientations:

- *Commission 1:* Trends and experiences in the introduction and use of NITs in educational systems:
- *Commission II-.* Latest developments in NITs and their application in education:
- *Commission III:* Policies and co-operation for the use of NITs in education.

The themes proposed to be discussed in the *commissions* include:

- *Policies* (Developing National Plans. Strategies for Change at Institutional Level, Strategies for a Future-Proofed Curriculum):
- *Technologies* (Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies, Multimedia and Telematics);
- *Teachers* (Current Practices with New Technologies, Pre- and In-service Teacher Training, New Roles for Teachers):
- *Learners* (Learning Tools, New Roles for Learners, New Options for Learning inside and outside Educational Institutions):
- *Social, Economic and Cultural Issues*
- *Transverse Themes* (Lifelong, Open and Distance Learning, Measuring the Impact. UNESCO and International Co-operation).

The themes proposed for the *workshops* on 4th and 5th July 1996 include:

- Information Superhighways and Education;
- Medical and Psychological Consequences:
- The Software Environment - a Perspective for Effective involvement:

	1 July	2 July	3 July	4 July	5 July
9:00-10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops**
10:30-12:30	*Plenary* Keynote speeches	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	Demonstrations, exhibitions, visits
12:30-14:00	**L**	**U**	**N**	**C**	**H**
14:00-15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops**	*Plenary*
16:00-18:00	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	Demonstrations, exhibitions, visits	Closing speeches Declaration and Recommendations **Closure**

- Transfer of Knowledge and Skills through Information and Communication Technologies;
- National Policies - Transfer of Technologies:
- individual Distance Training (for the French-speaking countries):
- Analysis of UNESCO/IFIP documents, published by UNESCO in 1994-1995:
  - Informatics for Secondary Education *(A Curriculum for Schools);*
  - A Modular Curriculum in Computer Science.

PARTICIPANTS AND OBSERVERS

As is common for international congresses of Category IV, UNESCO will invite the participants and observers in their personal capacity, at the proposal of its Member States, representatives/observers of UN specialized agencies, other intergovernmental organizations, international non-governmental organizations, professional associations, as well as public and private institutions working in related fields. The participants and observers will include decision-makers, researchers, teacher trainers, industrial trainers, university professors, teachers and information and communication specialists interested in the application of NITs in education. In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses. The Russian Organizing Committee will make arrangements through Aeroflot, the designated official carrier for the Congress, for reduced air fares. The participants will also benefit from reduced hotel room prices.

EXHIBITION

In conjunction with the Congress, a major exhibition will be organized, in which ministries educational institutions, research centres, publishers, as well as private companies involved in the development and application of NITs in education are welcome to participate. Those interested in presenting their projects or products at the exhibition are invited to contact the Secretariat of the Russian Organizing Committee (see address on p. 3).

LANGUAGES

Simultaneous interpretation in three languages (English, French, and Russian) will be available for the plenary and commission sessions.

PREPARATORY CONFERENCE AND EXPERT MEETINGS

In preparation for the Congress, the following conference and expert meetings are scheduled: a conference in Novosibirsk (19-22 March 1996, in the Russian language), and regional expert meetings, namely, in Austin (Texas, USA, 9-1101.1996) for North and Latin America as well as for the Caribbean countries: in St. Petersburg (25-26.02.1996) for the Europe Region: in Vladivostok (10-1405.1996) for Asia and Pacific countries, and in Dakar (March 1996) for Africa.

SIR/MADAM,

UNESCO is pleased to invite you to participate in the preparation of the above Congress by:

- *Commenting on the proposed programme of the Congress:*
- *Proposing candidates for keynote speakers so as to allow the International Programme Committee to select from a wide geographical representation.*
-

The comments and proposals should reach the UNESCO Secretariat by 15 February 1996.

- *Preparing a National Report (maximum 20 pages on a floppy disk) which should give an overview of the state-of-the-art of NITs in your educational system, including priorities in your national plan concerning the introduction of NITs in various forms and at various levels of education (primary school, secondary school, higher education, teacher/instructor training, industrial training and retraining etc.): the level of computer hardware and software provision, including in educational administration: any policy towards standardisation; the use made of broadcast technologies in education; the factors limiting progress in the adoption of new technologies in education, including insufficient numbers of trained staff, any inadequacy in the infrastructure of service utilities (electricity supply, broadcasting, telephone services, telematics etc.): participation in international programmes concerning the use of NITs and the benefit you may derive from it.*

Your National Report should reach the UNESCO Secretariat by 15 March 1996.

- *Preparing a paper which might be selected to be presented as a contribution to the discussions in the commissions. The paper should be prepared on a floppy disk and should not exceed five pages.*

The paper should reach the UNESCO Secretariat by 31 March 1996.

SPONSORSHIP

The Member States and potential sponsors are kindly asked to look at the possibility of helping specialists from developing countries financially (by sponsoring travel grants, fellowships etc.) so that they can participate in the Congress. Kindly inform the UNESCO Secretariat if you are willing to do so.

For further information on the EI'96 Congress, please contact:

UNESCO
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INTERNATIONAL CONGRESS
EDUCATION AND INFORMATICS
EDUCATIONAL POLICIES and NEW TECHNOLOGIES

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EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

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PROGRAMME

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

TIMETABLE

	1 July	2 July	3 July	4 July	5 July
9:00- 10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops** | | | | |
10:30- 12:30	*Plenary* Keynote speeches	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	Demonstrations, exhibitions, visits
12:30- 14:00	**L**	**U**	**N**	**C**	**H**
14:00- 15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops** | | | | |	*Plenary* Closing speeches Declaration and Recommendations **Closure**
16:00- 18:00	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	*Commissions* I | II | III Presentations Discussions	Demonstrations, exhibitions, visits	

MONDAY, 1 JULY 1996

9.00-10.25 hrs. - Opening Ceremony (Grand Hall)

Addresses by:

• Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education of the Russian Federation

• Mr. Colin N. Power, Assistant Director-General for Education of UNESCO

• Mr. Kurt Bauknecht, President, International Federation for Information Processing

• Mr. Armando Rocha Trindade, President, International Council for Distance Education

• Mr. Viktor A. Sadovnichy, Rector, Moscow State University

10.25-10.30 hrs.- Break

10.30-12.30 hrs. - Plenary (Grand Hall)

• Election of the President

• Adoption of the Rules of Procedure

• Election of the other members of the Bureau and members of the Drafting Group

• Keynote speakers:

• Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education (Russian Federation), *Education and Civilization*

• Mr. Colin N. Power, Assistant Director-General for Education (UNESCO), *New Perspectives for Learning in the Information Age*

• Dr. Norio Matsumae, President, Tokai University (Japan), *New Directions in Education*

12.30-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 1: Learners

Speakers:

• Acad. Blagovest Sendov, President of Parliament (Bulgaria), *Learners in a Global Knowledge Space: Towards Global Wisdom*

• Mr. Tahar Hafaied, Directeur, Institut National de Bureautique et Micro-Informatique (Tunisia), *Training in the Context of New Information and Communication Technologies*

15.30-16.00 hrs.- Break

16.00-18.00 hrs.- Commissions:

Commission I: Room 01 - Main Building of Moscow State University

Theme 1.1

Speakers:

• Prof. Sergei S. Goncharov, Deputy Director, Research Institute for the Mathematical and Informational Basis of Education (Russian Federation), *Peculiarities of Usage of New Information Technologies in Secondary and University Education*

• Mr. Francis Moret, Centre Suisse de Technologie de l'Information dans l'Enseignement (Switzerland), *Compulsory Education and the Secondary Level*

Discussion:

• Prof. Yasen N. Zasursky (Russian Federation)

• Dr. Mohamad Noor Burhan (Syria)

• Prof. Gia G. Gvaramia (Georgia)

Commission II: Room 02 - Main Building of Moscow State University

Theme 1.2

Speakers:

• Mr. Predrag Pale, Deputy Minister of Science, Ministry of Science and Technology (Croatia), *Can Education Save the World?*

• Mrs Yaffa Vigodsky, Head of Division, Ministry of Education, Culture and Sport (Israel), *Tomorrow '98: The Computerization of the Educational System*

Discussion:

• Prof. Yuri A. Pervin (Russian Federation)

• Mr. Alain Chaptal (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 1.3

Speakers:

• Mrs. Anne Marrec, Directrice générale, Télé-université (Canada), *The "Neurone-Student" in a Reconfigured Education System*

• Mr Peter Baumgartner, Institute for Interdisciplinary Research and Further Education (Austria), *Evaluation of Technology-Based Learning. A Social Science Approach to Quality Assurance in Education*

Discussion:

• Prof. Viktor A. Bolotov (Russian Federation)

• Mr. Tamás Káldi (Hungary)

TUESDAY, 2 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 2: Teachers

Speakers:

• Mr. Kunming Qian, Deputy Director, Distance Education Center of Central TV University (People's Republic of China), *New Information Technology and Teachers*

• Prof. Alexei L. Semenov, Vice-Chairman, Moscow Department of Education (Russian Federation), *The Teacher in a National and Regional Perspective of the Informatization of Education*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 2.1

Speakers:

• Dr. Betty Collis, Faculty of Educational Science and Technology, University of Twente (The Netherlands), *Teachers and Telematics: Lessons from Experience with Computer Implementation*

• Mr. Gérard Lisée, Président, Comité exécutif de STÉFI, Université de Montréal (Canada), *Development and Experimentation of Education Services Using Information Superhighway Infrastructures*

Discussion:

• Dr. Sergei A. Khristochevsky (Russian Federation)

• Prof. Bengt Bengtsson (Sweden)

Commission II: Room 02 - Main Building of Moscow State University

Theme 2.2

Speakers:

• Prof. Jenny Sendova, Institute of Mathematics and Informatics (Bulgaria), *Enhancing the Teacher's Creativity by Exploratory Computer Environments*

• Mr. David A. Thomas, Montana State University (USA), *Internet-based Inservice Teacher Training in Montana*

Discussion:

• Acad. Alexander A. Samarsky (Russian Federation)

Commission III: Room 611- Main Building of Moscow State University

Theme 2.3

• Mr. A.Y. Montgomery, Head of Department, Royal Melbourne Institute of Technology (Australia), *Development of "Multi Media" Teaching and Learning Environments*

• Prof. Paul Resta, Director, Learning Technology Centre, University of Texas at Austin (USA), *Building a Community of Learners: New Tools for Collaborative Learning*

Discussion:

• Mr. Yves Brunsvick (France)

• Prof. V. L. Matrosov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 3: Technologies

Speakers:

• Prof. Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France), *Which Technologies for Education? New Education Technologies at the Time of Deployment*

• Mr. Rockley L. Miller, President, Future Systems Incorporated (USA), *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training and Global Communication*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 3.1

Speakers:

• Prof. Sandra Wills, Director, Educational Media Services, University of Wollongong (Australia), *Interface to Interactivity: Technologies and Techniques*

• Dr. Hartmut Grebe, Consultant (Germany), *Is Technology the Answer for Our Changing Educational Means? Yes, but only If...*

Discussion:

• Acad. Oleg M. Belotserkovsky (Russian Federation)

• Dr. Gerhard Eisfeld (Germany)

Commission II: Room 02 - Main Building of Moscow State University

Theme 3.2

Speakers:

• Prof. Dines Bjørner, Director, International Institute for Software Technology, UN University, *Teaching the Laws of Informatics and Its Applications*

• Prof. Igor A. Mizin, Director of the Institute of Problems of Informatics, Academy of Sciences (Russian Federation), *Present and Future Trends in the Development of Telecommunication Technologies in the Field of Education and Science*

Discussion:

• Prof. Ivan N. Pustinsky (Russian Federation)

• Mr. Eric Garnier (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 3.3

Speakers:

• Dr. Ella Kiesi, Head of the Unit of Educational Technology, National Board of Education (Finland), *Regional Co-operation in the Construction of Information Networks*

• Dr. Alexei M. Dovgyallo, Deputy Director, UNESCO/IIP Research and Training Centre, V.M. Glushkov Institute of Cybernetics of the Academy of Sciences (Ukraine), *Communication and Information Technologies Infrastructures in a Country in Transition*

Discussion:

• Dr. Valery A. Vasenin (Russian Federation)

• Prof. P. D. Kukharchik (Belarus)

WEDNESDAY, 3 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 4: Social, Economic and Cultural Issues

Speakers:

• Dr. P.A. Motsoaledi, Minister of Education, Northern Province (South Africa), *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*

• Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany), *New Information Technologies as a Challenge for General and Vocational Training: Chances for International Co-operation*

10.30-11.00 hrs. - Break

11.00-13.00 hrs.- Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 4.1

Speakers:

•Prof. Yuri N. Afanasiev, Rector Russia State University of Humanities (Russian Federation), *New Information Technologies in Humanities Education*

• Dr. Siegfried Hermann, Bundesinstitut für den wissenschaftlichen Film (Austria), *Scientific Film in Education*

Discussion:

• Prof. Yuri M. Arsky, Viktor T. Trofimov (Russian Federation)

• Prof. Esengheldy U. Medeuov (Kazakhstan)

Commission II: Room 02 - Main Building of Moscow State University

Theme 4.2

Speakers:

• Mr. Régis Poubelle, Directeur de PDO MEDIA (France), *Electronic Publishing on Optical Support and Education*

• Dr. Nikolai I. Listopad, Director, Ministry of Education and Science, Prof. S.V. Kritsky (Belarus), *Use of Telecommunications in the Field of Education and Science*

Discussion:

• Prof. Alain Meyer (France)

• Prof. Konstantin K. Kolin (Russian Federation)

Commission III: Room 611 - Main Building of Moscow State University

Theme 4.3

Speakers:

• Mrs. Jeanne Girardot, Présidente, Internews Europe-France), *International Community of the Hearing Impaired: Education and New Technologies*

• Prof. V. A. Zhuravlyov, Rector, Udmurt State University (Russian Federation), *Introduction of New Information Technologies in Higher Education in the Context of Difficult Financial Conditions*

Discussion:

• Mr. Paulin Mbalanda Kisoka (Zaire)

• Prof. Viktor L. Mironov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - PlenaryGrand Hall

Theme 5: Educational Policies

Speakers:

• Prof. José A. Valente, Coordinator, Núcleo de Informática Aplicada à Educação, Universidade Estadual de Campinas (Brazil), *The Role of Computers in Education: Achievement and Comprehension*

• Prof. T. Plomp, University of Twente (The Netherlands), *Worldwide Information and Communication Technology in Education Study*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 5.1

• Mr. Gilles Braun, Ministère de l'Education Nationale (France), *New Technologies in the French Educational System*

• Mr. Jan Wibe, Centre for Continuing Education (Norway), *Distance Education in the Nordic Countries*

Discussion:

• Prof. Alexander G. Asmolov (Russian Federation)

• Prof. Roumen Nikolov (Bulgaria)

Commission II: Room 02 - Main Building of Moscow State University

Theme 5.2

Speakers:

• Mr. German Escorcia, IBM-CLIE (Mexico), *Preparing Children for a Knowledge-Based Society: Latin American Experiences Using Megatools to Develop Megabilities*

• Prof. Ludavit Molnár, Slovak Technical University (Slovakia), *Transforming Curricula in the Transforming Countries*

Discussion:

• Acad. Stanislav V. Yemelianov (Russian Federation)

• Mr. Gerald McConaghy (Canada)

Commission III: Room 611 - Main Building of Moscow State University

Theme 5.3

Speakers:

• Mr. Mohammad Larijani, Director, Institute for Studies in Theoretical Physics and Mathematics (Iran), *Modern Technologies in Education and Science*

• Mr. Mushobekwa Kalimba wa Katana, Ministre de l'Enseignement Supérieur, Universitaire et de la Recherche Scientifique (Zaire), *Policies in the Computerization of Education in African Countries*

Discussion:

• Prof. Vladimir E. Tretiakov (Russian Federation)

• Mr. Don Ferguson (New Zealand)

THURSDAY, 4 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 6: International Co-operation

Speakers:

• Mr. H. Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics (UNESCO), *UNESCO Intergovernmental Programmes in the Field of Communication, Information and Informatics*

• Prof. Armando Rocha Trindade, President, International Council for Distance Education, *International Co-operation in Open and Distance Learning*

• Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission), *Multimedia for Education and Training*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 6.1

Speakers:

• Prof. Peter Bollerslev, Chairman of TC-3 (IFIP), *Information Technologies and Education in IFIP Activities*

• Mr. Mike Aston, Director, The Advisory Unit: Computers in Education (UK), *The Impact of New Technologies in the Schools of Europe and the G7 Nations*

Discussion

Commission II: Room 02 - Main Building of Moscow State University

Theme 6.2

Speakers:

• Prof. Jean A. Vergnes, Université d'Aix-Marseille (France), *On Education and Use of Information Technologies*

• Prof. Ivan Stanchev, IPC Scientific Secretary (The Netherlands), *Flexible and Distance Learning through Telematic Networks*

Discussion

Commission III: Room 611 - Main Building of Moscow State University

Theme 6.3

Speakers:

• Prof. Valery S. Meskov, Vice-Chairman, Russian State Committee for Higher Education (Russian Federation), *International Projects: Creation and Development of a Common Distance Education System*

• Mr. John Middleton, Economic Development Institute (World Bank), *Looking Sideways*

Discussion:

• Dr. Vitaly Boyko (Russian Federation)

• Prof. Gennady Ryabov (ILO)

13.00 -14.00 hrs - .Lunch Break

14.00-18.00 hrs. - Workshops, demonstrations, exhibitions, visits

FRIDAY, 5 JULY 1996

9.00-13.00 hrs. - Workshops, demonstrations, exhibitions, visits

14.00-15.30 hrs. - PlenaryGrand Hall

Speakers:

- Acad. Yury L. Ershov, Co-Chairman of the EI'96 International Programme Committee (Russian Federation)
- Prof. Jef Moonen, Co-Chairman of the EI'96 International Programme Committee (The Netherlands)
- Prof. Arkady Golubkov, Chairman of Presidential Committee for Informatization (Russian Federation)

15.30-16.00 hrs. - Break

16.00-17.30 hrs. - Summing up the Results of the Congress

- Oral Report on Workshops
- Oral Report on the Work of the Commissions
- Oral Report by the Rapporteur-General
- Adoption of the Declaration and Recommendations

17.30-18.00 hrs. - Closing Ceremony

- Mr. Colin N. Power, Assistant Director-General for Education (UNESCO)
- Mr. Viktor A. Sadovnichy, Rector, Moscow State University

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
1	Information Superhighways and Education:	Prof. Konstantin K. Kolin, *Institute of Problems of Informatics (Russian Federation)*			
	Part I: Perspectives and Problems Related to the Development of World and Regional Common Information Space for the Field of Education	Mr. Harald Schütz, *Deutsche Welle (Germany)* Dr. Shota Sh. Chipashvili, *Institute of Problems of Informatics (Russian Federation)*	4 July	14.00-16.30	Main Building, Room 01
	Part II: From Information Literacy to Information Culture	Dr. Sergei A. Khristochevski, *Institute of Problems of Informatics (Russian Federation)*	5 July		Main Building, Room 01
2	The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies	Prof. Irena V. Robert, *Institute of General Secondary Education of the Russian Academy of Sciences (Russian Federation)* Prof. Alexei M. Bolshakov, *Sechenov Moscow Medical Academy (Russian Federation)*	4 July	14.00-18.00	Grand Hall
3	The Software Environment - A Perspective for Effective Involvement	Mr. David Walker, *Consultant (UK)*	5 July	9.00-12.00	Main Building, Room 02
4	Transfer of Knowledge and Skills through Information and Communication Technologies	Prof. Alexei L. Semenov, *Vice-Chairman, Moscow Department of Education (Russian Federation);* Dr. Heinz-Werner Poelchau, *Ministerial Counselor;* Mr. Harald Schütz, *Deutsche Welle (Germany);* Dr. Elena I. Bulin-Sokolova, Dr. P.A. Yakushkin, *Institute of New Educational Technologies (Russian Federation)*	4 July	14.00-18.00	Main Building, Room 611
5	National Policies - Transfer of Technologies	Mr. Peter Waker, Consultant, Interware (South Africa)	4 July	14.00-18.00	Main Building, Room 02

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
6	Individual Distance Training	Mr. Alain Meyer, Directeur, *Conservatoire National des Arts et Métiers (France)*	5 July	9.00-12.00	Main Building, Room 611
7	Analysis of UNESCO/IFIP Documents Published by UNESCO in 1994-1995	Prof. Tom van Weert, *University of Nijmegen (The Netherlands)*			
	Part I: Informatics for Secondary Education (A Curriculum for Schools)		5 July	9.00-10.30	Grand Hall
	Part II: A Modular Curriculum in Computer Science		5 July	11.00-12.30	Grand Hall
8	Logics, Informatics, Education	Prof. Yury V. Ivlev, *Philosophical Faculty, Moscow State University (Russian Federation)*	4 July 5 July	14.30-18.00 9.00-12.30	First Building of the Humanities Faculties Room 1157
9	Information Technologies and Humanities Education	Prof. Yury N. Afanasiev, *Russian State University ofr the Humanities (Russian Federation)*	4 July	14.30-18.00	Russian State University for the Humanities
10	Development of Pre-University Education via Modern Information Technologies and Methods	Prof. N. N. Evtikhiev, *Moscow State Institute for Radioengineering, Electronics and Automation* Prof. N. I. Klyatova, *Moscow City Palace for Children and Youth Creativity* Prof. V. A. Mordvinov, *Moscow Institute for Radioengineering, Electronics and Automatics (Russian Federation)*	4 July	14.30-18.00	Moscow City Palace for Children and Youth Creativity
11	Medicine: New Approaches to Knowledge Acquisition and Improvement	Prof. Oleg S. Medvedev, *Faculty of Fundamental Medicine, Moscow State University* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences* Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*	4 July	14.00-16.00 16.30-18.00	Main Building, Room 1029 Medical Centre "GAZPROM"
12	Forming Integrated World Data Bases and Knowledge about the Planets of the Solar System and Their Use in Research and Education	Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*	5 July	9.00-12.30	Main Building, Room 1806

MAIN WORKING DOCUMENT

INTRODUCTION

The rapid development of information and communication technologies and their application present the world community not only with opportunities but also with new challenges. The evolution towards the so-called "information highway" and their associated economic, social, cultural and educational effects could lead to considerable changes in forms of governance, creativity, co-operation, sharing of ideas and knowledge and daily life. It will also call for wider participation and action on the part of national, regional and international organizations and agencies. Under its Constitution, UNESCO is required "to collaborate in the work of advancing the mutual knowledge and understanding of peoples, through all means of mass communication and to that end recommend such international agreements as may be necessary to promote the free flow of ideas by word and image", "give fresh impulse to popular education and to the spread of culture " and "maintain, increase and diffuse knowledge". With regard to information and communication technologies, that mission today embodies three main functions:

(i)promoting the application of information and communication technologies for the free flow of information, innovation and effective management in education, science, culture and the media;

(ii)encouraging international co-operation on legal, ethical and educational issues raised through the social and cultural implications of information and communication technologies; and

(iii)assisting Member States, particularly developing countries, in building information and communication capacities, benefiting from new applications of information and communication technologies, and ensuring that those technologies do not lead to exclusion among and within societies.

The urgency of the national, regional and international action in this field has been greatly accentuated by the constantly accelerating rate of change in the technologies relating to information presentation, access and exchange. A growing flood of data is potentially available anywhere in the world. The digital technology revolution, integrating text, graphics, video, voice, and music in digital form, is providing powerful new tools for the representation and communication of knowledge and tools for learning. Their use has been greatly enhanced by the fact that devices cost less and are more powerful; more countries have plans and budgets for provision and for teacher training in some stage of execution; and the Internet allows technology and knowledge transfer to the benefit of all levels of education. More teachers at all levels of education have some opportunity to experience training, or even just computer use, and the cascade process of dissemination- both formal and informal - has led to an ever increasing understanding of the potential of computer related strategies as a cost beneficial solution to some learning problems. More software, courseware, research and case study material now exists and is being shared or purchased internationally.

The International Commission on Education for the Twenty-first Century stressed in its report (*Learning: The Treasure Within, 1996*) that "... these technologies are in the process of accomplishing nothing short of a revolution before our eyes, one that is affecting activities connected with production and work just as much as those connected with education and training." Technology has enabled students in isolated areas of the world to access information resources and expertise unavailable locally. It has provided new tools for cognitive learning, intellectual collaboration and problem solving. It has enabled children to work with other children across the globe through computer-mediated communications and develop new levels of cultural insight and understanding. It has opened new perspectives for the education of the handicapped. It has enabled adults to receive job retraining and professional development opportunities through new distance learning technologies. In addition, the new multimedia technologies have provided unique and powerful ways to convey difficult and abstract concepts. Research in cognitive learning is providing new insights and strategies for facilitating student learning and new and different ways in which technological tools and information resources may be integrated into the learning environment. In short, from pre-school to higher education, learning will never be the same.

Probably the most radical change that information and communication technologies bring to learning is the abolition of distance. By freeing learners from the constraints of time and place, it can potentially offer new and more flexible learning opportunities. Distance learning, which has rapidly spread all over the world, is widely used at all levels of education, including higher education. UNESCO's "Policy Paper for Change and Development in Higher Education" urged higher education institutions to make greater use of the advantages offered by the advancement of communication technologies. As a result of such developments, not only have large-scale "mega-universities" emerged as alternative delivery systems, but also the distinction between traditional and distance universities has become blurred.

While the developments in information and communication technologies in many ways challenge the society in general and its educational provision in particular, they do not affect everyone in the same manner. The methodologies of the "information society" are not universally available. The "superhighways" that allow information access and exchange are not open to all. There has been a growing gap between developed and developing countries in their ability to access and use technology. This gap, which was viewed with concern at the 1989 Congress, has widened in the intervening years, and developing countries are perhaps even further disadvantaged in technology access and use than they were seven years ago. For a great number of developing countries, technologies generally available in developed countries, such as telephone, television and even electricity, are still beyond their reach. Therefore, full participation of developing countries in the "information society" and in the use of opportunities offered by information and communication technologies are crucial issues to be faced today. Undoubtedly, this inequity in access to information technologies exists not only among countries but also within countries. The International Commission on Education for the 21st Century felt that there is a real danger of societies with fast and slow tracks, depending on individuals' ability to access technology. It considered that the emergence of information societies is a challenge to both democracy and education, and that the two aspects are closely integrated. Therein lies also humankind's quest for peace. New perspectives, strategies, skills, and knowledge, as well as new levels of cultural understanding will be required in order to surmount the growing array of complex social, political, economic and ecological issues confronting all countries. The educational systems of the world, with the assistance of communication technologies, must play a key role in developing the human potential needed to address these challenges.

It was the rapid development of communication technologies, the increasing awareness of their great potential at the service of education and the concern about the inequity in access to technologies between developed and developing countries that encouraged the resolution at the 27th Session of UNESCO's General Conference to convene the Second UNESCO International Congress on Education and Informatics to provide decision-makers, educators and technology specialists with an opportunity to:

- *discuss the latest developments in New Information Technologies (NITs) and their implications for education and training;*
- *explore current trends and pedagogical issues in the application of technology in different educational and training systems;*
- *discuss effective strategies as well as pitfalls in the planning and implementation of NITs in education and training;*
- *examine important policy issues and opportunities for regional and global collaboration in the use of NITs to improve learning and teaching.*

The Congress is designed to help decision-makers and educators understand the ways technology may enhance the teaching-learning process and the ways in which students can acquire the knowledge and skills needed for the next century. A number of current efforts to restructure educational systems include technology as an important component of a national strategy. What the various strategies share is the need to modernise the systems of educational provision and expand the access of millions of adults and young people to education through communication technologies, including open and distance education. This accords with UNESCO's leading principle of "Lifelong Learning for All" and its "Learning Without Frontiers" programme. Here, it is particularly important for decision-makers to understand how technology can impact on learning in the context of the culture, the curriculum, educational system goals, and evaluation criteria, as well as to realise the costs and projected benefits of the technology implementation.

The Congress will focus on current needs and applications of NITs as well as emerging issues, directions and scenarios as we approach the 21st Century. Its programme will aim to reflect the needs and interests of its delegates:- decision makers, researchers, teacher trainers, industrial trainers, university professors, teachers, information and communication specialists, and technologists and system designers interested in the application of NITs in education and training. The programme at times is divided, for convenience, into three commissions, running in parallel. *Commission I* will reflect trends and experiences in the introduction and use of NITs in educational and training systems. *Commission II* will be concerned with the latest developments in NITs and their application in education and training. *Commission III* will be concerned with policies for and co-operation in the use of NITs in education and training. While it is envisaged that the first commission will be of particular interest to teaching/training practitioners, the second to technologists and developers, and the third to decision makers, participants will be free to choose which commissions they attend each day.

THEMES OF THE SECOND INTERNATIONAL CONGRESS

The Congress is organised around six major themes that will provide a framework for focusing the discussions of important issues related to the application of NITs in education and training. The outputs from the theme-related discussions will be used by the Congress to produce a general declaration, develop recommendations to UNESCO and its Member States, and formulate proposals for regional and international co-operation.

THEME 1: LEARNERS

The shift from the teacher as information dispenser towards the role of mentor, guide and manager of learning requires, in turn, more responsibility on the part learners in the learning process. Moves toward more constructivist and collaborative learning environments are resulting in changes in the role of students. These new environments require that the learners become more self-directed and take greater responsibility for their learning. Although this is more true in some cultures than in others, it is important to understand both the benefits as well as the stresses that result from the new learner roles. It is also important to understand better how technology may support or detract from these new roles.

Technology provides learners with an array of new tools and resources to facilitate cognitive activity. There are, however, wide variations in the type and level of access to technological tools by different groups of learners within educational systems. With limited resources, it is difficult for policy makers and educators to decide the level of technology access that should be provided to primary, secondary, vocational, and higher education, students. It is important to understand how change can be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.) - from open classrooms to open universities and other forms of continuing education. In fact, lifelong learning is of increasing importance, also because of the significant changes taking place in the nature or work. While technology has reduced the need for certain jobs it has also created a number of jobs that require new knowledge and work skills. It has also changed the demands and skills needed for many existing occupations. To accommodate these changes individuals must continuously learn new skills and acquire new knowledge. NITs may help address this need in providing educational and training opportunities to adults through distance learning, open education and by providing learning opportunities in contexts other than schools and at times and places convenient to the learner.

Among the questions that may be addressed at the Congress are:

(a)*Learning Tools.* We all remember inspiring teachers who in some way influenced our lives. From the learners' viewpoint how can we be sure that new technologies do not impede this special process? In what ways can the curriculum become more than the old content delivered by new media? Can learning become too dependent on the computer? What would be the effects of this? How can the design of learning tools - the user interface, graphic presentation, readability - enhance equity of tool provision and use?

(b) *New Roles for the Learner.* What stresses do the new roles (having more responsibility for their own learning, the move towards a more constructivist learning and collaborative working) put onto learners? How do new technologies enhance or detract from these changes? Is it possible to maintain any equity between students who have access to technology on a regular basis and those who do not have this access? Is there any evidence indicating the learning roles which are most favoured by the learner and those which are most productive?

(c)*New Options for Learning.* How can change be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.)? How can distance learning techniques best help the learner who cannot attend a traditional institution for learning? How does the learner make these choices, particularly at the post-secondary level? Is distance learning necessarily the second best option (compared with face-to-face learning)? What are the circumstances that make it the best option for the learner? How can we best make use of NITs for the education of the handicapped?

THEME 2: TEACHERS

13.The new information and communication technologies provide both new opportunities and challenges for teachers. The NITs can be used to serve as a catalyst to help change the role of teachers from information dispenser to that of guide, mentor, knowledge navigator, consultant and even co-learner with the student. They can also be used to support traditional teaching modes and practices. A critical variable in the effective use of the NITs is the knowledge and skill of the teacher in the application and integration of the technologies into instruction. Pre-service teacher education programmes are needed that not only prepare teachers to use the current generation of technologies but also to accommodate and even develop new technologies in the future. To accomplish this goal requires that the teacher preparation institutions provide adequate student and faculty access to the technologies. In order that they can model the use and integrate technologies into the pre-service curriculum, the faculty must also be provided with training and support. A critical need also exists to enhance the technology skills of existing teachers. In-service professional development programmes are needed to provide technology training opportunities and technical support. Improved programme documentation, teacher-oriented computer-based programmes and the new distance learning technologies may assist in this effort. Without effective teacher training, investments in technology will bear little fruit.

Among the teacher-related issues and questions to be addressed in the Congress are:

(a)*Current Practice with New Technologies.* What makes for successful teaching using new technologies? How is this success gauged? What characterises a successful teacher's use of NITs? Does particular software use seem to promote success? Are the characteristics for successful teaching with new technologies the same in all sectors of education - primary, secondary, higher, vocational and informal adult teaching? Is the use of film, television and radio in teaching strategies less valued when computers are introduced? If it is, should it be? How do we best teach information skills to students? Information overload results from the unlimited access to information that new technologies can bring the learner. How do we teach selection, indexing, alternative presentations and evaluation of information? Since access to information is at the root of much of what is being discussed, how can efforts in this area be co-ordinated and how can standards be arrived at?

(b)*Teacher Training: Pre- and In-service.* How are teachers best being prepared (pre-service) and supported (in-service) to use new technologies in their teaching roles? How are they best supported technically? Can ongoing professional support, for example by Telematics, be incorporated into overall policy and funding for teacher education? How will a remote trainer, providing training through Telematics be able to match the policy, provision and support available locally?

(c)*New Roles for Teachers.* The role of the teacher is said to be shifting from that of an instructor to that of an organiser and guide. Do new technologies hinder or support this shift? Is this movement the same in all sectors of education and training? To what extent does culture shape this expectation of change in the teachers' roles? What are the stresses that the teacher must confront with regard to these new roles?

THEME 3:
TECHNOLOGIES

The new information technologies are evolving very quickly. Since the First Congress of 1989 remarkable progress has been made in the development of informatics and communications technologies and their use in education and training. We have seen the development of several generations of increasingly more powerful educational hardware and software at lower cost. We have also seen the rapid and largely unforeseen development of global networking. For example, the Internet has grown so rapidly that there are thousands of databases and information resources available on a global basis, and an array of new navigation and search tools to help users find needed information. The rate of development of NITs has continued to accelerate each year. There is a general trend to use technology to accommodate better the individual needs of users. Translated into an educational perspective, this trend refers to the use of NITs in order to support further individualisation, differentiation and user (learner and teacher) control. This trend must, however, be embedded in a pedagogical approach which should focus on the improvement in the involvement of the main actors in the teaching-learning process (learners and teachers), and the integration of the enormous range of information gathering possibilities and communications with peers, through the use of Telematics, into the curriculum.

The expanding use of computer-related technologies in education has focused increased attention on the most appropriate ways of assessing the impact of NITs on learning. Although traditional assessment methods and criteria will continue to be used, new assessment models and methods are being developed to understand better the effects of the new technology-based tools and environments for cognitive activities.

In exploring both current and emerging trends, some of the questions that must be asked are:

(a)*Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies.* What sort of students need to learn *about* the technologies (as opposed to *with* the technologies) at the various stages of education? How are software and hardware changing? Does the CD-ROM, for example, change how we teach? What is the place of educational television? How can we make television more interactive? To what extent is research on artificial intelligence and intelligent tutoring systems contributing to learning and instruction? Do the models of the learning process apply universally? Are there decision points for policy makers?

(b)*Multimedia.* We need to examine what is now possible in multimedia and gauge what contributions multimedia makes/could make to the educational process. The analysis of cost v. educational gain needs to be considered. Is this simply a technology enriching what would otherwise be delivered by traditional teaching methods, or does it add a new dimension and new possibilities to the educational process? Is there an equity issue? How can more expensive equipment be made available with best results? (The following strategies might be considered: centres visited by students; mobile equipment e.g. computer bus classrooms; or equipment only in experimental or "magnet", schools.)

(c)*Telematics.* Communications on, for example, the Internet can bring the work of an expert or a rare information resource to a widely dispersed set of students comparatively cheaply. Telematics has given rise to new international curriculum projects which have, incidentally, brought students from different countries together to work on projects. However, the telephone is still a rare and often a costly resource, even in the world's richest countries. Is there a primary focus for Telematics investment (high school students? students in higher education? handicapped students? teachers in-service? adult learners?) ? How can technologies such as packet-radio and satellite transmission economically compensate for poor terrestrial networks? As all jobs change and the requirements for employment in them change, there is an ever increasing need for retraining. This life-long learning is becoming heavily reliant on new technologies and bringing with it new challenges to the traditional educational system. To what extent can mechanisms be put in place to share the expertise needed to produce this training, even between commercial rivals and different countries?

THEME 4: SOCIAL, ECONOMIC AND CULTURAL ISSUES

It seems evident that the current developments in NITs have and will continue to have a strong impact not only on education but on social, economic and cultural development in general. The concern which has already been expressed about the growing gap between developed and developing countries in their ability to access and use information technology is here accompanied by another concern, emanating from the fact that the new technologies are emerging primarily from the developed world. The content and form of the messages they carry typically reflect the cultural values, methodology and interests of that world. There is the danger that the technologies, for all their worth, may result in the homogenisation and loss of culture and language among many peoples of the world. For example, media such as television, radio and films have resulted in massive and continuous exposure of peoples to the language, cultural values and information of other cultures with few opportunities for reinforcement of their own heritage. The expansion of the Internet and other internationally accessible communication networks tend to stress generality at the expense of specificity, adding to the concern about the loss of native culture. Many of its essential aspects including language, folklore, oral histories, traditions, and food may be lost in the flood tide of Western and other dominant cultures.

In addition, there is a lack of culturally appropriate educational resources in schools serving some students. Western culture curriculum and instructional methods often fail to support or reinforce other cultural values, history and knowledge. Consequently, for many children, education has sometimes meant alienation from their cultural identity. There is a critical need for appropriate cultural materials to infuse and integrate into existing instructional programmes and to create new instructional programmes to better serve all peoples.

Technology now provides powerful and easy to use tools to enable communities to develop their own culturally appropriate curriculum resources. In addition, through multimedia databases, telecommunications networks, television and radio, it is possible to provide wide access to such materials and information. The proliferation of digital electronic libraries and the complex webs and links between nodes and layers of information is having an impact on society. Materials (for good or bad) in digital form that reside in any one place are now available globally and can be accessed 24 hours a day. This has an impact on economic, medical, social and educational structures.

The developments in NITs have dramatically reduced the size of the world. Local events have suddenly become global events in which it is possible to be psychologically and emotionally present while being physically far away. Technology has delivered a potential means for the promotion of peace and international understanding but also for disinformation and propaganda. It is at the cross-roads of these two possible options that education has to stand in its quest for peace.

Among the questions that may be addressed at the Congress are:

(a)*Economic Issues.* All national policies for the introduction and support of new technologies are tempered by the availability of funding. The amount of the available budget for education which is spent on new technologies is often more dependent on the advocacy of the enthusiast than on data. This is in part because of the paucity of data. This can be true at all levels of decision making from the national to the institutional. Practitioners at the institutional level complain of the lack of any long term planning for the financial support for new developments. New plans are adopted but have to be abandoned for want of continued financing. The time it takes to get results from a change of methods is not always appreciated by policy makers, and practitioners are often slow to produce evidence on which policy can be made. What ways are there to ensure that finance provided for change doesn't get wasted? How can technology support lifelong learning in different economic and socio-cultural scenarios?

(b)*Social and Cross Cultural Issues.* Are new technologies increasing or decreasing inequities among groups in society? Can the effects of national wealth, language, gender and culture be overcome through the use of technology in striving to provide some equality of educational opportunity worldwide? Are new technologies further advantaging the more elite educational institutions? To what extent should a global aspect of learning be limited by local political decisions? How can the development of appropriate resources be fostered in order to, at least, protect and, at best, reinforce native cultures.

(c)Peace and International Understanding. Are the new technologies *per se* contributing to peace and international understanding? What may be some of their positive and negative effects? What is the long-term effect of the Internet, and, specifically, electronic mail and bulletin boards? How should international agencies make use of NITs to promote their programmes for peace and international understanding?

THEME 5:
EDUCATIONAL POLICIES

As the use of NITs in education is a matter of societal, cultural and financial choice, the issue is central to the concern of governments and their decision makers. Within the limits of delegated institutional autonomy, it can be an issue at every level of education and training. Yet the formulation of the respective policies for the utilisation of NITs is rarely based on the same criteria in developed and developing countries. The financial constraints faced by the developed countries bear no comparison with those of the developing countries which often cannot afford to set up an adequate infrastructure necessary for the successful use of NITs in education. Therefore, the technology is determined by the scarcity of resources which limits the options available to the policy makers.

In formulating educational policy related to the implementation of NITs, policy-makers are challenged by questions about the appropriate role and function of technology within the context of their educational system. Some view technology as a necessary component of a quality educational experience and have had curricula redesigned to provide students with technology-related skills and knowledge needed for the next century. Others are more interested in how technology may increase the productivity, efficiency and effectiveness of their educational systems, or they emphasise the use of technology for extra or external school activities such as radio, television and tele-learning. And still others emphasise the use of technology as a catalyst to help transform the learning environments within the school.

Whatever the national choices concerning the use of NITs in education may be, it appears evident that the matter does not deal only with technology but also with the question as to how knowledge and information will be accessed in the future. As the teacher is increasingly being transformed into a mentor, guide and manager of learning, his or her previous role as the information dispenser is being taken over by technology. How to ensure a pedagogically successful interaction between the two is the aim - not the promotion of technology *per se.* The mere fact that technology exists is, in itself, no sufficient reason for governments to invest in it. This is a central issue of educational policies.

The Congress will examine these technology-related policy issues and address questions such as:

(a) *Developing National Plans and Policies.* To what extent is it possible to learn from other countries successes and failures in designing national policies for the introduction and support of new technologies in education? Can/should policies be developed for more than one sector of education at a time? How can the success of individual centrally initiated policies be determined in the light of learner performance. teacher performance, and cost benefit? How can each successive layer of education - school, college, employment training - be made to be responsive to what has gone on before? What ways tend to ensure this continuity of practice? In what ways can central administration facilitate a liaison between employers, the community and students to the benefit of each group and the nation?

(b)*Strategies to Bring about Change at Institutional Level.* How do central decisions alter what goes on at institutional level? To what extent can institutions learn from each other? To what extent does the uncertainty of funding lead to poor decision- making? Are there ways in which central policy can still allow institutional autonomy? Are the issues the same for training as for education? To what extent can there be/should there be policies in place to promote equity between institutions? How can training and support be promoted nationally, regionally, and at institutional level so that, for example, the training does not create a demand for technology that cannot be realised? Are there examples that we can share of policies that allow for the support for individuals and institutions to change? Do NITs themselves help in this?

(c)*Strategies for a Future-Proofed Curriculum.* To what extent can any curriculum or examination systems remain independent of the new technologies as they develop? For example, the development of telephone-related technologies, like the Internet, have changed the way students *could* search for information, and the computer has enabled a widening variety of ways through which they could present this information. These changes make it possible to change the curriculum as more skills are made accessible. Should we be making decisions that accommodate these ever changing scenes? If so, how? How can we design strategies that allow for periodic updating of equipment, curriculum, teachers and the community? How can decision-makers stay informed in order to be able to make these decisions with confidence? After more than a decade of computer-related technologies in education (and considerably longer with broadcast technologies), increasing attention is being given to their impact on learning and other aspects of educational productivity. How can the impact of new technologies on learning be measured in terms of educational benefits, efficiency and effectiveness so that public calls for accountability are satisfied? Can this research have any universal relevance? How can we help each other to have the data necessary on which we can each build our policies?

THEME 6:
INTERNATIONAL CO-OPERATION

The rapid development of NITs has not only created unforeseen opportunity for global communications but also has made it more necessary than ever before. As everything is linked to everything else, fewer and fewer activities can be done alone. Isolation and information are internally contradictory. It is the new interconnectedness of everything that presupposes international co-operation which then has to be viewed in the broad context of what the international community together, rather than this or that country alone, can accomplish in a field that is of existential importance to humankind.

In the promotion of NITs for education, UNESCO assumes an internationally important position. In its present Medium-Term Strategy for 1996-2001 (28 C/4) and the Approved Programme and Budget for 1996-1997 (28 C/5), specific actions are included to address the issue of information and communication technologies. The approach combines reflection and action and seeks to respond to two major concerns, namely, to reflect on the impact of the new technologies and to foster their appropriate use in the Organisation's sphere of action. More specifically, UNESCO's Major Programme IV "Communication, Information and Informatics" reflects the increasing convergence of communication, information and informatics by extending the principle of "free flow" to all forms of information that contribute to the progress of societies and by adopting an integrated approach to capacity-building for development through these three areas. The role of UNESCO's General Information Programme (PGI) and its Intergovernmental Council focuses on the challenge of the information technology revolution, taking into account, for example, new possibilities in the application of information technologies in libraries and archives ("virtual" libraries and archives). The Intergovernmental Informatics Programme (IIP), on the other hand, focuses on the application of information technology particularly in supporting the new generation of information systems and services in its programme and activities. Specific activities and projects are carried out also in other Major Programmes, as well as in the transdisciplinary projects. These include, in particular, the use of technologies for extending access to lifelong education for all (Major Programme I), fostering wider access to information or facilitating exchanges and transfer of knowledge and experience (Major Programme II).

Closely linked to these activities are those relating to the adaptation of copyright to the new technological environment, the protection of new categories of works and the encouragement of electronic cultural industries in developing countries with a view to protecting cultural diversity (Major Programme III). UNESCO, which traditionally has a specific and important world role with regard to copyright, recently organized an international symposium on "Copyright and Communication in the Information Society" (Madrid, March 1996). Undoubtedly, copyright rules have a tendency to lag behind progress in the field of technology as NITs could allow very easy copyright breaking of items stored in digital form down the "information superhighway". While there is a need to draw the attention of policy-makers and educators to the copyright of authors whose materials are used for education and training purposes, attention should also be drawn to the need for easy access to both national and foreign educational networks.

The expanding role of NITs in education systems suggests a more intensive cooperation with the producers of both hardware and software, including international companies, especially publishers and computer and media companies. It is important that educators' and trainers' voices can be heard by these companies, but there needs to be an international channel through which these voices can be routed. UNESCO might be considered to be the right "honest broker" to establish this dialogue.

Among the questions related to international co-operation and UNESCO's role in it are:

(a)*UNESCO's Catalyst Role.* What role should UNESCO play, in collaboration with other agencies of the UN system, intergovernmental and nongovernmental organisations, professional associations, private industry and others, to facilitate the sharing of available resources and expertise to strengthen the use of new technologies in education and training, especially in developing countries? In what way can international agencies and programmes support national initiatives and what are the most promising sorts of collaborations that may help support the formulation of better policy-making related to NITs? What specific recommendations should be made to UNESCO and its Member States to ensure that maximum benefit be derived from the use of the new information technologies in education and training? What priorities should be established for UNESCO's strategies in this field? What mechanisms of co-operation should be followed at the international and regional level? What specific global projects could be proposed for UNESCO to foster?

(b)*Information and Copyright Issues.* What are the most effective strategies for increasing the exchange of information and data on the use of informatics in education? How can intellectual property be safeguarded and yet be made widely available? With the complexity of "cyberspace", to what extent is it possible to check up on practice? To what extent and in what ways can education be effective in regulating and /or educating the practice of its staff and students with regard to the intellectual property of others?

(c)*UNESCO's Role as Go-between.* What patterns of co-operation can be suggested for education and industry? Should UNESCO convene meetings between industry and education? What outcomes could be envisaged? What specific co-operation could be imagined with the potential partners: large software development houses, system integrators and hardware manufacturers? What recommendations should be made to ensure continuing dialogue? How should UNESCO best make these (and any other) discussions accessible to everyone who might be interested?

SUMMARY

Advances in information and communication technologies have in recent years resulted in challenging innovations, including a convergence with other technologies, which are providing a very powerful sets of tools to allow individuals and institutions access to other communities, to information, to learning, to scarce resources of expertise and to sharing of ideas and knowledge. The new information technologies have had global impact in shaping the "information society". They have transformed business, industry, government, science, medicine and other sectors of global society. Indeed, they provide exciting new opportunities as well as challenges to the educational systems of the world.

However, inequity in access to information and communication technologies among countries remains a serious problem. Because of their cost and because of the built-in dominance of the culture of the nations mainly developing NITs (not least because of the dominance of the English language in the new media), there is a growing gap between the ability of developing and developed countries to have access to the technologies. Such a gap exists also within several developed countries, with a potential consequence of generating a new type of class society based on an unequal distribution of information.

The very fact that the technology is changing so fast is a disincentive to decision makers. Technology gets out-of-date so quickly that it never seems the right time to make a policy to purchase, and this can become an excuse for inaction. There is also, to many, the disincentive of the dominance of foreign culture, language and values. The technology is not itself essential but its interaction with learning and its role within the context of the overall educational system. This calls for respective educational policies and plans for the introduction and use of communication technologies in education.

Among the most central aspects present in educational policies, often inextricably interlinked, are: Learners, Teachers, Technologies, Policies, Economic, Social and Cultural Issues, and International Co-operation. UNESCO is pleased to invite the distinguished participants of the Second International Congress on Education and Informatics to explore these and other related themes, in view of recommendations to UNESCO and its Member States, and proposals for regional and international co-operation in the field of education and informatics. As tomorrow's progress is based on today's action, the 21st Century has virtually begun.

INVITATION

OF THE DIRECTOR-GENERAL OF UNESCO

Sir/Madam,

I have the honour to inform you that, in accordance with resolution 1.18 adopted by the General Conference at its twenty-seventh session (October-November 1993), UNESCO, in cooperation with the Government of the Russian Federation, is organizing the ***Second International Congress on Education and Informatics (EI'96):*** *Educational Policies and New Technologies, which will be held in Moscow from I to 5 July 1996.*

The first Congress, which took place in 1989 at UNESCO Headquarters in Paris, stressed the need to 'benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation in this field be strengthened.

Today, co-operation is needed more than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby each succeeding generation of hardware and software has rapidly given rise to significant innovations and opportunities for convergence with other technologies. Unforeseen media combinations of global dimensions have emerged to shape the "information society" and to challenge those living in it. In the midst of the phenomenon of "information superhighways", education itself is challenged to critically re-examine its position in view of the fact that technologies tend to develop faster than education's capacity to make use of them.

The Congress, which offers an international forum to discuss the future of education and informatics, will analyse national, regional and international trends and experiences in the introduction and use of NITs in educational systems; review the latest developments in NITs and examine their application in education; discuss international, regional and national policies for the use of NITs in education; and make recommendations for international co-operation.

The Congress, which will pursue the above objectives through six central themes: Policies; Technologies; Teachers; Learners; Economic, Social and Cultural issues; and Transverse Themes, calls for broad international co-operation in order to reflect the variety of needs and aspirations of Member States in this increasingly challenging field.

I should be pleased if your Government would suggest names of individuals or institutions to whom invitations could be sent and to contribute to the preparation of the Congress as detailed in the Annex.

In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses.

Accept, Sir/Madam, the assurances of my highest consideration.

FEDERICO MAYOR

DIRECTOR-GENERAL

DECLARATION

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We, the participants of the Second International Congress *"Education and Informatics: Educational Policies and New Technologies"* convened by UNESCO, in collaboration with the Russian Federation, in Moscow from 1 to 5 July 1996,

Referring

to the Recommendations of the first International Congress *"Education and Informatics"* of 1989,

Aware

of the rapid development thereafter in information and communication technologies (ICTs) and in their education application in particular,

Recognizing

the great potential that ICTs possess at the service of education, science, culture, peace and international understanding,

Concerned

by the possible manifestations of misuse of ICTs for disinformation and propaganda, the potential threat to culture and languages, and the overburden of information,

Cognizant

of the increasing responsibility of the Member States, intergovernmental and nongovernmental organizations and others concerned with the development of national, regional and international information infrastructures to enable all peoples of the world to benefit from ICTs,

Addressing

the needs of developing countries in order to bridge the gap between them and developed countries,

Considering

that ICTs are emerging primarily from the industrialized world carrying messages of its content and form, accelerating the further homogenization and loss of culture and language among many peoples of the world,

Recognizing

the mutual benefit of closer co-operation between education and industry, including hardware and software producers and companies delivering telecommunications systems,

Therefore,

declare our commitment to the effective use of ICTs to improve educational practice, to strengthen communication among nations and individuals, to help promote peace and international understanding and to foster international co-operation in a field of such essential importance to the future of humankind.

We, the participants of the Congress, in the above spirit and with reference to the recommendations here below, appeal to:

governments, educational authorities, business and industry, to strengthen their joint efforts in this field seeking new patterns of co-operation to ensure the availability of adequate ICTs at all levels of education for the ultimate benefit of learners within the framework of lifelong learning for all;

UNESCO and other agencies of the United Nations System, including the United Nations Development Programme, the International Labour Organisation, the World Bank, regional development banks and others concerned, to extend their support to the introduction and application of ICTs in education, notably to the benefit of developing countries.

RECOMMENDATIONS

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

THEME 1:

LEARNERS

UNESCO should make available, via the Internet and other suitable distribution channels, existing high quality case studies and research on the use of Information and Communication Technologies (ICTs) in teaching and learning for all populations (primary, secondary, higher education, adult education, vocational education and special education) and, where it exists, provide evidence of most favoured and most productive examples. The needs of the hearing impaired should be especially considered.

Where there are critical research gaps, UNESCO should encourage (or even commission), research from Member States to produce evidence, with examples drawn from a cultural sample as wide as possible. Pilot projects should be set up in order to test new teaching/learning philosophies using ICTs in education. The studies should not only investigate the delivery of the old curricula through ICTs but also new curricula which the availability of ICTs has enabled.

UNESCO should investigate new evaluation and assessment paradigms to better reflect the cognitive learning processes and skills resulting from the effective application of ICTs. Researchers should be encouraged to compare learning achieved by traditional pedagogy, by an ICT-enriched pedagogy and by an ICT-based pedagogy.

Museums, broadcasting and media institutions, archive collections should be encouraged to make their collections widely accessible to the community (especially to teachers and learners) through the use of the Internet.

Specific skills are required by the learner and teacher to effectively use Distance Education. UNESCO should encourage international co-operation in creating and disseminating programmes that assist in the proficient use of Distance Education.

THEME 2:

TEACHERS

National and international agencies should support the dissemination, by appropriate means, of successful strategies and best practices of teachers' and trainers' use of ICTs. Teachers and their professional associations should be encouraged to involve themselves in the process of change to revalidate their roles and to master ICTs. The development of ICTs must not be left to the commercial and industrial world alone but be developed in co-operation with it.

Research data should be collected (and frequently updated) on the changes in the role of the teacher from an instructor to a guide and mentor. UNESCO should encourage the inclusion into on-line data bases of research data collected in developing countries. UNESCO should make links to these data bases from its sites in the World Wide Web.

UNESCO should collaborate with other agencies to set up models of in-service training and professional development for teachers and trainers which make effective use of the approaches, facilities and opportunities provided by the use of technology, including telecommunications. In particular, UNESCO should encourage the organization of workshops and seminars in developing countries, such as the ones using the UNESCO/International Federation for Information Processing (IFIP) document on *"Informatics for Secondary Education"*.

UNESCO should explore the possibility of linking regional telematic centres world-wide to cover topics such as the use of multi-media, training of trainers, management techniques, instructional design, pedagogical innovation, etc. and should endeavour to incorporate into such an initiative priority pilot projects, e.g. telematic development centres in Africa.

THEME 3:

TECHNOLOGIES

Policy-makers in Member States at all levels should set up working parties to consider priorities in the provision of technology for education and training, appropriate to the resources and infrastructure within Member States. Member States should consider lodging copies of reports on the strategies they are adopting or considering with UNESCO for it to make these available to help worldwide debate.

UNESCO should look into the possibility of setting up a forum on the Internet in which practitioners report on their use and on their opinions as to the value of emerging technologies in the educative process.

UNESCO is urged to consider co-operating with concerned nongovernmental organizations and professional associations such as IFIP in order to stimulate research on the improvement of computer interfaces for learning, particularly in teacher training and primary and secondary education.

The International Standards Organization, or such an appropriate body, should be invited to review, simplify and update the terminology in the area of new technology, in association with educational experts.

Governments of Member States are encouraged to urge their telephone and communication companies to consider the establishment of appropriate links to educational institutions, either free of charge or at discount rates.

Member States and UNESCO should consider supporting and facilitating the sharing of interactive television technology practices and output between countries.

THEME 4:

SOCIAL, ECONOMIC AND CULTURAL ISSUES

UNESCO should encourage Member States to share their ICT funding strategies and to consider publishing a selection of these where there are elements in the plans that could be of use to other States.

UNESCO should encourage the research community in Member States to address issues such as the value of ICTs in the pursuit of peace and international understanding, in reinforcing or protecting native cultures and in providing educational opportunity worldwide. UNESCO should use its offices as a clearing house for the publicity and dissemination of these research ideas.

It is recommended that Member States develop regional co-operation to encourage the pooling of experiences in the use of ICTs, acquired in comparable environments, in order to avoid the repetition of mistakes and the wastage of time and scarce financial resources. Telecommunications could assist this co-operation.

UNESCO, in co-operation with the World Health Organization, should consider re-assessing the effects of ICTs on the health and behaviour of children and students and disseminate the results and any recommendations to teachers, programme designers, students and the community at large.

THEME 5:

EDUCATIONAL POLICIES

It is strongly recommended that national governments plan and start evaluation programmes on the implementation of ICTs in their educational systems if they are not already doing so. UNESCO should act as a collector and disseminator of this information.

Case studies should be collected on successful techniques for implementing institutional change using ICTs and on their impact, both positive and negative, on changing existing curricula. UNESCO should disseminate these case studies. A comprehensive and systematic study of the causes and consequences of changes on society and learning systems (brought about by the introduction of ICTs in education and training) is needed. Special emphasis should be put on the interdependency of change factors in this area and their impact on strategic planning and policy.

UNESCO should encourage Member States to upgrade their ICT specialists by further education in their own or other countries, by the use of international consultants and/or by distance learning. UNESCO should facilitate this where possible.

UNESCO and Member States are asked to encourage national and international funding institutions to pay due attention to the potential of information and communication technologies as tools to improve educational access and opportunities, particularly for unreached communities and children with special needs.

Member States, who have not already done so, should be encouraged to formulate a national strategic plan for the introduction of information technology into their educational systems. This plan should take account of social, cultural and economic conditions.

It is recommended that UNESCO considers commissioning IFIP, established by UNESCO, to prepare a report on *"Information and Communication Technologies in Education"*. Although the report should cover the widest spectrum of policies, it should also specifically address the needs of developing countries.

Member States are asked to consider looking into ways in which business and industry can work co-operatively with education in order to enhance the teaching/learning environment. UNESCO might consider it appropriate to offer its services as an honest broker to facilitate this process.

In line with the recommendation in the report

"Learning: The Treasure Within" 1996, UNESCO is encouraged, with an eye to the future, to set up an observatory to look into new information technologies, their evolution and their foreseeable impact not only on education systems but also on modern societies.

UNESCO is encouraged to continue its work in copyright concerning the new technologies, working towards international standards of law and practice. Member States are urged to bring forcefully to the attention of their educational communities the illegality of malpractice and piracy.

THEME 6:

INTERNATIONAL CO-OPERATION

UNESCO should examine the possibility of convening a follow-up meeting soon after the Congress, inviting the collaboration of representatives of other agencies of the UN system, relevant intergovernmental and nongovernmental organizations, professional associations, private industry and any other appropriate individuals or bodies, to decide on the priority to be given to each recommendation made by the Congress and to identify responsibility for its implementation. UNESCO is urged to give some priority in its ITC programme to countries in transition and to developing countries, such as those in Central and Eastern Europe, the Palestine Authority and South Africa.

UNESCO should consider one or two major worldwide projects involving ICTs to directly meet the needs of Member States, e.g. *"A Global Network for Tele-training for Teachers"* and *"A UNESCO Institute on Educational Policy and NITs"* (see Annex), to be implemented in collaboration with appropriate partners.

A priority need expressed frequently during the Congress has been for the collection and dissemination of data on best practice. This could usefully include a bank of exemplary test items, case studies, curricular materials and accounts of implementation techniques. UNESCO is asked to consider establishing such a collection, accessed by way of the Internet.

Being aware of the urgent need to support schools in developing countries, the Congress urges Member States to initiate programmes which twin their schools with those in severe need in order to assist them in the acquisition and use of ICTs and to promote cultural exchanges and mutual understanding.

PROPOSALS FOR POSSIBLE UNESCO PROJECTS

UNESCO GLOBAL PROJECT:

"A GLOBAL NETWORK FOR TELE-TRAINING FOR TEACHERS

The proposal indicates plans for a Global Teachers Network Service Organization (GTNSO) which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet.

With rapid advances in technology, it is difficult for the existing systems of teachers training and in-service to stay up-to-date in terms of the implications of innovations in teaching and practice. Awareness and experience with the use of new technologies in teaching and learning are not yet found in all teacher education systems.

These new communication and information technologies provide opportunities for a worldwide community of experts to be brought together with teachers through a global project that facilitates the provision of quality courses and resources for teachers through a common service organization. This proposal defining such an organization is based on UNESCO's unique international network of scientific experts and national contacts such as Ministries of Education. A special benefit of such a service organization is that it can not only service existing institutes of teacher education and in-service but also the teacher's emerging needs for lifelong training.

A special feature of this proposal, in addition to the unique human, professional network on which the Network Service Organization can be built, is the provision of "authoring templates" for course materials. Course providers in countries throughout the world can provide course content, in their language of choice, and the content can be fitted into various templates for hyper linked, multimedia distributed access. Currently these templates make use of World Wide Web technologies.

Another strength of the proposal is the collection and availability of examples of models of good practice, involving new technologies and new didactics in the classroom. These models will come from a wide range of cultural settings, and will be eventually expressed in a range of languages as well as media, so that teachers can see, hear, or read about classroom applications of new technologies and student work developed from those applications.

The proposal is connected with a number of projects already attempting to use network technologies to bring networked services to teachers. At the same time the Project should benefit from the results of all R&D projects on national and transnational levels in which UNESCO is directly or indirectly involved (for example, the Russian DESCOP - Distance Education in New Information Medium, and others).

These are the arguments for presenting this proposal to the UNESCO Congress participants and to the Director-General of UNESCO. We hope that the Member States will support the proposal and include the Project into the final document.

2. A UNESCO INSTITUTE ON EDUCATION POLICY AND NEW INFORMATION TECHNOLOGIES

Proceeding from the recommendations worked out by international forums held under the UN auspices as regards the implementation by all Member States concerned of coordinated actions with the purpose of defining the community's policy and types of activity for the sake of humankind's steady development,

Basing on the fact that education policy should embrace postulates included in the recommendations of the International Commission on Education for the Twenty-first Century: learning to know; learning to do; learning to live together, learning to live with others; learning to be,

Recognizing that education technologies must create an environment allowing colleges and other academic, scientific and vocational training establishments to perform a critical role in the sphere of developing and accomplishing the strategy and policy of development,

Bearing in mind the necessity of applying new information technologies to education purposes for deriving advantages from a collective know-how, as well as a joint utilization of limited resources,

Participants of the Congress deem it essential to endorse the initiative to establish in Moscow a UNESCO Institute on educational policy and new information technologies with the object of working out a model of global lifelong education for all and everybody,

Recognizing that its activity will foster the elaboration, professional estimation, selection and worldwide dissemination of prospective education and information technologies, as well as updated means of communication.

FINAL REPORT
OF UNESCO
"EDUCATION AND INFORMATICS "

FOREWORD

The purpose of the present Report is to give a comprehensive and accurate presentation of the work and outcome of the meeting. Its contents are mainly fact-oriented.

The lines below are meant to bring into the limelight the people and institutions or organizations whose unflagging support, dedication and energy have paved the way for its successful preparation and organization.

It is due to the active and generous support received from the Russian Government, both in financial and technical terms, and the assistance offered by several sponsors, that the Congress was able to reach its objectives.

I would like take this opportunity to thank all members of the International Programme Committee for their high intellectual contribution to the preparation of the Congress programme. Their continuous commitment and enthusiasm were essential to its success.

Equally important was the intellectual and financial contribution made by the Children in an Information Age Programme, headed by Academician Blagovest Sendov, Dr. Ivan Stanchev (Bulgaria); Directorate-General XIII of the European Commission; The University of Twente, The Netherlands (Professors Jef Moonen and Betty Collis); the International Federation for Information Processing (Dr. Peter Bollerslev); the International Conference on Technology and Education (Mrs. Sylvia Charp, Mr. John Foster); and the University of Texas at Austin, USA (Professors Michael Thomas and Paul Resta).

Tribute also should be paid to the almost 100 Russian leading specialists whose intellectual contribution and organizational efforts to the preparation of the Congress have won wide recognition. In this respect I would like to thank particularly Professor Vladimir Kinelev, Minister of Education of the Russian Federation, who chaired the Russian Organizing Committee and presided over the Congress, and his close collaborators from the Russian Organizing Committee: Professor Valeri Meskov, Acad. Yuri Ershov, Dr. Irina Smirnova, Professor Eduard Manushin, Mr. Konstantin Peev, to mention only a few.

Thanks are also due to Professor Viktor Sadovnichy, Rector of Lomonosov Moscow State University, to the academic staff and students of the University for the hospitality and excellent conditions offered to participants.

Last but not least a word of sincere gratitude to my colleagues for their advice, assistance and encouragement, particularly to Heimo Mäntynen, Marco A. R. Dias, Peter Herold and Mariana Pătru.

EVGUENI KHVILON
CONGRESS COORDINATOR

INTRODUCTION

ORGANIZATION, OBJECTIVES AND OUTCOME OF THE CONGRESS

In accordance with Resolution 1.18 of the twenty-seventh session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, organized the Second International Congress (Cat. IV) on ***Education and Informatics (EI'96) - Educational Policies and New Technologies*** in Moscow, from 1 to 5 July 1996. The Congress was hosted by Lomonosov Moscow State University.

The first Congress, held in Paris in 1989, had stressed the need *to benefit from collective experience and the sharing of scarce resources in the field of new information and communication technologies (ICTs) in education* and, to this effect, recommended that international co-operation be strengthened. The recent years have witnessed remarkable developments in information and communication technologies, whereby hardware and software generations have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to further shape the *information society* and to challenge those living in it. In the midst of the information superhighways, education is challenged to reexamine its position critically, especially since technologies seem to develop faster than education has the capacity to use them.

The Second Congress, which offered an international forum for the discussion of problems of immediate concern for all countries in the world, was intended to pursue the following objectives: (i) to *analyze* national, regional and international trends and experiences in the introduction and use of new information and communication technologies in educational systems; (ii) to *review* the latest developments in the field of new information and communication technologies and *examine* their application in education; (iii) to *discuss* international, regional and national policies for the use of these technologies in education; (iv) to *make recommendations* for international co-operation.

At the end of its work, the Congress adopted a *Declaration* and *Recommendations* addressed to Member States and to the Director-General of UNESCO, as well as proposals for international co-operation and specific major projects in the field, notably to the benefit of developing countries.

As common for international congresses of Category IV, UNESCO invited Member States, international governmental and nongovernmental organizations, other UN specialized agencies, professional associations as well as private companies active in the field of introduction and application of new information and communication technologies in education to designate participants and observers in their personal capacity. Participants and observers included ministers, members of parliament, decision-makers, teachers, researchers, students, software and hardware developers, representing seventy-one countries and nine international governmental and nongovernmental organizations. Given the big interest called by this important event, a considerable number of Russian participants and observers attended the Congress.

BACKGROUND DATA AND PREPARATION OF THE CONGRESS

In order to ensure a good preparation of the Congress, UNESCO set up an International Programme Committee (IPC), which included academicians, presidents of universities, researchers and experts, representing all regions of the world. Academician Yuri L. Ershov (Russian Federation) and Professor Jef Moonen (The Netherlands) acted as IPC Co-Chairpersons. For the coordination of all preparatory activities and co-operation with UNESCO, the Government of the Russian Federation established a Russian Organizing Committee, consisting of ministers and rectors of leading Russian higher education institutions.

In order to identify the priorities and needs of Member States concerning the introduction and implementation of information and communication technologies in education, ten regional and sub-regional expert meetings/seminars were organized from 1994 to 1996 in preparation of the Congress. Four regional expert meetings were held in 1996 in: Austin (USA) for North and Latin American, as well as Caribbean countries; St. Petersburg and Vladivostok (Russian Federation) for Europe Region and Asia and Pacific countries, respectively; and Dakar (Senegal) for African countries. Six sub-regional meetings took place in Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (The Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russian Federation, 1991, 1996).

Based on the proposals and recommendations put forward at the regional expert meetings, the International Programme Committee and UNESCO Secretariat elaborated and distributed a main working document and other reference documents which outlined the programme, the six major themes and the sub-themes to be examined at the Congress in the light of the objectives set.

PROGRAMME AND THEMES

In keeping with the established programme, the Congress conducted its work in plenary and commission sessions. Each Congress day began with a plenary session in which a keynote speaker made the main presentation on a major theme, followed by presentations and discussions in three commissions. Commission I focused its debates on *trends and experiences in the introduction and use of ICTs in educational systems*; Commission II, on the *latest developments in ICTs in education*; Commission III, on *co-operation for the use of ICTs in education.*

Six major themes were selected to address the needs of all those involved in the educational process at various levels. The first one dealt with *Learners* (learning tools, new roles for learners, new options for learning inside and outside educational institutions); the second was devoted to *Teachers* (current practices with new technologies, pre- and in-service teacher training new roles for teachers); the third theme focused on *Technologies* (computer science, computer-enhanced instruction and "traditional educational technologies, multimedia and telematics); the fourth theme dealt with *Social, Economic and Cultural Issues* (the role of ICTs in helping to ensure equal opportunities for the development of skills and knowledge; how the new learning and teaching methods, using the advantages of the already existing networks, can contribute to the overcoming of the social, economic and cultural barriers with reasonable and cost-effective solutions, negative and positive changes in the society under the pressure of the technology development); the fifth theme covered *Educational Policies* (developing national plans, strategies for change at institutional level, strategies for a future-proofed curriculum); and the sixth theme centred on *International Co-operation* (the needs for international co-operation in the human resource development area, the increasing role of UNESCO in promoting international co-operation in the field of open and distance education among interested partners).

The debates of the plenary sessions, which amounted to twenty hours in all, were daily broadcast via the Internet.

In addition to the plenary and commission sessions, twelve workshops were organized on the last two days of the Congress. More detailed information about the workshops is provided in para. 61 of the report.

In conjunction with the Congress an international trade fair (EDIT'96) was organized, in which 80 organizations, both Russian and foreign, participated (higher education institutions, research institutes developing educational software, etc.), as well as 15 leading computer companies, IBM, Apple, Novell, Oracle, Informix, to name only the most important. On display were the latest achievements in educational media and technology, telecommunications and information resources of global computer networks, general and special purpose computer equipment, broken down into ten categories: electronic educational media; telecommunications; distance education; general and vocational education; multimedia in education; information resources of higher education; expert and intellectual systems; simulation and computer-design systems; support of scientific and technological enterprise in higher education; and future technologies in higher education. The total trade fair space amounted to 1,000 square meters.

EXECUTIVE SUMMARY

OPENING CEREMONY

The opening ceremony was held on 1 July 1996 in the Grand Hall of Lomonosov Moscow State University. Mr. Vladimir G. Kinelev, Deputy Chairman of the Government of the Russian Federation and Chairman of the State Committee for Higher Education, welcomed participants and read out a message addressed to them on behalf of President Boris Eltsin.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience welcoming participants on behalf of Mr. Federico Mayor, Director-General of UNESCO.

Mr. Kurt Bauknecht, President of the International Federation for Information Processing (IFIP), an organization affiliated to UNESCO, then took the floor.

The next speaker was Mr. Armando Rocha Trindade, President of the International Council for Distance Education (ICDE), also affiliated to UNESCO.

At the end of the opening ceremony Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, addressed the audience welcoming them and expressing confidence in the success of this high-level international forum.

OPENING PLENARY SESSION

According to item 2 of the provisional agenda, the Congress elected Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education of the Russian Federation, as President of the Congress by acclamation. After the adoption of the Rules of Procedure, the President of the Congress requested participants to approve the constitution of a Bureau.

A group was elected by acclamation to draft the Declaration and Recommendations of the Congress.

The President introduced the provisional agenda (ED-96/ICEI/1) which was adopted.

The opening plenary session began with the presentation of three keynote papers, the purpose of which was to explore the current trends and pedagogical issues in the application of new information and communication technologies throughout the world, to analyze their strong impact on social, economic and cultural development in general, and to examine policy and strategy issues related to the expansion of the access of millions of young people and adults to education through communication technologies, including open and distance education.

The first presentation, entitled "Education and Civilization", was made by Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education (Russian Federation), who emphasized the great responsibility incumbent on today's policy-makers, educators, scholars to foresee the development trends of ICTs and come up with appropriate solutions to overcome negative social, economic and cultural effects. He made a brief overview of the rapid changes which science and technology have made particularly over the past two centuries, stressing that education has become an issue of concern to a wide range of stakeholders: teachers, scholars, scientists, and decision-makers. He also pointed out that the new information and communication technologies have opened new opportunities for teachers and students alike, the creation of global networks facilitating the access to, and the dissemination of, knowledge and skills. He further stressed that today's educational system should be capable not only of equipping students with knowledge, but also with skills and habits which enable them to study independently throughout their lives. He concluded by saying that education for the 21st century should be education for all, providing equal opportunities for individual development.

In his speech on "New Perspectives for Learning in the Information Age", Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, referred to the profound revolution which education is undergoing today, as profound as the invention of printing, and to the ways in which ICTs are transforming the perspectives of teaching and learning in all societies. He stressed that these technologies offer students the possibility of exploring domains of knowledge for themselves, of becoming genuinely active participants rather than passive recipients of knowledge dispensed by the teacher. The role of the teacher is also radically changing under the impact of ICTs, from that of a solitary information provider to that of a manager of class learning. He drew particular attention to the concern of UNESCO to ensure that the information revolution does not serve to widen the gap between the haves and the have-nots, between those who are and those who are not connected to the information superhighway, in other words between developed and developing countries. In this context he mentioned UNESCO's Major Programme IV ("Communication, Information and Informatics") of the Approved Programme and Budget for 1996-1997, which is focused on capacity-building in the developing countries in the field of communication, information and informatics, its International Programme for the Development of Communication, General Information Programme and Intergovernmental Informatics Programme. He pointed out that education is for UNESCO the single most effective means to curb population growth, eradicate poverty, reduce child mortality and foster democracy, peace and sustainable development. At the end of his speech, he mentioned the recommendation made to UNESCO by the International Commission on Education for the Twenty-first Century in its report, namely to create an 'observatory' to explore and ponder the likely impact of ICTs on human freedom and development and on educational and learning process in particular.

The opening plenary session ended with the speech given by Dr. Norio Matsumae, President of Tokai University (Japan), on "New Direction in Education". The paper focused mainly on the need to reevaluate educational values for the 21st century and the impact that changing technology or society have on education. The speaker's arguments focused on six principles: (i) the need to redefine human values starting from a reflection on the traditional concepts for the purpose of finding out the new direction in which education develops; (ii) the need to create a basic idea on the target of education with due consideration of Japan's postwar education; (iii) the complementarity of state and private educational institutions and their contribution to developing a sense of fair competition, as illustrated by the Japanese educational system; (iv) this fair competition has a positive impact on society from the perspective of the introduction of advanced information technologies: (v) the danger that advanced technologies pose to the preservation of traditional culture and values and the important role played by education in preventing undesired effects; (vi) the beneficial use of advanced information and communication technologies in higher education in the next century, including satellite-based distance education, and the role and responsibilities of universities in this new age.

THEME 1: LEARNERS

The first theme was introduced by two keynote speakers, Mr. Blagovest Sendov, President of Parliament (Bulgaria) and Mr. Tahar Hafaied, Director, Institut National de Bureautique et de Micro-Informatique (Tunisia).

In his keynote speech, entitled *In a Global Knowledge Space: Towards Global Wisdom*, Mr. Sendov drew attention to the challenges, both political and technological, that the world is confronted with on the threshold of the 21st century. The information society built upon global information networks offers new challenges to policy-makers, researchers, teachers and learners. He pointed out that the fact that the Congress was held in the European Year of Lifelong Learning was not accidental, on the contrary it reflects the concern of UNESCO and of the European Commission to ensure the conditions for the worldwide dissemination of a technology-driven educational reform. Such a reform would give learners all over the world unlimited access to information and locally available educational services, expertise and resources. However, in the speaker's opinion, ICTs should not be used to the detriment of cultural values, traditions, national identity. In this respect UNESCO is called upon to promote programmes aimed at preserving the cultural diversity in the world. One of the most important changes is the enormous information overload due to the low cost of multimedia information production and distribution and the diversity of distribution channels. This information overload could trigger off an information overskill problem, as the filtering of the great volume of information is very difficult to make and only a small amount of it can be transformed into usable knowledge. It is precisely in the selection of information that the role of teachers is most important. The speaker concluded that UNESCO, other UN specialized agencies, IGOs and NGOs, national governments should coordinate their efforts and launch programmes aimed at smoothing the transition to a communication and information technology-based education.

Mr. Hafaied developed in his speech, *Training in the Context of New Information and Communication Technologies*, some ideas touched on by the first speaker. He drew attention to the fact that the globalisation phenomenon in the application of new information and communication technologies brought about competitive strategies and instituted a new total quality management system in all sectors of activity. The new technologies have become decisive instruments in the development strategy of any country and the information infrastructure has a great impact on the management of most socio-economic activities. The training system (pre-, in-service or continuing) should better equip learners with the knowledge and skills necessary to help them cope with a rapidly changing environment. The speaker argued in favour of a transdisciplinary and dynamic educational system based on a systemic, interactive approach which takes into account the expected objectives. The traditional role of teachers is radically changed. They should be capable of rationally using the new information and communication technologies and of mastering the methodological concepts to allow them to simulate and navigate through the information flow, selecting and restructuring information according to well-defined educational objectives. The speaker stressed the importance of pre- and in-service teacher training courses, which should integrate cognitive, psychological, pedagogical and communication modules. The strategy to be adopted in order to bridge the gap between the traditional and the new, technology-based approach consists in the progressive integration of new information and communication technologies so as to eliminate the phenomenon of rejection due to high costs and human resources involved. Thus the new pedagogical solutions advanced by teachers and teacher trainers would in their turn lead to an evaluation feedback from the peers and ultimately to increased co-operation and participation in the training process.

The discussions in Commission I focused on the peculiarities related to the stages of introducing new information and communication technologies at different levels of education, in the fist place in secondary and higher education. In a first stage special attention should be paid to the acquisition of computer literacy skills, to the teaching of informatics in schools and higher education institutions. Thus the use of the new technologies gradually expands to various knowledge areas. The second stage is linked to the emergence of personal computers in secondary education, which are used not only in the teaching of informatics or foreign languages but also in the teaching of physics, mathematics chemistry and biology. However, several participants noted that only a few elite schools could use ICTs in the first stage. Concrete experiences in the teaching of informatics were provided from secondary schools in Switzerland and Russia. The third stage refers to the use of ICTs in higher education. Universities worldwide have developed programmes aimed at introducing ICTs in order to increase the efficiency of the teaching-learning process, to create more opportunities for distance learning, to give students more time for individual study. The special tasks of universities is to advance knowledge through research in the field, to experiment the application of ICTs in education and to caution against excesses. A general remark was that more attention should be paid to the human aspect when introducing new ICTs in distance education. More studies in psychology should be conducted to promote individualization, division of learners by learner types and the adaptation of learning materials. In spite of the rapid development of new information and communication technologies, the access to them remains restricted, many countries still lacking the necessary equipment.

Participants in Commission II devoted particular attention to the fundamental reorganization of society brought about by the introduction of personal computers and technologies linked to the Internet. These technologies, unlike books and TV, enable global communication between end-users without the need of intermediaries. The opinion was expressed that the changes in educational systems and in the role of the teacher lag behind those in the field of new technologies. However, the information disseminated by means of the new technologies becomes widely accessible and provides new educational opportunities through parallel educational channels. Concern was expressed with respect to the lack of sufficient rules of behaviour permitting to evaluate the correctness of the information disseminated via the Internet and to control possible misuse, particularly concerning international transfers where different legal systems apply. There is also the problem of increased error risk due to the concentration on limited sensory channels of communication. Laws cannot be expected to ensure the necessary behavioural changes which will require an increasing reliance on co-operation rather than competition in human relations. The suggestion was made that academic communities could provide a useful model for testing and emulation in this context, given that their working methods and approaches are already more co-operative and less competitive than in other sectors of society. Two case studies of programmes to introduce informatics in national school systems were presented at length (Israel and Russia). Other discussions centred on encouraging students to produce, and not only use, computer programmes and on providing sufficient training and back-up for teachers.

The discussions in Commission III focused on the Canadian experience in the creation and operation of the Tele-University in Québec and on the achievements in the globalisation of teaching and learning. An interesting presentation was made about a project involving the transfer of educational film to digital format for use on the Internet. The importance of distance education for a wide category of users was stressed, in particular for handicapped as well as gifted children and for the professional retraining of teachers themselves. Concern was voiced over the lack of worthwhile information on the Internet. Attention was drawn to the problems teachers in Central and Eastern countries face (e.g. Hungary) in developing curricula after a forty-year period of overcentralized national educational policy which tended to minimize the input of teachers. Other issues of interest referred to evaluation of successful educational programmes and to comparison criteria of new and old educational methods. According to one opinion, success is a function of three variables (the "3P" model): expected payoff, level of problems that have to be overcome and intrinsic pleasure in being involved with a computer-related innovation. One of the advantages of new information and communication technologies lies in the cross cultural transference of technological innovations in education. The problem of copyright and royalty payment to authors of educational materials 'broadcast' on the new communication technologies should be solved as a prerequisite to their successful application. Two recommendations were made to UNESCO: the first, to set up a working group which should examine the pedagogical aspects related to the use of new information and communication technologies, the present and future data exchanges between countries; the second, to collect and disseminate 'best practice' case studies on projects using new information and communication technologies.

THEME 2: TEACHERS

The second theme was introduced in the plenary session by Mr. Qian Kunming, Deputy Director, Distance Education Centre of Central Radio and TV University (People's Republic of China) and Mr. Alexei L. Semenov, President of Moscow Institute for Teacher Development, Vice-Chairman of Moscow Department of Education (Russian Federation).

Mr. Kunming's paper, *New Information Technology and Teachers*, gave an overview, based on statistical data, of teacher training programmes at the national level which make use of ICTs, a phenomenon which has gained momentum over the last years. Faced with the challenges of the 'information society' and of the 'information highway', the traditional teacher-centred educational model had to be changed and new policies be developed. He illustrated his arguments by taking his university, Radio and TV University of China, as a concrete example. The success of the teacher training programme based on ICTs, introduced by the University (1.5 million college graduates in 8 years only), prompted the Chinese government to extend the use of the new technologies in the training of primary and secondary school teachers. A national network of satellite TV education was established, which broadcasts two sets of educational programmes through a Chinese communication satellite. Special emphasis was laid on the courses produced by China TV Teachers College, covering a wide range of subjects (156 in total), 12,000 hours of visual teaching programmes, which are very popular among teachers. The growing role of distance education has turned the latter into an independent educational model. The wide use of the new information and communication technologies has radically changed the traditional teacher-student relationship. Notwithstanding the rapid development of ICTs, the latter can never replace the direct interpersonal exchange in the educational process. The speaker concluded by stressing the key role of the human factor (i.e. the teacher), the only one capable of inculcating moral values in students.

Mr. Semenov placed his presentation, *Informatics in Russian Secondary Education*, in the general framework of the in-depth educational reform going in Russia at all levels and covering all aspects, teacher training included. His conclusions are based on first-hand experience in the introduction and application of new information and communication technologies in secondary schools all over the country. The experiment conducted in secondary schools once again underlined the key role that teachers play in the reform of the educational process and that particular attention should be therefore paid to their pre- and in-service training. The assimilation by teachers of the necessary skills in mastering the new technologies was conceived as a modular, multi-stage process, designed to overcome possible psychological barriers. This process was backed by the development of federal and regional guidelines regarding the application of information technologies followed by all secondary schools. According to the curriculum, information technologies were included in the general domain of technology studies, involving the development of software environments (e.g. general applications, construction kits, combination of logo and hyper-encyclopedias on CD-ROMs). The success of the programme was ensured to a great extent by the good co-operation relations established between teachers-specialists in new technologies and non-specialists in the teaching of various subjects. Given the vast amount of information disseminated, teachers and students came to regard the Internet as a form of alternative and informal education, a source for student investigation and data collection projects, teleconferences in the framework of the regular curriculum. The speaker concluded that the Russian teachers involved in the project were ready to share their experience with colleagues from other countries and develop co-operation in the field.

The discussions in Commission I began with an evaluation of the results of what is referred to as the "first wave" in the application of computers in education. Proposals were then made for the "second wave" of computer network applications. Access to infrastructure and economies of scale at national or regional level was stressed. In order to minimize the problem of teachers facing difficulties in the access and use of computers, developers/project initiators should work through with teachers all problems related to the use of computers in the classroom. It was emphasized that there are no grounds for concern over the fact that the increased use of ICTs might lead to lack of communication with the students or for a need to protect the latter from harmful information. Governments and educational institutions should not carry out large-scale teacher-training programmes. It is better to concentrate efforts on small projects which are both cost-effective and relevant to immediate concerns. Mention was made of the lack of a large commercial market of computer software and commercial networks for educational purposes. The setting up of cost-free networks for teachers and students is a must in the face of the new challenges. Computer networks permit teachers to have wider access to information and resources and to choose relevant software for their teaching programme. Several speakers pointed out that the development of educational software should not be left to the commercial and industrial world alone. Teachers and their professional associations should be encouraged to become pioneers, innovators and initiators of the wide application of new technologies in education. An interesting presentation was made of a project on how information superhighways can be used for the purpose of introducing pedagogical innovations. Attention was drawn to the fact that the use of ICTs should focus on the pedagogical, and not technological, aspect. The teachers' role as coordinators and 'navigators' was emphasized. They should stimulate reproductive, problem-based and quality learning by using ICTs as one of the tools among others. Integrated curricula, active students and passive teachers, critical thinking and individualization are the key approaches which should be applied in computer-based teacher training programmes.

Commission II launched its debates by questioning whether the new information and communication technologies do actually benefit education. A case study conducted in Bulgaria suggested that they could, on condition that they help introduce a discovery approach to learning and that teachers are well prepared and enjoy their new roles. It was demonstrated that the application of computers can actually empower students, minimizing their traditional role of passive recipients, an autocratic teaching style being no longer possible. Another case study referred to the use of the Internet in the schools of Montana (USA), a state which, in certain respects, can be compared to some developing countries because of its isolation and relatively poor economy. The Network Montana project was developed on a cost-effective basis by planning for the whole state, enlisting the co-operation of industrial partners and making use of the communication channels developed for larger Internet users. A concrete example was the earth sciences curriculum delivered via the Internet, which makes extensive use of real data and image analysis software available on the Internet. It was noted that such experiments cannot be conducted in developing countries, on the one hand, because of the lack of corresponding infrastructure, and the considerable financial expenditure involved, on the other hand. The proposal was made that UNESCO should help these countries in evaluating these technologies and advising on their use.

Among the issues discussed in Commission III was the importance of 'strategic planning' for educational technology projects using new information and communication technologies, which has the following main stages: staff development, curriculum development, equipment development, courseware development and laboratory/practicum development. It was argued that the move to multimedia, like the move to effectively adopt any new teaching and learning methodology, can only be successful and viable if it is undertaken as part of a coherent long-term plan designed to provide solutions in a system-wide manner. One of the projects presented involved several US schools in a model of computer use, called Computer Supported Collaborative Learning. Aimed at changing the role of the teacher and the student and based on pedagogical goals of constructivism and 'intentional learning', the project has created a knowledge building community, using telecommunications, within and without the school, plus group support system software to achieve these goals.

THEME 3: TECHNOLOGIES

The third theme was introduced in the plenary session by Professor Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France) and Mr. Rockley L. Miller, President of Future Systems Incorporated (USA).

Professor Arnaud's keynote speech, *Quelles technologies pour l'éducation? Les Nouvelles Tech-*

nologies Educatives à l'heure du déploiement (Which Technologies for Education? New Educational Technologies at the time of Deployment), brought to the fore several questions linked to the application of new technologies in education: (i) the purpose for which a student should acquire more in-depth knowledge about informatics and computers (what solution can be found to the "computers as object of study versus learning tool" dilemma); (ii) the growth of tertiary-professions favours the emergence of an information industry and calls for a change from the so-called processing informatics to communication informatics: in the light of these developments, what is the impact of information superhighways on educational systems and methods? (iii) as social and economic transformations accompany these technological changes, more and more time is devoted to the search for information, which is one of the principal components of knowledge acquisition and training: do the information and communication systems operating in educational institutions keep the pace with this evolution? can training remain a local or a national concern at the time of global networks? The answers lie in the new approach to learning, which should be regarded as a lifelong education process, giving everybody the opportunity to continuously update their knowledge and know-how throughout the active life, to enable them to cope with the everyday changes in the social and economic sphere. That is why the application of informatics in lifelong education has been developing at a more rapid pace than in pre-service and higher education. The speaker argues that the emergence at the end of the 1980s of the global networks and the definition of communication architectures have offered their users new models for the organization of their information systems, informatics changing its vocation from an information-centred to a knowledge-management system. The entire argumentation is based on a clear fact, namely that technologies are only a means to reform the teaching/learning process and not a substitute, and that software developers should systematically include in their projects an educational component accessible to all actors involved (teachers, institutions, enterprises).

Mr. Miller, the second plenary keynote speaker, whose paper was titled *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training, and Global Communications*, began by explaining why Moore's Law has proved incredibly reliable over the past two decades of computer evolution and has had a profound impact on the computing industry and all those parts of society that have benefited from harnessing that growth in computer power. Gordon Moore, founder of Intel Corporation, had predicted that the transistor density - and thus the raw processing power - of silicon-based microprocessor would double every 18 months. The speaker argued that the same law, which is expected to remain reliable for the next twenty years, is now having a major impact on the field of telecommunications, an impact especially demonstrated in the exponential growth in the vast international network of computers known as the Internet. With respect to the impact of technology advancement on public policy and social development, the presentation raised several hot issues of debate at the national and international levels: (i) the perceived widening gap between the 'haves' and 'have-nots', between developed and developing countries; given a proper measure, how can the same technologies be used to narrow it? (ii) the impact of technology advancement on the free flow of information across national borders, can the global marketplace of ideas be controlled by any governmental force, including the United Nations? (iii) can this flow be harnessed to serve every community of people? (iv) what policies and perspectives are necessary to harness Moore's law on behalf of the public good and to allow any country to ride the upward spiral of exponential advancement? The speaker provided statistics in support of his arguments on the fast development of the CD-ROM and multimedia markets over the last years, explaining why more and more educators, trainers and public policy bodies have become aware of the immense potential of computers and the wealth of information disseminated through such means, including the Internet.

The debates in Commission I began with a CD-ROM presentation on interface to interactivity, a necessary condition to an effective learning environment which can be reached through the use of ICTs. An important feature of educational interactive multimedia is that they bring a personal touch or human enthusiasm into the learning materials. Software design should be based on pedagogical needs, i.e. equally content- and learner-oriented. It is important to see how various technologies complement each other to produce the most relevant interactive learning materials (classical as well as ICTs). This presentation was followed by an analysis of the latest developments in ICTs and their application in education. High expectations were put on large computer information systems to solve social and economic problems. As a result, deficiency in applying ICT analysis in many areas called for a more in-depth analysis of the use of such technologies. Some pertinent conclusions emerged from this analysis: (i) an activity should only be "computerized if the structures are well understood and have reached a certain degree of formalization"; (ii) structures should be precisely mapped into computer algorithms before they are honed for higher performance; (iii) when introducing technology, one should build upon existing structures; however deficient they might be, and advance in small steps to new patterns and practices; (iv) the social interaction component should be more and more present in technology. Another presentation referred to distance learning, where more emphasis should be placed on the teaching of mathematical models. With respect to distance education, UNESCO was invited to support training in this area as it requires special training.

The debates in Commission II centred on the complementary nature of science and technology. The regret was voiced that computer science is taught mainly as technology (*learning to use*) instead of paying more attention to its fundamental laws as in other sciences. It was noted that generic informatics tools exist for particular disciplines and that higher-level tools should be able to incorporate the laws of programming educational interfaces in any discipline. A recommendation made referred to the introduction of mathematical modelling in school curricula at an early stage. Thus computing could help illustrate the concept and practice of modelling. It was argued that computer science "laws" are of a practical rather than abstract nature and that they could be readily learned by students. The opinion was expressed that laws and concepts should be introduced in primary and secondary school curricula instead of programming techniques, since the latter could be learned at the professional level when needed. Another aspect stressed was the importance of taking the clients' needs into consideration in developing educational software and of incorporating true interactivity for the user. Software should be designed within a strategic approach in which the context of usage is clearly defined, including the role of the computer among other learning tools used. A number of practical guidelines were developed within this concept, allowing the incorporation of all the required information in the software and taking into account the motivation of the users. Another interesting project, developed by CITCOM, a subsidiary of France Telecom, referred to the setting up of distance education networks based on videoconference techniques in 15 countries and pinpointed universities as the largest users of such systems. However, the project stressed that these new systems should not be seen as replacing the traditional educational techniques, but rather as useful tools in certain contexts. Another experiment revealed the possibilities of resorting to unused TV channels for educational teletext, but with little interactivity or use of a feedback channel in the educational process. A conclusion of the debates was that technologies exist independent of the educational context. The need of reinforcing defined educational methodologies using ICTs was stressed. Attention was also drawn to the importance of studying the psychological aspects of computer use in education and to the role of computers in meeting the special needs of gifted students.

Commission III focused its discussions on the experience of several countries and organizations in the application of ICTs in education. The examples referred to the organization of local schools and regional school networks in Finland; projects carried out by the UNESCO International Research and Training Centre at Glushkov Institute for Cybernetics in Kiev (Ukraine) on Internet literacy, creation of teleteaching networks, promotion of information and communication technology-based didactic laboratories for lifelong teacher training; the development of educational computer networks by the Informatics Centre of Lomonosov Moscow State University; and the structure of the Local Area Network at Minsk State University (Belarus). UNESCO was invited to make known the work and results of the Moscow Congress at the International Conference on Education, to be convened in October 1996 in Geneva, and to support, in co-operation with other partners, initiatives aimed at launching an international database of successful, right-scaled projects which give clear guidelines on teaching and learning methods. UNESCO was invited to promote, in co-operation with other partners, much closer international partnerships at the school level with regard to their experience in the use of ICT-based educational materials.

THEME 4: SOCIAL, ECONOMIC AND CULTURAL ISSUES

The fourth theme was introduced in the plenary session by Dr. P. A. Motsoaledi, Minister of Education of the Northern Province (South Africa) and Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany).

Dr. Motsoaledi focused in his keynote speech, titled *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*, on the social, economic and cultural implications for his Province, one of the most deprived regions of the country during the apartheid years, with respect to the introduction and use of ICTs. While fully aware of the need to accelerate this process, comparing it to a "revolution within a revolution", he argued, based on concrete facts, that it raises a number of questions which need to be looked at from the perspective of ICTs being imported from the West to a developing country. The inadequate provision of math and science education at primary and secondary school level, the underqualification of matriculating students entering teacher training colleges, thus preparing to perpetuate the poor standards they themselves worked under, called for the urgent initiation of a range of projects using ICTs. The aim was to provide the reconstruction of education with an adequate infrastructure. The speaker argued that the introduction and application of ICTs in education should be seen as a mutually beneficial exchange between the developed and developing countries and not as a form of cultural hegemony. Since all technologies and inventions bear the imprint of the cultural setting of the countries of origin, developing countries should strive towards becoming technology self-sufficient and not technology dependent in the long run. They are continuously in danger of being consumers of foreign culture. That is why the speaker stressed that the preservation and the nurturing of cultural values should not be alienated from the production process and the invention of new technologies. This is where the positive role of international exchanges comes in, the conclusion being that: developing countries should be encouraged to enter into international co-operation projects in the field of ICTs which promote development, cultural diversity and democracy.

The second speaker, Dr. Poelchau, although representing a developed country, placed the issues under discussion in a wider context. In his speech, *New Information Technologies as a Challenge for General Education and Vocational Training: Chances for International Co-operation from the point of view of the Federal Republic of Germany*, he referred to the rapid developments in the field of new technologies and to the multifacetted challenges the latter pose for society, in an attempt to answer whether ICTs can provide solutions to ever growing and diversifying social needs. In an increasingly interconnected world, he stressed the central role that ICTs can play in disseminating information and knowledge, in promoting economic development, in safeguarding cultural identity and ensuring individual wellbeing. Like the preceding speaker, he warned that a misuse of ICTs might further widen the existing gap between developed and developing countries, between the so-called *information-rich* and *information-poor*, and argued, therefore, in favour of expanding international co-operation in the field. This phenomenon calls for appropriate educational policies and concerted action at national, regional and world levels. Such policies would help to overcome social disparities, ensure wide access and equal opportunities. The speaker outlined the actions in the economic and social spheres taken by Germany over the past decade in order to ensure the transition from an industrial to an information society, leading to a 50 per cent increase in the number of jobs in the information processing sector. This has been made possible following the adoption of new educational policies in the mid-80s aimed at encouraging the use of ICTs in general education and vocational training and attracting the participation of private companies in the development of educational software and training programmes. By way of conclusion, the speaker suggested that international forums be set up for exchanges of experiences in the use of ICTs, inviting UNESCO to launch such an initiative.

The debates in Commission I continued some of the issues raised in the two keynote speeches. An interesting presentation was made concerning the application of scientific films in education using a compact interactive video disk, a project developed by the Austrian Federal Institute for Scientific Film. The opinion was expressed that the multimedia encyclopedias allow learners to study independently but they cannot replace the traditional teacher-student interface. The new curricula using ICTs should not be based only on the latest products, they should incorporate the resources existing in archives. Educational institutions and companies producing educational software should co-operate more closely. In this respect a proposal was made that UNESCO should coordinate at international level an appropriate mechanism which should facilitate the acquisition of educational software, regulate its legal use and ensure a market specially targeted at schools. Another presentation referred to the introduction and use of ICTs in the teaching of the humanities, stress being placed on the need for universities to find adequate solutions to the computerization of these disciplines. A major concern would be to make better known the specific nature of the humanities, a prerequisite for a successful definition of the role and place of new technologies in education in a longer perspective. The new information environment fully meets the most urgent requirements concerning the teaching and learning of the humanities. The expanding informatization of the educational process in these disciplines calls for the elaboration of new strategies so as to ensure students wider access to the knowledge and information imparted by teachers. Information self-sufficiency and information freedom are two major objectives to be pursued in university-level education. The importance of preserving and nurturing human values in the teaching of natural and exact sciences, as well as of engineering-technical subjects was stressed.

In Commission II discussions focused on issues related to the methodology and market for interactive media used in distance education from the viewpoint of a commercial publisher. A clear-cut distinction was made between products for collective versus individual use and those used in real time versus local or asynchronous mode. It was shown that multi-target applications on today's market may be overtaken by finely targeted products for very specific educational use. A clear commercial strategy is needed before a company can invest in multimedia production. The new technologies may become important factors of industry growth but on condition that they are accepted by the market. Real progress could be achieved by countries if they agreed to develop multilingual applications and consequently share resources, each specializing in a particular area. An issue high on the agenda, particularly of Eastern and Central European countries is the development of educational networking. Such networks are considered as the only possibility to overcome the information and organization marginalization of their educational and research institutions, the difficulties to publish and disseminate ideas and results, as well as to ensure the integration of these countries into the world community. The results of an interesting project, developed by the Conservatoire National des Arts et Métiers (France), in the field of distance education courses for adults were presented, which uses the on-line versus local approach and individual versus collective self-learning. However, a hybrid of on-line and local delivery was seen to be generally most appropriate. Self-learning is typically supplemented by real time telecommunication links to remote video presentations and student discussion meetings. An analysis was made of the impact of the development of informatics and of new information technologies on the socio-economic and technical-scientific development of society. Two recommendations were made to UNESCO: to draw the attention of the world community to copyright problems in respect of educational programmes and to organize workshops for African countries in particular, aimed at ensuring a wider use of educational software.

The debates in Commission III touched on such issues as the development of distance education in certain Latin American and Caribbean countries, as well as the current status of international co-operation in this domain, with particular reference to UNA-CRESALC projects. Stress was laid both on the organizational and technological progress achieved in this field and on the main problems facing distance education in the region, the latter including high dropout rates (about 90%); lack of policy continuity; low interaction between students and teachers; obsolescence of materials; and scarcity of staff development programmes. In order to deal successfully with the above problems, international co-operation, both inside and outside the region, is particularly important. The analysis of the development of distance education in Latin American and Caribbean countries ended with several recommendations addressed to developing countries and countries in transition. A project, entitled *International Visual Communications*, run by InterNews, a nongovernmental organization, which was designed to meet the educational needs of the hearing-impaired (200 million members), pointed to the particular opportunities that ICTs (especially, visual communication) create in this field and the need that the traditional educational policies with respect to the education of the hearing-impaired be changed. This process would not only respond to the requirements of this community but would also enrich the common educational and cultural heritage. A case from Zaire drew attention to the fact that the developing countries should not be left out of the "information revolution". Emphasis was placed on the need for the development of appropriate educational policies with regard to the purchase and use of computers for educational purposes, as well as for the protection of intellectual property rights. An appeal was made to UNESCO to assist in this respect.

THEME 5: EDUCATIONAL POLICIES

The fifth theme was introduced in the plenary session by Professor José A. Valente, Universidade Estadual de Campinas (Brazil) and Professor Tjeerd Plomp, University of Twente (The Netherlands).

In his keynote speech, *The Role of Computers in Education: Achievement and Comprehension*, Professor Valente started from the assumption that in most cases educational processes are restricted to asking students to do various activities, which they can, or cannot, do successfully. However, the fact that they may be able to accomplish these activities does not mean that these students necessarily comprehend what they have done. To substantiate his arguments, the speaker referred to the distinction, made by Piaget, between achievement with success (*savoir faire*) and the comprehension of what is achieved, according to which the passage from the level of achievement to the level of comprehension is being done thanks to the grasp of consciousness. This passage requires the transformation of action schemes into notions and operations. With the computer, the student can do lots of activities and achieve them successfully. However, depending on the type of software used, and the teacher's involvement in the computer activity, the student may, or may not, understand what he/she has accomplished. This is the case when the student uses a tutorial or many multimedia software. The speaker stressed the need for a new approach, one that encourages students to engage in a programming activity that demands different actions which can create the conditions for comprehending what he/she is doing. This process of programming can be seen as a cycle consisting of description-execution-reflection-debugging-description. In this cycle, "debugging" constitutes a unique opportunity for the student to construct his/her knowledge and understand what he/she is doing. Programming, the speaker argued in conclusion, is an opportunity to engage in the passage from achievement to comprehension, as it involves certain actions which are essential for the development of important skills that are not often present in the educational process today, nor in many types of educational software.

The second keynote speech, *New Approaches Needed to Teaching, Learning and the Use of Information and Communication Technologies in Education*, introduced by Professor Plomp, centred on the new challenges facing society, in general and all the actors involved in the education process, in particular, as a result of the impact of the use of ICTs in education. One major challenge the educational system faces today is to prepare individuals to cope successfully with the change from an industrial to an information society. Other challenges refer to the capability of educational systems (i) to find solutions to the social, cultural and economic problems of the society; (ii) to ensure individualized and flexible training, suited to specific needs, as the growing individualization in and diversification of society call for new approaches to education; (iii) to provide opportunities for lifelong learning and new demands for learning, since the guarantee for open and equal access to education for everybody is, under the current circumstances, becoming almost unaffordable. Immediate objectives, to be pursued by educational systems, such as managing large amounts of information, developing learning strategies to facilitate effective learning and assuring that all citizens are skillful in assessing, selecting and dealing with information are considered of critical importance. The speaker argued in favour of a new balance between a teacher-oriented and a student-oriented process, with much more emphasis to be given to the latter. He pointed that ICTs provide a means to instrument such revolutionary changes called for by the transition to an information society. The solution proposed was that today's schools and teacher training institutes should design programmes providing bridges from "old" to "new" definitions of education. Their main focus should be to generate and support "emergent practices", with ICTs as a medium, in order to prepare both students and teachers for their new roles in an information society.

Commission I focused its debates on current policies regarding the use of ICTs in several countries. For example, in France, the Ministry of Education has launched a number of initiatives aimed at modernizing educational management in schools; introducing relevant ICTs in technical and vocational training; ensuring the use of ICTs as a teaching aid in various subjects; expanding the use of ICTs in secondary schools by connecting them to Internet; and, last but not least, providing access for students to computers. Inter-school networking and twinning with secondary schools in other countries have also been developed. Leading schools which have put into practice ICT-based systems and programmes should be encouraged to make their resources available to other schools. Stress was laid on the importance of pre- and in-service teacher training programmes as teachers should play a pioneering role as far as the application of ICTs in education is concerned. Another case presented a programme developed by the Norwegian Ministry of Education, Research and Church Affairs for the 1996-1999 period designed to promote the use of ICTs at all educational levels. The programme pointed to the need of upgrading teacher skills in the use of information technologies and to the increasing role of distance education in teacher training. The experience acquired over a 25-year period showed that the main obstacles to the widespread use of ICTs in education had been the lack of computers, of a curriculum adjusted to their use and of adequate teacher education. While technology is no longer a problem and efforts have been made by most countries aimed at upgrading curricula, difficulties still persist in teacher education, a serious problem being the lack of funding for teacher training courses. In this context, distance education is seen as playing an important role. It was noted, however, that even the most sophisticated technology can never substitute the human factor, the face-to-face contact between a teacher and a student. Other issues discussed touched on the importance of elaborating a more clear classification and terminology in the field of ICTs and the need to promote a wide range of research on the effective use of ICTs.

Commission II began its debates with the presentation of a project carried out by IBM-CLIE (Centro Latinoamericano de Investigación en Educación), a research centre in Mexico, on the development of educational tools and approaches meant to prepare students to better cope with the new challenges they will face in a society rapidly transformed by information technology. Skills in knowledge navigation, new learning culture and role transformation are acquired through education based on the *Genesis* concept which stresses the development of imagination, initiative, observation and flexibility. This concept has been introduced in the curricula of about 1,500 schools in several Latin American countries, through the use of specialized microcomputer-based software modules developed by IBE-CLIE. An extension of the programme, called *Quorum*, employs networking in the region to provide a "knowledge production space" enabling children to co-operate in building conceptual knowledge maps. A case from Slovakia stressed a major problem facing Central and Eastern European countries, namely the so called double "brain drain" phenomenon, as it involves, on the one hand, students choosing to study in neighbouring countries and, on the other, graduates emigrating abroad. In order to minimize the effects of this phenomenon, the Slovak Technical University has developed policies intended to upgrade the information infrastructure, to encourage the study of all subjects in English as the latter is the dominant language of technology, to promote the international recognition of its diplomas, as well as to expand co-operation with Western countries. Three areas for further discussion were identified: (i) the Internet as a potential promoter or destroyer of cultural and linguistic diversity; (ii) the meaning of the "knowledge-based society" and the role of schools in bringing it about; and (iii) problems of access to information networks, particularly for rural areas. The SchoolNet project, sponsored by the ten provincial education ministries and the federal government of Canada, aims to link all 16,500 schools in the country to the Internet by 1997.Besides its pedagogical objectives, as it is designed to help teachers acquire the necessary skills to use technology in the classroom, SchoolNet hopes to strengthen communications and sharing among teachers who are scattered across the country. International co-operation, and particularly UNESCO's support, was considered to be very important in the preservation and dissemination of cultures and languages in an information society. A proposal was made that an international coding scheme for the content of databases and telematics applications be adopted.

The discussions in Commission III particularly wide-ranging in coverage of issues and in expressing a broad diversity of opinions. One opinion voiced the concern that ICTs should not dictate educational policy. Without denying the positive role of the new technologies, attention was drawn to the negative aspects of an endless thirst for information, a kind of "infomania". The problems faced by developing and least developed countries were particularly stressed: lack of political will and financial resources necessary for the development of ICTs; shortage of teachers; too small and widespread projects not backed by sound research and evaluation; not enough distance education curricula; lack of infrastructure, such as electricity and telecommunications; limited access to ICTs (technologies are accessible only in towns whereas the majority of the population live in rural areas); software inappropriate to cultural environment; software piracy. It was noted that instead of narrowing the gap between developed and developing countries in the field of ICTs, as recommended at the first UNESCO Congress, an opposite trend has been taking place. It was therefore proposed that associations of participating institutions be created at regional level, in which some members would act as "centres of excellence". Another issue centred on the need for research into students' concepts and attitudes to technology so as to train technologically aware and innovative youth capable of coping with the challenges of the twenty-first century. Several recommendations were made to UNESCO: (i) to assist African countries to formulate intellectual property legislation with a view to protecting the rights of African programmers; (ii) to set up a network of special teacher training centres in Africa; (iii) to help establish a database of ICT projects as an aid to policy advisors; (iv) to monitor the creation of an international network of women specialists in ICTs and to pay increased attention in its future action to gender-related information technology issues.

THEME 6: INTERNATIONAL CO-OPERATION

The sixth theme was introduced in the plenary session by Mr. Henrikas Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics of UNESCO, Professor Armando Rocha Trindade, President, International Council for Distance Education (Portugal) and Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission).

In his keynote speech, Mr. Yushkiavitshus gave a comprehensive outline of UNESCO's programme activities in the field of new information and communication technologies in the broader context of the emerging information society, of which both informatics and education are major building blocks. The speaker stressed that although the economic and commercial interests are the main driving force behind the building of the information superhighways, the development of education, culture and science as distinct and integral parts of human civilization cannot be left totally to the control of market forces. As an intergovernmental organization, UNESCO is concerned with ensuring access to the new technologies to its Member States, particularly to developing countries in order to reduce the gap between the "haves" and "have-nots". With the advent of the information age, learning is increasingly becoming a *lifelong* requirement giving individuals the possibility to be better equipped with the ever more diverse knowledge and skills characterizing an information society. In the field of education, information technologies can complement traditional educational methods and enable educational systems to adapt to different learning and training needs of societies. New tools such as interactive TV, computer simulation, telematics and teleconferencing provide an unparalleled opportunity to "reach the unreached" and to make lifelong education for all feasible, especially for learners for whom access is limited by time and space, age, or socio-cultural environment. As no country or even group of countries can hope to solve problems related to education and the information society single-handed, international co-operation is seen as a necessity and UNESCO is called to play the catalyst role in this process, in keeping with the ideals enshrined in its Constitution. Several actions undertaken by UNESCO aimed at expanding international dialogue in this area were mentioned such as a series of pilot projects, developed in co-operation with the International Telecommunication Union, on the educational application of interactive television in various developing countries (India, Mexico, Morocco); INFORMAFRICA, a programme launched in 1990 designed to help African countries to introduce informatics in their educational systems; or the Regional Informatics Network for Africa project, carried out by the Intergovernmental Informatics Programme of UNESCO. UNESCO's efforts in the promotion and defence of copyright and intellectual property rights were also stressed.

The second speaker, Professor Trindade placed emphasis in his speech, *International Co-operation in Open and Distance Learning*, on the increasing role of distance and open education in an information society. While admitting that certain skills and a number of subject matters cannot be taught to isolated users studying at home, even if linked to the teaching system by the most sophisticated telecommunications network, he argued that educational institutions should adopt a "mixed-mode" model of operation. This solution would ensure the necessary flexibility in the teaching and learning of various disciplines as it allows a balanced combination of face-to-face interaction and distance learning approaches. The speaker further added that although a mixed-mode model of operation is not formally adopted, institutional co-operation between distance teaching systems and conventional ones, belonging to the same linguistic and cultural area, always bear fruit. International co-operation in scientific and methodological research, exchanges of academic staff members are both profitable and motivating for all parties involved. The distance learning approach has been used successfully in vocational training, either in the initial stage or as continuing, lifelong training. Unfortunately, in spite of the diversity of organizations and institutions offering open and distance learning services and products, there is not yet a structured market in the field. This makes certain services and products very expensive for the current individual end-user when they are provided by private operators. The speaker mentioned another deterrent factor, namely the fact that continuing education has not been yet recognized as an individual and social right , which prevents the underprivileged categories of users from access to its benefits on a permanent basis. He concluded, however, on an optimistic note, reiterating the idea expressed by the previous speaker, that international co-operation is of paramount importance to pool experiences, to reduce costs, to create synergies and economies of scale. Intergovernmental and nongovernmental organizations such as UNESCO and the International Council for Distance Education should join their efforts and pursue common strategies in order to improve, democratize and reinforce education and training opportunities all over the world.

Mr. Jansen made a presentation of the European Commission's Task Force Multimedia Educational Software and of its main goals. The latter can be summed up as follows: (i) to identify the most appropriate R&D activities; and (ii) to promote the use of multimedia in education and training at all levels on-line and off-line. These goals have been set in order to better respond to the increase and diversification of the education and training needs that are developing as a result of the emerging information society, to upgrade and strengthen European industry by improving provision of high quality training material, and to enable companies, in particular small- and medium-size ones, to open future markets. The Task Force is seen to make a major contribution to increasing European employment, economic and social cohesion, by respecting cultural diversity, and bringing sustainable services to the citizen. In a world of growing competition, notably from the USA, European countries should strive to create major opportunities and benefits for a quickly expanding home market, which in turn requests further research to develop the next generation of products and services, and to train a better skilled workforce at lower cost. All these actions are aimed at preparing the individual to better cope with the new challenges of the information society. Various programmes such as Socrates and Leonardo da Vinci have been developed to stimulate research efforts through co-operation.

The debates in Commission I covered a presentation of the aims and objectives of the International Federation for Information Processing (IFIP), its relations with UNESCO and the International Council of Scientific Unions (ICSU). The presentation was followed by a briefing on the history of computer processing and the objectives of using computers in teaching and on the activities of IFIP's Technical Committee on Education (TC 3). The importance of using computers in curricula, stimulating computer-based learning and of producing information on teaching strategies was stressed. In this connection, mention was made of an IFIP publication on the pedagogical and psychological impact of information technologies, as well as of a modular curriculum for secondary school using ICTs. Another presentation concerned the impact of new technologies in the schools of Europe and the G7 nations, particularly in Canada, France and the UK, which introduced information technologies in national curricula. Statistics show that there are a lot of disparities among countries with regard to the number of microcomputers, percentage of primary and secondary schools with one or more computers and student/computer ratio. The importance of adequate teacher training programmes using ICTs was stressed, to enable teachers to make effective use of information technologies and thus to improve the quality of the educational process. A suggestion was made that an inter-governmental programme for the legal support of distance education be established to ensure state licence, as well as accreditation at national and international levels. Such a programme should also deal with legal protection against discrimination.

The debates in Commission II referred particularly to the need for policy- and decision-makers to redefine the mission of the school in a fast changing society under the impact ICTs. They are confronted with problems of adapting their educational systems and, consequently, curricula and teaching methods, so as to better respond to the emerging needs of an information society and facilitate insertion into the socio-economic sphere. Experience shows that ICTs play a decisive role in increasing the efficiency of the teaching/learning process and the adaptation capacity of educational strategies to the real demands of society. However, in a world of highly diverse educational systems, a prerequisite for the success of these changes is that they should take into account national specificities. Emphasis was placed on the need to promote education throughout life as knowledge and information acquired in school become rapidly obsolete. It was shown that teachers will play new roles as a result of the application of ICTs as present-day societies witness a shift from a mass educational to a partially individualized, "custom-tailored", process. A proposal, titled *A Global Network for Teacher Tele-Training*, continued some of the issues earlier discussed. It indicates plans for setting up a Global Teachers' Network Service Organization (GTNSO), which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet. With the rapid advances in technology, it is difficult for the existing pre- and in-service teacher training systems to keep pace with the innovations in teaching methods and practice. Participants suggested that the proposal be included in the recommendations of the Congress.

Commission III centred its debates on the results of some projects aimed at expanding international co-operation in the use of ICTs in education. One such project, developed in the Russian Federation, referred to the creation of a telecommunication infrastructure for science and education. The presentation was accompanied by an on-line demonstration between two Russian cities, Moscow and Novosibirsk. Attention was drawn to the importance of extending economic support for the introduction and application of ICTs in education, research and development, especially in countries undergoing transition. Telematics creates new possibilities for reinforcing co-operation between countries members of the Commonwealth of Independent States. In this context a proposal was made for the establishment in Moscow of a UNESCO Institute on Educational Policy and New Information Technologies, which would foster international co-operation in the use of ICTs in the region. Another presentation, expressing the viewpoint of the Economic Development Institute of the World Bank, stressed the fact that it is not only information technology that is changing. Many countries are undergoing both economic and political transitions, which bring with them enormous demands for knowledge, not just from students, but also from the public at large. Much of this demand is for knowledge that is built on the experience of other countries. The major problem for international organizations, such as UNESCO and the World Bank, is how to increase the chances for knowledge to flow, not from the rich to the poor, but among nations and individuals as information equals. The continuing global effort to reduce poverty through sustainable and equitable development should be at the centre of concerns for equitable access to technologies and the knowledge they carry. Governments play a key role in ensuring equity and in providing those public goods, such as education, that enable individuals to share in the benefits of growth. The importance of international partnership programmes was emphasized with a view to avoiding duplication of effort and costly mistakes. Several initiatives at the world level were mentioned, such as the Economic Commission for Africa's programme for telecommunications development, USAID's Leland Initiative to build Internet access in Africa, the World Bank's INFODEV programme in which both the Bank and the private sector are co-operating to improve telecommunications policies and applications, or the pilot project launched by the Economic Development Institute of the World Bank to establish international Internet networks in the former Soviet Union.

WORKSHOPS

In addition to the plenary and commission sessions, twelve workshops were organized on 4 and 5 July 1996 on the following topics: *Information Superhighways and Education*; *The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies*; *The Software Environment - A Perspective for Effective Involvement*; *Transfer of Knowledge and Skills through Information and Communication Technologies*; *National Policies - Transfer of Technologies*; *Individual Distance Training*; *Analysis of UNESCO/IFIP Documents published in 1994-1995 (Part I: Informatics for Secondary Education -A Curriculum for Schools; Part II: A Modular Curriculum in Computer Science)*; *Logics, Informatics and Education*; *Information Technologies and Humanities Education*; *Development of Pre-University Education via Modern Information Technologies and Methods*; *Medicine: New Approaches to Knowledge Acquisition and Improvement*; and *Forming Integrated World Data Bases and Knowledge about Planets of the Solar System and Their Use in Research and Education*. The workshops were chaired by leading experts, academics and researchers, such as David Walker (United Kingdom); Peter Waker (South Africa); Alain Meyer (France); Tom van Weert (The Netherlands); Harald Schütz (Germany); K. K. Kolin; Yury N. Afanasiev and Alexei L. Semenov (Russian Federation).

A number of recommendations made by participants in the workshops were included in the Declaration and Recommendations of the Congress. The issues discussed are covered in depth in the Congress proceedings to be published.

CLOSING SESSION

Academician Yury L. Ershov and Professor Jef Moonen, Co-Chairpersons of the International Programme Committee of the Congress, took the floor to present a summary of their personal views on the discussions having taken place during the Congress, stressing the increasing role ICTs play in all educational systems today and the need for national governments to develop adequate educational policies and programmes on their implementation. The views of both speakers converged in stressing that the success of the policies aimed at expanding access to, and the use of, ICTs in education depends to a great extent on an improved coordination of the efforts made by various international organizations, UNESCO playing a unique role in strengthening international co-operation in this field.

Mr. Ivan Stanchev, Workshop Programme Coordinator, reported on the results of the twelve workshops. The topics of the workshops were related to the six major themes of the Congress. He stressed the wide coverage of the issues discussed, the diversity of opinions expressed and the large number of proposals which would be included in the recommendations of the Congress. More than 200 participants presented papers and took part in the debates. The main conclusions resulting from the discussions were the following: (i) ICTs lead to new forms of learning, such as open and distance education, individualized training, which complement the traditional system; (ii) teachers and trainers should be trained properly to use the new technologies through well-developed and flexible pre- and in-service teacher training programmes; (iii) there should be a closer co-operation between educators as ICT users and technology developers, with a view to broadening the access to network connection between teachers, schools and higher education institutions and providing a full multimedia platform; (iv) ICTs are recognized as a powerful tool for changing the educational systems of developing countries and countries in transition; (v) ICTs are also changing the cultural perception of the learning process and are leading to more individual-oriented education and training; (vi) governmental support is needed for the communication networks to be used by educational institutions, especially in developing countries and countries in transition; (vii) the need to establish a real functioning system for international co-operation between teachers and for UNESCO to play an important role by encouraging supporting the internationalization of information and curricula exchange in the area of teaching the basics of ICTs.

Then followed the oral reports on the work of the three commissions. Ms Katerina Martcheva, President of Commission I, gave an overview of the discussions which had taken place in the Commission. She emphasized the high interest of participants - decision-makers, academics, researchers, in the topics discussed, as demonstrated by the big number of recommendations made. The issues discussed included an analysis of the latest developments in the field of ICTs and the best approaches to the latter's introduction in curricula, of the trends and experiences in the application of ICTs in educational systems, as well as the results obtained at national, regional and international levels. The proposals put forth by participants, while emphasizing the important role of ICTs, voiced concern for the preservation of the social, cultural and linguistic diversity.

Mr. Gerald McConaghy, Rapporteur of Commission II, took the floor. He stressed the large representation from many countries and the variety of views expressed. He summarized the main issues discussed at length, such as the importance of promoting and enriching culture and language through the use of new technologies and the Internet; the provision of equal opportunities in access to computers and the Internet; the important role of teacher training, particularly as it relates to the use of technology as part of the teaching experience and methodology; the need for the sharing of information, of various models that have been used, of programmes; and, last but not least, the need for closer co-operation between education and industry through the development of partnership schemes. He underlined the common interest all participants shared in trying to promote ICTs as an important tool to help young people learn.

Mr. Alexei M. Dovgyallo, Vice-President of Commission III, made a summary of the results of his commission. He stressed that distance education was given particular attention in the discussions and many recommendations were made in this respect, especially from the perspective of the needs of developing countries and countries in transition. A proposal made by the Russian participants and supported by the rest of participants to be included in the Recommendations of the Congress referred to the creation in Moscow of a UNESCO Institute for information technologies in education, which should focus its attention, among others, on scientific expertise of short-term forecasts in the field of new information technologies in education.

Mr. John Foster, Rapporteur-General of the Congress, then summarized the results of the Congress, the general conclusions, recommendations and suggestions for action drawn up by participants during the Congress.

The President of the Congress requested participants to adopt the Declaration and the Recommendations, mentioning that the final text will include all the recommendations made during commissions and workshops.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience recapitulating on the work of the Congress and assured participants that their recommendations would be taken into account insofar as possible in the Organization's future programme, especially those concerning the strengthening of national, regional and international co-operation.

Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, took the floor on behalf of the host institution. He stressed the role of international co-operation and exchanges in promoting the use of, and research on, ICTs in education.

Mr. Vladimir G. Kinelev, President of the Congress, thanked participants for their contribution to the success of the debates and declared the Congress closed.

REPORT

UNESCO'S MAIN ACTIVITIES IN THE FIELD OF EDUCATION AND INFORMATICS AFTER THE FIRST INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

INTRODUCTION

The purpose of this document is to provide an overview of UNESCO's activities carried out after the First International Congress on Education and Informatics held in Paris in 1989. In line with its recommendations, the Organization's activities have focused on the promotion of international cooperation in the application of new information technologies in education and training with the aim to alleviate educational disparities within and between the countries, improve the management system of education and to broader access to various types and forms of education and training within the context of a future complex learning society.

This concern was reflected in UNESCO's Third Medium-Term Plan (28 C/4) for 1990-1995, which stressed the need for cooperation -with inter-governmental and non-governmental organizations to promote the use of the new information and communication technologies in education. Based on the Third Medium-Term Plan, the subsequent Approved Programme and Budget for 1990-1991, 1992-1993 and 1994-1995 foresaw national and regional activities which were carried out within the framework of the Organization's Regular Programme, Participation Programme and extra-budgetary operational projects. The Regular Programme activities consist of the organization of seminars, research, publications, promotion of networks and pilot projects. Assistance is also provided to Member States in the planning, implementation and consolidation of national and regional projects through extra-budgetary operational projects. Within the Participation Programme, contributions are also made to national activities in informatics and education through consultancy services, purchase of equipment, fellowships and study grants.

While these three programmes constitute the main modalities for the promotion of information technologies in education, it is important to single out the Intergovernmental Informatics Programme(IIP) which UNESCO's General Conference created in 1985. In order to meet the challenge posed by the widening gap between the developing and developed countries, the IIP has centred its development objectives around the valorization of human resources for informatics and through informatics, the main areas of activities being the training of specialists, teachers and informatics users, the promotion of informatics networks, the development of software, research and development and the development of policies and strategies in informatics. From 1988 to 1995, more than 180 projects were carried out within the framework of IIP.

The present report focuses on the main activities in the broad field of education and informatics initiated by UNESCO in close cooperation with related NGO's, IGO's, Aid agencies and professional associations. The activities are presented under the following five categories:

(i) The introduction of information technologies in schools, universities and in institttjites of non-formal education Information technologies as a subject matter, as a main or support learning tool

(ii) Information technologies and the role of teachers

Awareness raising, training of teachers in the use of information technologies at school, development of educational software

(iii) Development of informatics in education

Development of educational software, training of experts and users, promotion of networks and cooperation schemes, policies and research, socio-cultural considerations

(iv) Information technologies as a tool for educational management. Use of informatics for educational statistics, management and administration in the educational system

(v) Information technologies for the development of distance and open learning the use of information technologies as instructional methods or means of communication for student support.

(I) THE INTRODUCTION OF INFORMATION TECHNOLOGIES IN SCHOOLS, UNIVERSITIES AND INSTITUTES OF NON-FORMAL EDUCATION

DEVELOPMENT PROJECTS

A project on the introduction of informatics into a national education system in Syria was carried out with the aim of developing a computer education programme in secondary education. Four Informatics Teacher Training Centres were established and 120 teachers were trained to be responsible for teaching computer science as a subject in secondary school. As many as 5,500 students in 14 pilot schools were involved in the training process.

In Bulgaria, a national Research centre for Educational Informatics was established within the framework of a project on the introduction of informatics in education of children in Bulgaria. The centre serves as a focal point for all national activities related to the application of advanced information technology to children's education and promotes research, exchanges and training in methods and techniques for introducing informatics into the education of children. The project outputs were awareness of the introduction of computers and related tools into the process of education and education of teachers; development of research, adaptation of training systems; implementation of new methods and new tools - hardware, software, videoware etc.; establishment of a system of scientific and technical publications and information bulletins; exchange of experience in the above fields.

The project «Development of computer education programme in Egypt» was designed to introduce and teach informatics as a subject of instruction in secondary school, and to prepare the groundwork for the use of computers as educational tools in teaching other subjects as well as in school administration. More than 3,000 teachers and 20 teacher trainers were trained and an Educational Software Development Unit has been set up.

The REDALC Project (Support to Telematic Academic Networks for Research and leaching in Higher Education, Science and Technology in Latin America and the Caribbean) is executed by the UNESCO Office in Caracas,(CRESALC) in cooperation with the Latin Union, the Foundation for Networks and Development (FUNREDES) and the support of the Commission of the European Union. The main products of this project are:

- Inventory of information and communication systems for higher education and scientific and technological development in Latin America and the Caribbean.
- Methodology for the evaluation of academic information and communication systems.
- Methodology for the development of academic networks in higher education, science and technology in developing countries.
- Methodology for the creation and development of virtual communities and interest groups in the academic world for research, teaching and cooperative work. The Project *"Quality and Technology in Higher Education in Latin America and the Caribbean "*, as a follow-up of the REDALC Project and Network for the improvement of quality in higher education, was carried out by CRESALC between 1986 and 1989. The main products of the Quality and Technology project are two books published by CRESALC and four regional and sub-regional training workshops. (See Sections Publications and Training activities).

UNITWIN/ UNESCO Chair Programme

An innovative approach to the transfer of knowledge. Following the decision of the 26th Session of the General Conference of UNESCO, the UNITWIN/UNESCO Chair Programme was established with the aim to assist in the institutional development of higher education in the world and to promote rapid transfer of knowledge by developing university networking and linking arrangements among institutions. The programme lays special emphasis on co-operation among higher education institutions in the developing world and encourage networking at sub-regional, regional and interregional level. Focusing on graduate studies and research, the programme promotes visiting professorships and covers a wide range of fields: sustainable development, environmental and population issues, science and technology, social and human sciences' peace, democracy, human rights, the educational sciences, culture, communication. In Latin America, there is a UNITWIN Network of UNESCO Chairs on new technologies of information and communication in distance education for which the University National Abierta in Venezuela is the focal point in collaboration with UNESCO Office in Caracas .

3 UNESCO Chairs are established:

- UNESCO Chair in Information Technology, Universidad de la Habana, co-ordinated by the University of Murcia (Spain) and the Universidad Nacional Autonoma of Mexico
- *UNESCO Chair in Computer sciences. Uni*versity of Mauritius
- UNESCO Chair in Informatics for the Humanities, Institute of Mathematics and Informatics, Vilnius. The present Chair organized in 1994/1995 2 *basic courses for postgraduate students:*

- Informatics for the Humanities (1st level course) computerized data processing, data bases, academic and research computer networks.

- Informatics for the Humanities (2nd level course) image analysis, multimedia systems. Special courses for developers of telelearning materials in the field of informatics for the humanities are under preparation. To support the teaching and research activities, the Chair had 3 visiting professors, as well as a number of study tours and fellowships.

Within the framework of the UNESCO Associated School Project (ASP), a new ASP international telecommunication pilot project was designed and conducted on 16 November 1995. Entitled *"This is Our Time"* the project involved some 30 schools in 20 countries worldwide and focused on enabling ASP students to share their ideas about the 50th Anniversary of the United Nations and UNESCO and to learn about each other. The pilot project was conceptualized and designed by an ASP school in the Netherlands and funded from extra-budgetary resources.

Under the project *"Promotion of Science and Mathematics Education through Large-Scale Secondary Teacher Training Using Information and Communication Technologies in Uruguay",* action was initiated and co-ordinated with OREALC, Santiago, in 1994-1995. The project activities started in 1995 and will be continued through 1997. It is planned to use and replicate in the region the experience gained and results achieved in Uruguay.

In addition, numerous national projects and activities have been supported through UNESCO's Participation Programme including the introduction/reinforcement of informatics in technical institutes and universities (Guinea, Sierra Leone, Georgia, Botswana, Republic of Czech , Pakistan, Sao Tome-et-Principe), the use of informatics and information network for educational management (Seychelles, Fiji , Mongolia, Syria, Regional Africa, Gambia), teacher training (West Samoa, The United Arab Emirates, Saudi Arabia), informatics in secondary education (Tonga, The United Arab Emirates, Bulgaria, Burundi, Romania), regional meeting on information technologies and education (Japan), training seminar in educational technology/informatics (Jordan, Oman, Romania, Togo), computerization of the world register of university studies in Jewish civilization (Israel), training on the use of UNESCO CDS/ISIS Software (Canada), development of computer assisted learning (Turkey), specialists training (Ukraine).

RESEARCH AND POLICIES

Within the framework of the international programme «Children in the information age» a workshop *Informatics at school today and tomorrow* was organized by the Ministry of Education and Science of Bulgaria, the Bulgarian Mathematical Society and UNESCO in Sofia, Bulgaria in November 1994.

Under the project USEIT (Use in Systems of Education of Information Technologies) and in close cooperation with the International Association for the Evaluation of Educational Achievement (IEA), a survey on the situation and tendencies of the countries with regard the introduction of informatics in schools was conducted with the participation of 200 schools in 12 countries

The draft version of an inventory of *"Examples of Secondary School Curricula and Teacher Training Materials"* was prepared in 1995. The teacher training materials include - among others - programmes relating to the use of information and communication technologies for large-scale teacher training.

A sub-regional seminar on the introduction of informatics in secondary education was organized by the UNESCO Regional Office in Dakar (BREDA) in Ouagadougou, July 1989, with the participation of 30 experts from the sub-region in charge of projects in informatics education. The seminar focused on the elaboration of national policies for the introduction of informatics in education and the definition of a strategy for a progressive and selective introduction of .informatics as a teaching tool.

A case study on the experience in Ivory Cost of the introduction of informatics in technical and vocational training was carried out by BREDA. The study provided some information on the potential and means for the introduction of informatics in technical and vocational training.

A sub-regional consultation on the use of micro-informatics in science and technology education was organized by BREDA at the Institute de Recherches Mathematiques of the University of Abidjan (Ivory cost) in September 1989 with participation from Burkina Faso, Cameroon, Mali, Senegal and Ivory Cost.

The consultation examined five sub-themes: Programme and methodologies for computer-assisted learning; Programme and methodologies for a computer-assisted learning in the area of applied mathematics; the software available or to be produced; sub-regional and regional cooperation in the use of micro-informatics in science and technology education. The meeting recommended that micro-informatics for science and technology be introduced at senior secondary school level. Appropriate software to be produced locally by specialists in the sub-region based on existing programmes and manuals were also discussed as a modality for sub-regional cooperation.

A sub-regional seminar on the introduction of informatics in technical and vocational training was organized by BREDA in Dakar in July 1993.

The seminar discussed issues such as the introduction of informatics as both subject and a learning tool in technical and vocational training and the maintenance of equipment. Particular interest was the training of teachers in informatics as a subject, and the training of other teachers in the use of computer in the area of specialization. A programme for the training of trainers ;is well as a specific programme for the training in maintenance was suggested.

TRAINING ACTIVITIES

Regional training workshop for national coordinators of information systems for higher education, science and technology in Latin America and the Caribbean, within the framework of the REDALC Project (Brazil, 1991).

Regional training workshop for users of telematic networks in higher education and science and technology institutions in Latin America and the Caribbean, within the framework of the REDALC Project (Dominican Republic, 1992).

Sub-regional training workshop for the Andean sub-region in the use of new information and communication technologies in higher education and scientific research activities, within the framework of the REDALC Project (Ecuador, 1993).

Regional Training workshop on Mediatics and Telematics in the Academic World, in cooperation with the University of Quebec at Montreal, Canada, as part of the project *"Qualify and Technology in Higher Education in Latin America and the Caribbean "* (Venezuela, 1993).

Regional Workshop on Computer as a Teaching Aid in Higher Education (Alexandria, 13-14 October 1990).

PUBLICATIONS

«Informatics in Secondary Education» (English) published in the framework of UNESCO/IFIP cooperation scheme.

«Calidad, Tecnología y Globalization en la Educación Superior" (Quality, Technology and Globalization in Higher Education", as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean "* (Published by CRESALC in 1992).

«Una nueva manera de comunicar el conocimiento" (A new way to communicate knowledge), as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean"* (Published by CRESALC in 1993).

"Present and Prospects of Telematic Academic Networks in Latin America and the Caribbean ", as part of the REDALC Project (To be published by CRESALC in 1996).

As a follow-up action to the International Congress on Education and Informatics held in Paris in April 1989, a publication entitled *The Influence of Computers and Informatics on Mathematics and the Teaching* as Document no. 44 in the Science and Technology Education Documents Series in 1992.

A Guide book for the teaching of informatics in secondary level technical and vocational training was published by BREDA in 1994. The book describes some methodologies for the elaboration of teaching programmes in secondary level technical and vocational training.

(II) INFORMATION TECHNOLOGIES AND THE ROLE OF TEACHERS

RESEARCH AND POLICIES

In February 1994, a workshop was organized in conjunction with the Commission of the European Communities, the University of Twente and UNESCO under the theme *Teacher education and information and communication technologies: Issues and Experiences for Countries in Transition* (Enschede, The Netherlands). UNESCO granted 25 fellowships for the participation of specialists from Central and Eastern Europe. The workshop examined the use of communication and information technologies (CIT) in teacher education in Europe, and identified cooperative links for further partnerships among Western, Eastern and Central European CIT specialists in teacher education. Following the workshop, the publication *Information technologies in teacher education* (English) was published.

A study entitled *"Teacher Education, Open Learning and the Use of Information Technologies. An International Perspective"* is being finalized under contract with the Center for Research in Teacher Education, School of Education, The Open University.

TRAINING

In Africa, two sub-regional seminars on teacher training in informatics in technical and vocational training were held: in Harare, Zimbabwe in May 1993, and in Dakar, Senegal in July 1993. The major objectives of these meetings were to orientate those responsible for introducing computers into education towards the locally developed and produced materials and methodology for the training of teachers in informatics in order to facilitate the teaching and learning processes in technical and vocational institutions. The seminars focused on teaching informatics as a subject matter, the pedagogical applications of computers for teaching various subjects, and caching in computer maintenance.

PUBLICATIONS

Within the series Teacher Education, a handbook for teachers *Informatics in General Education* was published in 1994 (series No. 3).

(III) DEVELOPMENT OF INFORMATICS IN EDUCATION

DEVELOPMENT PROJECTS

The Programme INFORMAFRICA - Informatics in the Service of the Development of education in Africa was created in 1990 with the aim of helping African countries to introduce advanced technologies for educational purposes. The activities consist of training in and through informatics of teaching staff: management and administrative personnel in education) training of maintenance personnel that could take up the responsibility of maintaining the hardware locally at a relatively low cost rather than importing expatriates at high costs, training in the production of educational software at low cost with the participation of teachers and computers/software specialists.

INFORMAFRICA has started by a regional seminar organized by UNESCO within its Priority Africa Programme and in cooperation with the Agency for Cultural and Technical Co-operation (ACCT) in December 1990 in Lome, Togo, with the participation of 37 African Member-States. The seminar discussed the policy and strategy of incorporation of informatics in education, programmes of action for research and development, the production of educational software, maintenance and the problem of national languages, and the modalities for inter-African and international cooperation.

Within the framework of INFORMAFRICA, UNESCO through its Regional Office in Nairobi, has been involved in the following activities:

Conferences/Seminars/Workshops

• An international conference and exhibition on «Computer-based automation in developing countries (AUTO-DC '95)» was held in May 1995 at Enugu, Nigeria with the participation of 198 experts from various fields such as educators, researchers, computer consultants, vendors, computer managers/directors, planners and users.

• A workshop on informatics education was held in August 1995 at Ogbomoso, Nigeria with the participation of teachers from the universities, secondary schools. Federal Colleges, Ministry of education and private sector. The outputs of the workshop include recommendations regarding pre-university education in informatics and curriculum proposals for the teaching and learning of informatics in Nigerian secondary schools.

• In March 1995, a regional Forum de L'informatique, de la Bureaucratique, des Résuaux et de l'Electronique (FIBRE 95) was organized by the Centre National de Développement de l'informatique (CENADI) in Cameroon, with 237 participants from the sub-region.

• A national workshop for the drafting of curriculum for the teaching and learning of informatics in secondary schools in Kenya was organized by the Kenyan National Commission for UNESCO, involving educators, curriculum developers and informatics experts.

• A National Conference «Computers and National Development» was organized by the Computer Association of Nigeria (COAN) in Ilorin, Nigeria in May 1994. The Conference brought together 200 participants comprising educators, researchers, computer consultants, vendors, computer managers/directors, planners and users from within and outside Nigeria.

Projects

Under the project «Introduction of Computer Literacy in Secondary School in Malawi», a survey of computer courses to be introduced in secondary schools was carried out and training modules were produced. Computer equipment was procured and training workshops for teachers were organized. Introduction of the computer courses in selected secondary schools is expected to start in April 1996.

Research

The Centre des Techniques Informatiques (CTI) Lome, Togo, undertook a research study on the introduction of informatics into the education curriculum at secondary school level in the sub-region, between December 1994 and March 1995. The output of the study covered the strategy and policy for informatics education in secondary schools.

Training

- A three month training course in Micro informatics maintenance was organized at Yaba College of Technology, Nigeria, from September to November 1995 with the participation of 26 Nigerian trainees from the public and private sector.
- A «training the trainers» course in informatics was organized at the University of Swaziland in September 1995 with the participation of teachers from the local teacher training colleges. The course content included an introduction to computers and to computer applications(dBase, Wordprocessor and Spreadsheet).
- An on-the-job training programme in computer utilization was developed for and implemented at the Directorate of Public Service Information Technology Management in Namibia between May 1994 and August 1995. Computer equipment was also procured for this purpose.
- Under the project *Establishment of Computer Training Programme for Tanzania Women Scientists,* 8 women researchers and technologists were trained in computer skills at various levels between June 1994 and November 1995.

In order to widen the use of informatics in many areas including education and training, the development of national, regional and international networks in informatics is an important activity. Through IIP, UNESCO contributes to the launching and development of regional informatics networks which aim at linking institutions at regional level and serving as a bridge between national and international networks.

The Regional Informatics Network in Africa (RINAF) was established, with the objective of bringing together African scientists and academicians and facilitate exchange of scientific and technological information, thus fostering cooperation between them through:

- providing opportunities for countries in the region to share scarce resources (hardware, software, information, data etc.);

- serving as a gateway for Africa to link up with other similar networks in the region; minimizing duplication of time, money and materials in developing similar facilities;

- providing a unique opportunity for African students and academicians to interact via network brain-tapping and exchange of views on diverse topics;

- providing means for African informaticians to explore the resources of high performance computers and large databases that reside outside Africa.

A survey of the African institutions earmarked for participation in RINAF as communication and service nodes was made, as well as the specification and installation of additional hardware and software needed by the regional nodes, and training for regional nodes officials and on-the-spot training for operators responsible for the networks in the regional nodes were organized.

Experiments were carried out involving the exchange of messages and data between regional nodes and with international networks such as Internet and Rio, via links between Algiers and Pisa and between Dakar and Montpellier.

A workshop on the networks and the educational applications of informatics for the RINAF nodes in Southern Africa was organized in Zimbabwe in June 1994 .

In Arab States, the RINAS network aims at linking the countries of the Maghreb (Algeria, Morocco, Mauritania, Libya, Tunisia) and five Middle Eastern countries (Egypt, Jordan, Lebanon, Syria, Yemen) with the other Arab countries grouped in GulfNet. The actions taken within the context of the RINAS include:

- writing the technical specifications and supplying the additional hardware and software needed by the institutions chosen for RINAS to enable them to establish links with each other.

- making an inventory of the services offered by each institution, including messaging and data base, with a view to making them accessible through the network. A messaging system enables the institutions to communicate with each other and to communicate with other institutions through international networks.

In Europe, The RINEE has been the subject of a feasibility study involving network specialists from Eastern Europe. RINEE is in an experimental phase in six Eastern European countries (Bulgaria, Czech Republic, Estonia, Russia, Slovak Republic, Ukraine). The feasibility study has, made it possible to define:

- a general architecture for the links between the institutions in each country chosen as communication nodes.

- The technical means needed to establish the links and the additional hardware and software required. The additional equipment has been supplied and has made it possible to set up a messaging system and to gain access to Western European networks.

The BALTBONE network is a network that links the research and higher education networks of the three Baltic countries. Equipment has been supplied to Estonia, Lithuania and Latvia so as to link together three institutions, one in each country, themselves connected to the national research and education networks. The same equipment provides links with the international networks via the countries of Northern Europe.

In Asia, network-related activity is intense and corresponds to a highly diverse situation on the various economic, technical and human levels. An effort has been made to harmonize and coordinate initiatives under both RINSCA (South and Central Asia) and RINSEAP (South-East Asia and the Pacific).

A co-ordination meeting for RINSCA and RINSEAP was organized in New Delhi in November 1991. A regional seminar on the management of informatics networks was held in Melbourne in April

1993, jointly with the third RINSEAP planning meeting. The meeting examined the results of a study of the feasibility of an informatics network within RINSEAP carried out by New Zealand with IIP financing.

Within the framework of IIP, the following activities provided support to regional information networks:

- Computerization of student management at the National University of Engineering; testing of the Nicaraguan academic research network and organization of the international informatics congress, Nicaragua, 1992.
- Strengthening of the Sabaragamuwa affiliated University College's Regional Computer Centre, Sri Lanka.
- Establishment of a postgraduate training course in informatics applied to the water sciences, at the Ecole Inter-Etats d'Ingénieurs de l'Equipement Rural, Burkina Faso, 1989.
- Strengthening post-university training in software engineering, Sudan ,1994.
- Support to the education and research network, Baltic countries, 1992.
- The use of networks in distance education, Lithuania, 1992,
- Regional information network on educational software, Argentina, 1992.
- The development and production of educational software in Spanish-speaking countries of South America, 1989.
- Teacher training in informatics with a view to developing informatics application for education, Bolivia, 1992.
- New training syllabus in educational informatics, Cuba, 1992.
- Evaluation of educational software developed in Korea, 1992.
- Strengthening of a management system at Nouakchott University Services, Mauritania, 1992.
- Computer training for Government Offices staff in Equatorial Guinea, 1994.
- Organization of the Ibero-American Congress on educational informatics, Venezuela, 3992.
- Organization of the Congress on computers, education and society, Dominican Republic, 1992.
- Introduction of the use of micro-informatics in science and technology teaching in secondary schools, Nigeria, 1989.
- Computer-based education. El Salvador, 1991.
- Software production for science and technology teaching. Ivory Coast, 1989.
- Introduction of computer literacy in secondary schools, Malawi, 1994.
- Development of multimedia applications for handicapped children, Argentina, Paraguay 1994.

The Learning Without Frontiers Programme (LWF) Following the recommendations of the *Ad hoc forum of reflection on UNESCO's role in the last decade of the twentieth century,* convened by the UNESCO Executive Board in October 1993 (142EX/37), the Learning Without Frontiers Programme was launched with the aim of promoting learning increasingly free from restrictions as to when, where, at what age and in what circumstances it is to take place. Member States are encouraged and assisted in finding ways to «reach the unreached» and to diversify their education services to meet the learner's specific needs throughout their active life using diverse delivery systems -both formal and non-formal- including open and distance learning modalities.

Recognizing the potential of modern advances in technology to lower barriers surrounding traditional, institution-based education, specific attention is given to the integration of emerging technologies with existing ones while developing approaches that benefit the unreached and underserved.

A number of activities have been initiated within the framework of LWF programme, such as the coordination of the Joint Distance Education Initiative of the Nine High Population countries, launched by the nine high population countries as an attempt to exchange experiences in the use of distance and open learning in the provision of education for all.

Feasibility studies are carried out in India and Morocco for a Joint UNESCO/ITU pilot project for teacher education which makes use of television, telecommunication and computers. The project focuses on developing a learning model for in-service teacher training using the emerging capacities of interactive television. It is anticipated to lead to the definition of a flexible, durable system spanning a range of needs found in developing countries where the educational problems are most acute. "The system will incorporate the necessary flexibility to accommodate the range of delivery and telecommunications channels likely to be available to it, including terrestrial broadcasting, satellite and the public switched telephone networks(PSTN).

In collaboration with the International Centre for Distance Learning (ICDL), a data base on the use of electronic media in open and distance education is being developed and an analytical study prepared.

RESEARCH AND POLICIES

Following the recommendation of the first International Congress «Education and Informatics» a seminar «A European Platform to develop a mechanism for cooperation in the field of information technologies in education» was held in Moscow in June 1991 with the purpose of reviewing the present situation concerning the use of information and communication technologies in education and to elaborate on a possible platform for a more intensive cooperation. The meeting which brought together 70 participants from 19 European countries representing various fields such as education, technology, communication, information, and industry, focused on the central role of the teacher at all levels of education and training, and as a consequence, the crucial importance of the training of teachers in order to enable them to master the use of computers. It was emphasized that in order to create an effective interaction between hardware, software and educational personnel, the use of information technologies should be included in early phase of designing educational policies and planning curricula and teacher training programmes.

The importance of fast and easy access of educators to educational data bases was emphasized. In this respect, a special attention should be given to efforts to establish computer networks at sub-regional and regional level, as well as international networks such as BARN or INTERNET.

The development of educational software was given considerable attention whereby the close cooperation between educationists and software developers was viewed as a prerequisite of relevant software. At the same time, the protection and preservation of languages and cultural identity should be taken into consideration in the context of international standardization of information technology.

Modalities of European cooperation such as exchange of documentation, software, researchers, trainers as well as human, scientific, technical and financial means were discussed. In order to encourage sub-regional and regional cooperation, it was suggested to provide more opportunities for specialists in Eastern Europe to participate in international seminars, congresses and summer schools. Organizations such as UNESCO should support cooperation projects with Eastern European countries concerning hardware, software, and training.

The seminar had a positive impact as regards future perspectives concerning the role of information and communication technologies in education and the development of a cooperative framework.

Within the framework of the project Information Technology in Education of Children (ITEC), a multinational investigation was made on the impact of classroom computer use on children's high level cognitive functioning. The study which involved 25 countries, focused particularly on the reflection to the psychological and social consequences for the children from the application of the information technologies in education and the systemic investigation of the influence of different types and modes of information technology application in education on children's specific cognitive and social skills. The results of the study were presented at the Fourth International Conference «Children in the Information Age: The Impact of Technology in Education on Children» , Albena, Bulgaria, May 1991.

An international UNESCO symposium on *Copyright and Communication in the Information Society (global infrastructure, protection of rights, economic and cultural impact)* was held in Madrid, March 1996. Among other themes, the symposium focused on the author's rights in cyberspace, questioning whether additional law is needed to secure authors' rights in cyberspace, and suggesting that, while the need for more legal protection in cyberspace at national and international levels is being raised strongly, the issue of law reinforcement should be approached carefully through observing how cyberspace and markets for digital copies of copyrighted works develop and broadening discussions among governments, authors, users and publishers, in order to find out the right form of regulation suitable for everybody. The symposium discussed as well the potentials and challenges of the information highways in the widening of access to education.

- An expert meeting was held in Yalta, Ukraine, in September 1994 in conjunction with the East-West Conference on computer technologies in education,

- Regional Consultative Meeting of Experts on the Utilization of Micro Computers in the Teaching of Science and Technology (Cairo, 28 May-1 June 1989). This meeting was organized by UNEDBAS in cooperation with the Egyptian National Commission for UNESCO. Twenty five participants attended the meeting from the United Arab Emirates, Jordan and Egypt, representing educational institutions, information and computer centers, universities and other scientific institutions concerned with the use of computers in mathematics and technology. During the meeting, the participants formulated a number of recommendations related to the exchange of experience and expertise among the Arab States, the establishment of computer associations and the provision of support to those already established.

- Study on the *"Objectives of Computer Education in Science and Technology»* presented at the "Regional Consultative Meeting of Experts on the Use of Computers in the Teaching of Science and Technology" held in Cairo, 28 May - 1 June 1989 (Arabic, 15 pages).

- A Regional Seminar on Information and Computer Networks in the Arab Region (Damascus, 9-14 September 1989) was organized and conducted by the UNESCO Regional Office in Cairo (ROSTAS) and supported by UNEDBAS .

- A Regional Expert Meeting on Science and Technology Popularization and Networking (follow-up to UNESCO Project 2000+ on Science and Technology for All (Damascus, 16-19 May 1994) was attended by 11 participants, among them 6 women, from 11 Arab Member States, namely Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Qatar, Syria, Tunisia. Recommendations related to popularized scientific concepts in the programme and curriculum of formal and non-formal basic education were adopted. Attention was also devoted to the diversification of educational aids and technologies and exchange of information knowledge and experience in the context of regional and international co-operation.

PUBLICATIONS

«A Modular Curriculum in Computer Science» was published in the framework of UNESCO/ IFIP cooperation scheme.

«Les Nouvelles Technologies: Outils d'enseignement » by Henri Dieuzeide;

«Education and Informatics Worldwide: State-of-the-Art and Beyond» makes a attempt to look beyond the more immediate future in terms of a closer interaction between education and informatics at international and regional levels.

PARTICIPATION IN SEMINARS AND CONFERENCES

EDUCOM Conference in Atlanta, USA. This Conference gathered together about 4.500 researchers and educators from all regions of the world interested in the use of information and communication technologies at all levels of education (November 1994).

Iberoamerican Conference of the Iberoamerican Network for Education and Informatics (RIBIE) (Santo Domingo, Dominican Republic, June 1993).

Annual International Networking Conference of the INTERNET Society (San Francisco, USA, August, 1993).

III Regional Forum on Telematic Academic Networks in Latin America and the Caribbean

(Caracas, Venezuela, November 1993).

Annual International Networking Conference of the INTERNET Society (Prague, Czech Republic, June 1994).

IV Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Buenos Aires, Argentina, November 1994).

International Conference on Tele-Teaching (Trondheim, Norway, August 1994).

Annual International Networking Conference of the INTERNET Society (Honolulu, USA, June 1995).

V Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Lima, Peru, April, 1994).

Annual International Networking Conference of the INTERNET Society (Montreal, Canada, June 1996).

(IV) INFORMATION TECHNOLOGIES AS A TOOL FOR EDUCATIONAL MANAGEMENT

DEVELOPMENT PROJECTS

Within the framework of the Major Project of Education in Latin America and the Caribbean, UNESCO has developed computer analysis models to counter the deficiencies inherent in the poor quality and reliability of statistical data in order to promote research and information *for* decision making in education.

UNESCO is sponsoring an «item bank» and conducting academic performance measurements in 12 countries. Eventually, this data will be processed and related to all information available on schools which are part of the respective samples. Progress has also been made in terms of functional illiteracy characterization, with seven countries having been measured, so far.

The creation and systematic use of basic indicators on education is another area where considerable progress has been observed. The limited use of available information may be attributed to the scarcity of analytical models, computer time and software programmes, and specialized human resources. The Regional Information System in Latin America and the Caribbean (SIRJ) has been responsible for developing models that measure access to primary education , entry age, permanence in the system, progress in the higher grade basic education, and grades ultimately passed. SIRJ has also developed analytical models designed to integrate the finding of multiple research on the causes of low quality education , high repetition and temporary drop out rates.

Through its Regional Office for Asia & the Pacific (PROAP), UNESCO provides support to the development of Educational Management Information Systems (EMISes), which consist of the establishment of reliable information systems for the processing and production of education information such as education indicators in Asia and the Pacific countries. EMISes are broadly used by planners and administrators to assess the performance of the school system and the level of attainment and investment policies, and they are key tools to monitor the progress of education and to ensure the sustainability of funding and renewed interest in the education and training.

HEMIS (Higher Education Management Information System) is a component of the broader field of higher education management which covers, *inter alia,* institutional and staff development. HEMIS refers to the use of computerized management of universities and similar institutions: academic records, enrolment and timetabling are a few examples of its many applications UNESCO has undertaken activities in this area to promote research and training. The International Institute for Educational Planning (IIEP) as well as the UNESCO Regional Office in Bangkok (PROAP) organized training seminars within the framework of HEMIS. A study on the needs of African universities in this area was completed in 1995 within the framework of the joint UNESCO/ACUCHEMS Higher Education Management Programme.

TRAINING

- As a part of Ghana Government's action plan to increase management capacity in higher education, a training on the skills of computer-assisted time tabling and academic programming was organized for University Officers at Legon University , University of Science and Technology and University of Ghana.

- Regional Seminar on Strengthening Information and Data Base on Girls and Women Education with emphasis on rural areas (Cairo 2 - 7 November 1995).

This meeting was jointly organized with ISESCO and in cooperation with the Institute of National Planning in Cairo. 18 participants, among them 6 women, from Jordan, United Arab Emirates, Oman, Sudan, Syria, Iraq, Palestine, Qatar, Morocco, Mauritania, Yemen, Lebanon and Egypt attended the meeting. The output of the meeting was the production and distribution of one manual on the improvement of data collection methods with respect to education of females in basic education in early 1996.

PUBLICATIONS

«Micro-informatique, gestion et planification de l'education en Afrique» was published by BREDA with the aims of reinforcing capacities of educational planners, administrators and managers in the application of informatics in the management of education system in Africa.

(V) INFORMATION TECHNOLOGIES FOR THE DEVELOPMENT OF DISTANCE AND OPEN LEARNING

DEVELOPMENT PROJECTS

Interactive Distance Education through Tele-Seminars: A combination of satellite T.V, written materials and discussions through INTERNET. In Latin America, UNESCO has initiated a pilot project on tele-seminars through the use of the Spanish satellite HISPASAT with the purpose of creating a powerful interactive learning tool among universities in the region. Under the coordination of UNESCO Regional Office in Santiago (OREALC) and in cooperation with the Iberoamerican Association of Educational Television (ATEI), a first tele-seminar on environment education was organized in the first semester of 1995. The material composed of video programmes and written material presenting a variety of experiences in the field of environment education was co-produced by 7 institutions from Chili, Colombia, Honduras, Mexico and Spain. The programmes transmitted via HISPASAT during 7 weeks was complemented by the use of E-Mail in order for all participants to interact with each other. This activity targeted to postgraduate students in education, teachers and professionals interested in the topic opened innovative discussions in environment education in 18 Universities in 10 countries of Iberoamerica.

A second Tele-Seminar on the topic « Quality in Education » was carried out in November/December 1995 and March/April 1996 with presentations of 10 institutions from 9 countries and the participation of 38 institutions from 11 countries.

Creation and support to the Network for Innovations in Distance Higher Education (RIESAD), within the framework of UNITWIN Programme and the Programme "Learning without Frontiers . The network is coordinated by the National Open University of Venezuela with the cooperation of the main distance education universities and higher education institutions from Brazil, Bolivia, Costa Rica, Ecuador, Mexico and Peru. This project and network has produced several training workshops, multimedia courses and telematic courses through the INTERNET (See Section Training activities). CRESALC will publish a book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean"* which gathers the first results of the project and the main trends problems and innovations of distance education in the region (See Section Publications).

UNESCO Series of Learning Materials in Engineering Sciences. Taking advantage of recent advances in information technologies which make affordable the production of multimedia learning materials, UNESCO has developed a series of distance learning materials in engineering sciences which provide new generations of engineers entering the world of industry and practising engineers already working in it with opportunities of studying at their own pace a subject which requires constantly an updating of knowledge. The first series of learning materials for undergraduate level engineering course were conceived for Africa within the framework of the project «African Network of Scientific and Technological Institutions» linking 50 scientific and engineering departments located in 32 sub-Saharan African countries. In 1991, a bulletin *UNESCO Series of Learning Materials in Engineering Sciences for Africa* was published.

A *Multimedia Postgraduate Learning Materials in Environmental Engineering* was developed comprising six modules on environmental engineering. The learning packages which are at the same time suitable for delivery and use in the formal classroom environment, consist of a combination of the following:
- structured written texts;
- video and audio cassettes;
- Interactive Computer Assisted Learning Programmes.

The structured text is presented to the end-users in the form of computer diskettes for viewing on a computer monitor or capable of being reproduced in loose or bound sheets at the user's end. This form of presentation has the advantage of mass production and therefore results in a relatively cheap unit cost to the end-user as compared with the high cost of standard text books.

The package is designed to be user-friendly and has a self-assessment software which enables students to assess their own understanding on a regular basis at their own pace.

The International Institute for Educational Planning (IIEP) has started in cooperation with the Russian State Committee for Higher Education (SCHE), a distance learning course on institutional management in higher education using Internet. The course which uses IIEP training materials is attended by senior administrative staff from 10 selected universities in the Russian Federation.

RESEARCH AND POLICIES

An Open Classroom Conference was organized by the European Distance Education Network (EDEN) and The International Council for Distance Education (ICDE) with the support of UNESCO in Oslo, Norway, in September 1995. The Conference's discussions, which focused on various topics concerning distance education and the use of technologies in education, were transmitted through satellite to schools and universities in Europe interested in the use of information technologies.

TRAINING ACTIVITIES

Regional Workshop on New Information and Communication Technologies in Distance Education, as part of the RIESAD Project and Network (Venezuela, 1994).

Tele-conferencing Workshop on Distance Education, as part of the RIESAD Project and Network (Several countries simultaneously through satellite communication and follow-up by electronic mail through INTERNET, 1995).

PUBLICATIONS

- Book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean "*, as part of the RIESAD Project and Network (To be published by CRESALC in 1996).
- World Wide Web information server on the INTERNET with information, documents and publications about distance higher education in Latin America, as part of the RIESAD Project and Network (In preparation, to be opened to the public in 1996).

ANNEX I

DOCUMENTS AND PUBLICATIONS

African universities - review of information systems by D. Mason. A Report funded by UNESCO. UNESCO/CHEMS (Commonwealth Higher Education management Services), 1995, 54 pp.

Calidad tecnologia y globalizacion en la educacion superior Latinoamericana. Caracas, UNESCO/CRESALC, 1992, 525 pp. ISBN 980-6226-66-6

Computers in education: the shape of things to come. Bulletin of the IBE, No. 250, January-March 1989. Paris, UNESCO-IBE, 1989, 96 pp. (Bilingual: E,F)

Contemporary information and communication technologies and education by A. Hancock. International Commission on Education for the Twenty-First Century, First session, Paris, 2-4 March 1993. Paris, UNESCO, 1993, 10 pp. EDC/1/3 (E,F)

Directory of the international network for information in science and technology education (INISTE). Paris, UNESCO, 1992, 157 pp. ED-92/WS/8 (Bilingual: E,F)

Education and informatics worldwide. The state of the art and beyond by Jacques Hebenstreit et al. London, Jessica Kingsiey; Paris, UNESCO, 1992,253 pp. ISBN 1-85302-089-3 & ISBN 92-3-102798-0

Education and informatics: strengthening international co-operation. International congress, Paris, 12-21 April 1989. Final report. Paris, UNESCO, 1989, 1 16 pp. ED/89/CONF/402/COL.4 (E,i-)

Education and informatics: strengthening international co-operation. International congress, Paris, 12-21 April 1989. Proceedings, Vol. I and 2. Paris, UNESCO, 1989, 757 pp. (Bilingual: E,F)

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ANNEX II

LIST OF ABBREVIATIONS

- ACCT Agence de Cooperation Culturelle et Technique
- ACU Association of Commonwealth Universities
- ASP UNESCO Associated Schools Project
- ATEI Iberoamerican Association of Educational Television
- BALTBONE Baltic countries education and research network
- BREDA UNESCO Regional Office for Education in Africa
- CDS/ISIS Computerized Documentation System/Integrated Set of Information System
- CEPES UNESCO European Centre for Higher Education
- CHEMS Commonwealth Higher Education management Services
- CIT Communication and information technologies
- CPSC Colombo Plan Staff College for Technician education
- CRESALC UNESCO Regional Centre for Higher Education in Latin America and the Caribbean
- EIMIS Educational Management Information System
- FUNREDES The Foundation for Networks and Development
- HEMIS Higher Education Management Information System
- HISPASAT Spanish satellite
- IBE International Bureau of Education
- ICDE International Council for Distance Education
- ICDL International Centre for Distance Learning
- IEA International Association for the Evaluation of educational Achievement
- ITIP International Federation for Information Processing
- IGO Intergovernmental Organization
- IIEP The International Institute for Educational Planning(UNESCO)
- IIP Intergovernmental Informatics Programme
- ILO International Labour Organisation
- INFORMAFRJCA Informatics in the Service of the Development of education in Africa
- INISTE International Network for Information in Science and Technology Education
- ISESCO Islamic Educational, Scientific and Cultural Organization
- ITEC Information Technology in Education of Children
- ITU International Telecommunication Union
- LWF Learning Without Frontiers
- NGO Non-governmental Organization
- OREALC UNESCO Regional Office for Education in Latin America and the Caribbean
- PROAP UNESCO Principal Regional Office for Asia and the Pacific
- PSTN Public switched telephone networks
- REDALC Project Support to Telematic Academic Networks for Research and Teaching in Higher Education, Science and Technology in Latin America and the Caribbean
- RIBIE Iberoamerican Network for Informatics and Education
- RIESAD Network for Innovations in Distance Higher Education
- RINAF Regional Informatics Network in Africa
- RINAS Regional Informatics Network in the Arab States
- RINEE Regional Informatics Network in Eastern Europe
- RINSCA Regional Informatics Network in South and Central Asia
- RINSEAP Regional Informatics Network for South-East Asia and the Pacific
- ROSTA UNESCO Regional Office for Science and Technology in Africa
- ROSTAS UNESCO Regional Office for Science and Technology in the Arab States
- SCHE Russian State Committee for Higher Education
- SIRI Regional Information System in Latin America and the Caribbean
- VIE UNESCO Institute for Education
- UNEDBAS UNESCO Regional Office for Education in the Arab States
- UNESCO United Nations Educational, Scientific and Cultural Organization
- UNEVOC UNESCO International Project on Technical and Vocational education
- UNITWIN University Twinning
- USEIT Use in Systems of Education of Information Technologies

ANALYTICAL SURVEY

ON THE ISSUE OF "EDUCATION AND INFORMATICS"

(NOTIONS, CONDITION, PROSPECTS)

PREFACE

This analytical survey on the issue of "Education and informatics" was prepared by a group of Russian specialists representing the International System Research Center for Higher Education and Science, Institute of Problems of Informatics of the Russian Academy of Sciences and the Russian Academy of State Service affiliated with the President of the Russian Federation at the request of UNESCO Education Department in the framework of preparation for the Second International UNESCO Congress entitled "Education and Informatics" (Moscow, July 1-5, 1996).

At the first Congress that took place in 1989 in UNESCO headquarters in Paris it was emphasized that "application of new information technologies in education is vital for using the advantages of the collective expertise and joint utilization of limited resources" and for this purpose expanding the international cooperation was highly recommended.

The letter of UNESCO General Director F. Mayor dealing with the Congress, its objectives, programs and topics, participants as well as other aspects distributed by the UNESCO headquarters in January 1996, states that the international cooperation in that sphere is now becoming even more critical than ever. In recent years the sphere of information and communication technologies is tending toward significant progress and as a result, generations of computer equipment and software are rapidly substituting one another and these innovations integrate into other technologies. It has also resulted in emergence of previously unexplored combinations of information means that leads to forming an "information society". Creation of information super highways urges the education sphere to detailedly revise its situation which is extremely vital given the conditions of rapid development of technologies in comparison with the possibility of their application at all levels of education.

Even countries with the most advanced education system fail to effectively solve the range of problems the education endures entering the 21st century. The Congress would be a fine meeting point for nations of the whole world. It will contribute to the development of international contacts in the education sphere, precise formulation and coordination of national education systems. Basically, the major issue the Congress is dealing with is the national and international strategies in the education sphere, organizational and technological forms for implementing this policy. The modern strategy in 1 lie education sphere is formulated based upon new information technologies and the legal and legislative principles that form the foundation of concrete decisions and results. That is why the word "Education" was deliberately put in the first place in the title of this Congress.

In this regard, the Congress will be dealing with an analysis of national, regional and international trends as well as the expertise of introducing and applying the new information technologies in education systems. It will also include a review-of state-of-the-art works in the sphere of new information technologies and study of their application in the education sphere as well as discussion of international, regional and national policies in using new information technologies in education and formulation of recommendations with regard to international cooperation.

It is essential that organizers of the Congress assumed that education is the top priority that is why the UNESCO General Conference chose Russia as the host country for holding the Congress which has achievements in education recognized all over the world. In addition to the role of the host of this global meeting, Russia will also act as a country running in the forefront of the education sphere and applying new technologies for developing it. The country possesses centers for computerization of higher and secondary education supported by the state. This centers offer methodological works and test samples of program complexes in a number of program spheres. There are also a series of tools for mastering and perfecting professional skills in technically complex professional spheres. These centers hold conferences and seminars, release numerous publications on the issue on the agenda.

For example, materials of the International scientific methodological conference entitled "New Information Technologies in University Education" alone (regarding mostly Russia and just certain CIS member-states) published by the Russian State Higher Education Committee and the Scientific Research Institute for mathematical and information education fundamentals affiliated with the Novosibirsk State University (Novosibirsk, 1996) totaled 24.5 quires. More than 220 reports offer works of specialists in the following directions:

- problems of higher education informatization;
- computer technologies in teaching natural science disciplines',
- computer technologies in teaching humanitarian and social economic disciplines:
- teaching informatics:
- distance education in higher schools:
- teaching computer systems in schools:
- instrumental means for developing teaching computer programs:
- application of computer networks and telecommunication systems in education.

It is important to point out that reports delivered on all topics are extremely practically articulated.

The Russian National Report entitled "Policy in the Sphere of Education and New Information Technologies" that will be delivered at the UNESCO International Congress offers an inclusive review of numerous directions in development of education and application of new information technologies. This report actually reflects the official opinion of state institutions education administrative organizations regarding the issue in hand.

On the other hand, it seems interesting and useful to set forth independent expert opinions represented by famous Russian specialists in the sphere of education and informatics regarding problems that are to be discussed at the Congress. The analytical survey was given birth in this regard. Its authors, according to the topic sequence of the Congress, analyze the current situation in Russia as opposed to other countries with regard to directions that fully correspond to the subject of the forthcoming international forum and render their opinions on each direction according to their own experience and domestic works available.

The section dealing with Russia's policy in the sphere of education and informatics sets forth the major principles and strategic objectives of Russia's education policy, shows the necessity of the country's education system informatization as an indispensable condition and a critical stage for the informatization of the entire country. It also describes the major directions of works covering practically all sides of pedagogical and scientific activities that will undergo reforms as a result of applying the new information technologies as well as renders a review of conditions and trends in developing the course of informatics in secondary and higher schools all over the world. It is pointed out that studies of informatics in the form of an obligatory course in secondary and higher schools that commenced quite recently - in the last ten years - is currently being conducted on a permanent basis in all higher education facilities and colleges of not only the developed countries but in many developing ones as well. In this context, the trend toward dispersing the course in the education sphere is showing a persistent growing curve, the contents of the course is undergoing changes and gradually assumes new features. The reason for these changes lies in the fact that the process of society informatization is now taking a global scale embracing practically all countries of the world including Russia. That is why knowledge of informatics fundamentals, its possibilities and prospects for development becomes necessary for basically all members of the modern society.

The survey also deals with the still controversial issue of choosing the name for the course of informatics. One of the compared titles is "Computer Science" (this term is popular mostly in the US, Canada and several countries of Latin America) and the other is "Informatics". The authors deem the second name more appropriate since it reflects the information orientation of the subject sphere of this scientific and educational discipline to a greater extent.

The survey emphasizes the necessity, importance and timeliness of drawing the attention of UNESCO leaders as well as those of education authorities, scientists and pedagogues of various countries of the world and the mass media to the fact that today informatics is one of the most important and lucrative "points of growth" of the world science with a new complex of information sciences forming around it. In this respect, it is necessary to recast not only the contents of the informatics course and technical disciplines similar to it (such as computers and cybernetics) but also a number of humanitarian disciplines such as philosophy, economics, sociology and psychology. The works of Russian scientists present information and scientific knowledge as important strategic resources for further development of the civilization and the problem of activation and effective use of these resources is given the top priority as the most important one among other scientific technical and social economic problems the modern society faces.

The preparation and organization of teaching the special educational course entitled "Social Informatics" which is a new and prospective complex scientific and educational discipline, is undoubtedly deemed as an achievement. Russia's expertise in introducing such courses as "Theoretical informatics" and "Information Technologies in the System of State Service Bodies" appears to be unique.

The analysis shows that during the last ten years of active application of new information technologies in education, the pedagogical software did not drastically change teaching in secondary schools with the computer serving more like an instrument assisting teachers in conducting their classes traditionally. On the other hand, application of computers made it possible for higher schools to introduce an effective computer experiment in a number of courses.

The major obstacle for developing pedagogical software is not the lack of instrumental means but the lack of purely pedagogical materials for implementing it on computers. It is necessary to form creative groups composed of practicing teachers, teachers-methodologists, artists, screenplay writers, programmers and other specialists.

It is also pointed out that the new model of using in schools one or two modern multimedia computers instead of purchasing a set of educational computers is most expedient.

The possibility of using network technologies in education are determined (just as with respect to developing pedagogical software) not by the technical characteristics of telecommunication systems but by the contextual and methodological contents which does not always manage to keep up the pace of development of technical means. On the other hand. using E-mail, teleconferences, distant databases and other modern information means for education purposes opens broad horizons for developing education technologies.

Expansion in application of new information technologies in education is getting underway given the conditions when teachers, pedagogues and students are not quite prepared for the new roles. The new role of the teacher is confined to the fact that he gains additional options for supporting and building the identity of the student, for creative search and organization of joint work, preparing and choosing the bast variants of education programs. There is also a possibility to give up the teacher's routine activities intrinsic to the traditional education by providing him with intellectual forms of labor. The information technologies release the teacher from the necessity to set forth a considerable portion of educational materials and operations related to practicing skills and knowledge. Expanding the sphere of application and increasing the effectiveness of using information technologies in the field of knowledge and skill conveyance require international coordination and joint efforts of specialists from different countries in working on the development of information and technological education means.

It also renders a review of models for using information technologies in schools showing that the traditional class-lesson model of interaction between students and information technologies has become outdated. It should be replaced by collective project and individual models. The major distinction of these models lies in the fact that they enable the informatization of the education process, make it possible to accomplish goals with minor costs and are particularly well suited for modern schools.

The strategic role of information technologies as a factor of social and economic development of modern society, may undoubtedly be regarded today .is commonly recognized. It is determined by a number of major features of information technologies specified in the work, that stipulate the necessity to give them the top priority both in the sphere of national scientific and technical policy and that of education.

It also points out the possibilities informatics provides for creating new solutions for a number of vital problems of modern culture. The possibilities of multimedia technologies are in particular so immense that the Russian culture scientists ungroundlessly refer to creation of a new direction in the cultural sphere namely - screen culture. It is extremely important that this direction find the proper reflection in the sphere of humanitarian education.

The analytical survey on the issue in hand would have been incomplete if the authors had not described a number of "transparent" topics, among which the priority ь given to the problem of distance education. The survey analyzes its possibilities, expedient spheres of application, drawing the conclusion that the distance education may successfully integrate into the existing systems of internal and external, open education, education at home or without abandoning the major activities. However, now we have to refer to the distance education mostly in subjunctive mood or in the future tense. Creation and implementation of the Federal Program "Development of a uniform distance education system in Russia" should bring the distance education considerably closer to the implementation phase.

In concluding the survey, a general prospective structure the education course entitled "Fundamentals of Informatics" is offered for the system of secondary and higher education in Russia. The structure is based upon a problem module principle and hence is quite flexible. The contents of the course is viewed in the form of critical comparison with the foundation materials of a similar course rendered in the Russian national report entitled "Policy in the sphere of education and new information technologies". It may be asserted that the contents of the course set forth in the survey shall contribute to practical implementation of the role of education as a forerunner in the process of intellectualization of the Russian society.

1. POLICY

1.1. FORMULATION OF NATIONAL PLANS AND STRATEGIES

The international cooperation in developing new information technologies and their efficient application in education is one of the major issues for humanity. There is no doubt that informatics is one of the most important "points of growth" of the world community, with broad prospects.

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

Major principles of Russia's education policy and general education programs are designed to resolve issues related to shaping culture in general, fostering intellectual, moral, emotional and physical evolution of individuals, formulating scientific concept of the world, assimilation of individuals in society. Russia occupies a respectable position in the world education system especially with regard to furthering methodological teaching principles. It is widely acknowledged in the world that Russia represents one of the top three countries with regard to level of comprehension in such general education spheres as mathematics, physics and chemistry.

The strategic objectives of Russia's state policy in the educational sphere are:

- creation and implementation of conditions for ensuring constitutional rights of citizens to obtain education, expanding boundaries for character-building of individuals and spheres of their self-evolution;
- development of mentality in the Russian society based upon general human values, adapting awareness of masses to shaping respect for human rights, public concerns as well as those of territorial and national communities;
- shaping a system of education capable of adapting to conditions and norms human existence as well as new type of interaction between theory and practice;
- introduction of promotional education principles and methodology of active approach, converting education into the sphere of comprehending different types of mentalities and activities;
- integration of the Russian education system into the world general education system.

The organizational basis for Russia's state policy in the sphere of education is formed by the Federal program on development of education, ratified by the supreme legislative body of the Russian Federation. The program stipulates concrete mechanisms for achieving the projected strategic goals.

One of the most important mechanisms embracing all of the major directions of education system reform in Russia is its informatization which may be regarded as an essential condition and a critical stage of Russia's entire informatization. The transition of community from industrial stage to the information one is based upon new information technologies (NIT).

Informatization of education will allow over the long run to effectively apply the Following vital benefits of NIT:

- a possibility of building up an open system of education ensuring a particular curve of self-training for each individual;
- a drastic change in organization of comprehension process by virtue of reshaping it toward the system mentality;
- efficient organization of comprehension activities for trainees in the course of education process;
- organization of an education process that furthers an active approach toward that process throughout all stages (demands-motives-goals-conditions-means-acts-operations);
- individual approach in the education process and preservation of its integrity based upon projectable nature and versatility of automated educational programs;
- a possibility to organize and apply radically new comprehension means.

Informatization of education is one of the most important means of implementing a new state educational paradigm, within the framework of which the focus is replaced - from the pragmatic goals confined to a single specialty to acquisition of general knowledge; from the historic context of scientific knowledge development to a modern concept of structure and integrity of science contents.

1.2 FORMULATION OF THE STRATEGY FOR REMODELING THE EDUCATION SYSTEM (AT THE LEVEL OF EDUCATION INSTITUTIONS)

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

In order to effectively use the huge volumes of information and knowledge accumulated in the course of modern information revolution for resolving real issues, it is necessary to formulate a strategy for remodeling the education system including that at the level of education institutions.

It requires a special information policy with its major provisions conceptually absorbed and set forth applicably to the education system in Russia. A series of programs stipulating implementation of large-scale projects with regard to the following directions is devised and executed.

Informatization of the education and upbringing process:

- transition from the disciplinary model of education contents to a system one with the major objective - to teach understanding of the world, society, oneself and one's occupation;
- radical replacement of the scientific methodological, educational methodological and information basis of education;
- providing equal opportunities for individuals with regard to obtaining an education of personal and public importance, that is capable of assisting them in spiritual and intellectual self-evolution as well as in finding the best possible niche in the job market;
- reducing terms of education by means of resorting to methods of modern intensifying and increasing effectiveness of the education process;
- formation and introduction of scientific methodological and educational methodological materials in order to support training in new information technologies.

Creation of modern information environment for the education system:

- ensuring links and interaction between information technologies and education institutions in the course of multi-phase education process (information links between subjects and objects in all stages of continual education);
- formation of information systems serving for purposes of particular educational institutions;
- forming and putting into operation functional complexes based upon local computation networks for automation of administrative activities at various levels and in different directions;
- creation of distribution databases in different subject spheres and educational topics.

Information integration of Russia's education system into the world education system:

- formulation of a new strategy for the international scientific and educational cooperation;
- ensuring independence of educational facilities in determining the locality and functional contents of international information networks and increasing their international mobility;
- creation of a global information computer network accessible for various higher education institutions ensuring their integration into international networks containing scientific, technical and educational information;
- cooperation in developing international educational standards for education;
- organization of international cooperation in exchanging expertise of the NIT application in education.

The major working directions set forth above embrace practically all aspects of pedagogical and scientific activities that may undergo transformation resulting from application of new information technologies. The above-mentioned directions fully reflect contents of the problem and in their entirety form an adequate conceptual information field required for organizing their implementation.

1.3. INFORMATICS COURSE IN THE EDUCATION SYSTEM: CURRENT CONDITION AND PROSPECTS FOR DEVELOPMENT

1.3.1. Condition and development trends of informatics course in secondary and higher school

Studies of informatics as an obligatory course in secondary and higher schools have started comparatively not long ago - within the last ten years. Primarily, this course was introduced into the training program for students of universities and technical higher education institutions of the developed countries and then started spreading out rapidly in the school education system as well.

Today the informatics course is studied practically on permanent basis not only in all higher education facilities and colleges of the developed countries but also in a majority of the developing ones. The trend of expanding the course on within the sphere of education persists through. The reason for such an event is confined in the fact that there is a serious permanent social demand for informatics studies in the society. It is caused by a hectic progress in means of computerization and communication, penetration of information technologies in basically all spheres of social practice and a pending necessity to efficiently apply them for solving a number of vital social and economic problems [1,2].

As far as the substance of informatics course is concerned, today in secondary schools and humanitarian higher education facilities it is mostly oriented at acquiring computer literacy, i.e. basic knowledge and skills in the sphere of applying modern computers and telecommunication systems for processing and transferring information, solving elementary tasks using the most of mass information technologies.

Apart from this, universities and technical higher education facilities offer broader knowledge in the sphere of technical and information support of informatics means and software, computer and telecommunication systems as well as in the sphere of new information technologies (NIT). This chapter of informatics course usually includes information regarding various types of intellectual and expert systems, methods and means of information modeling, hypertext and multimedia systems, computer graphics and virtual reality.

Particular chapters of the informatics course dealing with new information technologies have been lately more and more often included in educational courses taught at humanitarian higher education facilities as well as in lyceums and colleges. It is entailed by the global character of social informatization that embraces practically all countries of the world including Russia. That is why knowledge of informatics basics, its possibilities and prospects for development is an inalienable condition for the entire modern society.

1.3.2. Modern concept of informatics as a science and educational topic

The ever-disputed issue of choosing a name for the modern informatics course shall undoubtedly be dwelt upon in the context of the discussed problems. Not only is the nature of this issue educational and methodological but also philosophic and scientific for it is closely linked to the modern concept of informatics substance as a science and hence that of the educational course corresponding to that science. Ancient philosophers used to say "to name correctly means to understand correctly" and this issue is in serious controversy today.

For example, today the term "computer science" is commonly known in the United States, Canada and several South American countries. This term is used as a name for both scientific and educational courses dealing with procedures related to processing, storage and transfer of information via computers and telecommunication systems. Thus, the "computer orientation" of topics taught in the framework of these scientific and educational courses is accentuated.

As far as Russia, the CIS member-states and the Western Europe are concerned, a term of French origin - "informatique" is more popular. It is a apparently a derivative of two other French terms - "informatione" (information) and "avtomatique" (automatic).

In our opinion, the term "informatics" is more appropriate for naming the scientific and educational courses at hand because it to the greatest degree reflects the information orientation of their substance. Ukrainian scientists share this opinion with us. A fine example of it would be to cite the name of two academies of sciences that have been recently established in the Ukraine. On of them is entitled "The international academy of computer sciences and systems" and focuses its major activities on the issues of creating and effectively using computers and systems based upon them, that society deems extremely important for implementing modern and prospective information technologies.

The other academy of sciences - the Ukrainian Academy of Informatics chose studies of information, information-related processes in the society and social consequences of its informatization as the major objectives of its research.

As it appears, these two closely linked areas are considerably different in their essence.

Taking these facts into consideration, we may positively assert today that "informatics" and "computer science" are not two different names for the same scientific and educational courses. They are two closely related courses with different contents. In this context, due in the fact that contents of informatics is rapidly expanding, this difference will become more and more noticeable.

It is also worth pointing out that not only does informatics as an independent science and educational course have its own clearly outlined area of problems, but also its own research method - information-oriented approach. Applying this method makes it possible already today to reveal, analyze and perceive many new characteristics and principles of information and processes related to it that are under way in the society and the world around us.

The information culture becomes today an inalienable part of the general culture of the society and this may be regarded as the effect of objective civilization development laws.

1.3.3. Prospects of informatics development in the near future

Informatics as a science is currently undergoing a stage of intensive development Having been created in the framework of a science dealing with administration processes - cybernetics, the contents of informatics is rapidly expanding and we can witness that it turns from a technical course covering methods and means of processing data via computers into a fundamental natural science handling information and processes related to it that are under way in the nature and society [3].

We can reasonably assert that informatics is one of the most important and prospective "points of growth" of the world science with a new set of information sciences forming around it [4]. That is why it is of paramount importance to timely focus attention of the UNESCO heads, education bodies, scientists and teachers from different countries of the world as well as the mass media on that phenomenon in order to adequately reflect it in programs, methodologies and curriculums of the higher and secondary education systems as well as in the system of advanced training of specialists with higher education and primarily pedagogues.

This implies that changes must be introduced not only to the contents of the course dealing with informatics and other technical courses related to it (computerization, cybernetics), but also a number of humanitarian courses such as philosophy, economics, sociology and psychology. It is extremely vital to include this provision in the Recommendations of the UNESCO Second International Congress on "Education and Informatics".

1.3.4. Contribution of Russia's scientists to the development of informatics as a science and educational subject

Russian scientists have been lately energetically conducting fundamental research in the sphere of information-oriented problems of the modern society development including philosophic problems related to analyzing the role of information and scientific knowledge in the further evolution of civilization and transition of the society to a new paradigm of safe and stable development. This research is based upon the noosphere concept of biosphere evolution created by works of such world famous Russian scientists as K.E. Tsiolkovsky, V.I. Vernadsky, A.L. Tchizhevsky, and N.V. Timofeev-Resovsky. Today this concept gained momentum in he works of such Russian philosophers as N.N. Moiseev, A.D. Ursul, A.I. Rakitov, Abdeev and others [3-6].

Information and scientific knowledge are viewed in the current works of Russian scientists as essential strategic resources required for the further development of the civilization and the problem of activation and efficient application of these resources is given the priority among other scientific technical and social economic problems of the society today [7,8].

Results of this research are energetically discussed by scientists and pedagogues in scientific press, during seminars and conferences and are already reflected in a number of pilot educational courses on informatics taught in Russian higher education institutions.

For example, the course entitled "Theoretical informatics" taught in a number of years in the Russian Academy of State Service and to students of the Moscow State Social University, includes topics dealing with information, knowledge, information processes and information technologies that are set forth by the pedagogues precisely from the philosophical perspective and that of the general system position.

With regard to analyzing the role of information processes in modern society as well as impact of the global imformatization process upon the development of society and humans, these problems are dealt with in a special educational course entitled "Social informatics" which since 1989 is studied by graduate and postgraduate students of a number of Russian humanitarian higher education institutions in Moscow, Saint Petersburg and Nizhny Novgorod [10].

It is necessary to mention that social informatics as a new and quite prospective complex scientific and educational course has lately become more popular in the Russian educational system. A number of problem-oriented departments of social informatics have already been created and are successfully functioning in the Moscow State University named after Lomonosov, the Moscow State Social University, the Nizhny Novgorod State University and in Youth Institute. In 1994 an association of these departments was established. Problems of social informatics are given a great deal of coverage in Candidate's and Doctor's thesis works and regularly discussed at scientific and scientific methodical seminars.

The Supreme Attestation Commission of Russia was filed a motion by the scientific community on introducing a new scientific specialty - "Social informatics", which would assist in activating training of scientific personnel for this vital and socially important scientific problem.

Russia's expertise in applying the informatics and information technology courses when providing training and advanced training of specialists for state service authorities shall be undoubtedly taken into account. In particular, such courses are taught at the Russian Academy of State Service affiliated by the President of the Russian Federation. Starting in 1994, this Academy operating in the framework of the continuous higher education system for state officials also trains specialists that after accomplishing their thesis obtain the qualification of "System analyst in information technologies" [11].

Employment of specialists with such qualification in federal and municipal authorities of Russia already draws a great deal of attention It will positively contribute to fostering more effectively the process of informatization of the Russian society supported by the fact that the Academy of State Service has a number of branches in different regions of Russia.

1.3.5. Russia's international cooperation in dealing with new problems of theoretical and social informatics

Starting in 1989, Russia's scientific, methodological and pedagogical expertise in studying the aforementioned new problems of theoretical and social informatics is quite regularly discussed during international conferences, congresses and forums with specialists both from the Western and the "near abroad" countries - republics of the former Soviet Union - participating in them. For example, at the International Congress on "Information processes and technologies" (Moscow 1993) three out of four major plenum reports were dedicated to these problems [12-14]. Moreover, international conferences on the social informatics issues have almost gained the status of being "annual" Another conference entitled "Social informatics - 96" will take place in Moscow in April, 1996.

Results of scientific research and pedagogical expertise of the Russian scientists in informatics are now studied by specialists from a number of universities in the US, Great Britain, Western Germany, France, Spain, Portugal and India. Particular problems such as for example, those related to developing methods for distance education and multimedia technologies, are internationally cooperated in on a long-term contractual basis with such countries as

Great Britain and Spain and in the sphere of theoretical and social informatics - with scientists from the Ukraine [15,16].

In order to foster a broader and more inclusive international cooperation, it is vital to obtain financial support from the UNESCO and governments of the countries that are members of this organization. This support is primarily critical for publication and distribution of scientific works and monographs covering the future problems of informatics as well as for conducting scientific and methodological conferences and seminars on the most essential problems.

Regarding the issue of generalization and distribution of the generated scientific and methodological expertise in studying such courses as "Theoretical informatics", "Social informatics" and "Information technologies in the system of state service authorities", in our opinion, Russia's experience in this field is unique and worth being studied in detail.

2. TECHNOLOGIES

2.1. COMPUTERIZED EDUCATION

2.1.1. Current condition

In the last ten years of applying NIT in education, pedagogical software has not radically changed the teaching methodology in secondary schools. Computer is at best an instrument assisting teachers in the traditional way of conducting classes. According to expert estimates, computerization in higher schools allowed to introduce an effective computer experiment in a number of courses.

By Fall 1995, 34 thousand out of 35 thousand complete secondary schools had computers or computer classes with the average number of computers per school totaling nine. Schools are mostly equipped with different types of computing machines, for example 22 types of computers were used in Tomsk region in 1993 and 17 types in Novosibirsk region. During the last years, the type of computers acquired for secondary education was mostly confined to IBM PC or Macintosh but their number (according to experts) can hardly reach 10-15% of the entire number of all computers installed.

Only 365 schools out of 30.5 thousand (1.2%) had computers (according to the official statistics of the Russian Federation Ministry of Education with incomplete information on Chechnya and Dagestan). It suggests that application of computers and NIT in education provided for junior students did not exceed the limits of experiment.

With regard to complete secondary schools, the following conclusions may be drawn. Software and methodological support of the educational process informatization may be divided into six categories of educational computer programs:

1. Knowledge control and testing.
2. Training programs for solving problems.
3. Informative reference systems with materials of studies, "talking" systems, combinations of the above-mentioned directions.
4. Professional programs as a topic of studies.
5. Modeling programs, powerful graphical training and reference systems, complex computergames, framing modeling environments, multimedia systems.

Testing programs are the most spread out ones in Russia because they are easy to create. Almost in every sphere several testing and controlling root programs have been created for different types of computers.

Program and methodological complexes (PMC) have become popular lately as well. One of the first organizations to develop them was KUDITs (Moscow) operating in the framework of an IBM pilot project. PMC represent an autonomous product that includes:

- methodological support;
- software;
- information support.

Methodological support is the key component of these complexes. PMC present an opportunity to use the assistance of a teacher or study independently.

Until now no training environments have been created that serve for purposes of the masses, despite that there are projects aimed toward that end implemented in Pereyaslavl-Zalessky (Robotlandia), in Moscow (INT - Logomiry) and in other locations. Very few modeling, simulation and multimedia systems exist. In many ways it is related to the structure of the computer base in secondary education and higher educational facilities. The computer base in secondary education has already been described above, however, most of computers in higher schools are based on microprocessor 286. These models can hardly be deemed as a testing site for the modern instrumental programs and are hard to develop modeling and other multimedia systems on.

Despite the fact that a series of instrumental programs (such systems as "Urok", "Computer Stratum" etc.) were distributed in Russia in quantities totaling several thousand units, it almost ceased the development of domestic instrumental programs and those prepared by single authors and now such world popular author systems as Authorware Professional etc. are not used broadly. On the other hand, dozens of almost identical training programs covering small parts of the curriculum appeared on the market. Training in foreign languages (English primarily) for which quite inclusive courses containing different classes of educational means, may be pointed out among them.

The ordinary textbooks are still the major "instrument" of students. Any text is easier to read in a usual book than on the computer screen Electronic textbooks, on the other hand, is more comprehensive and effective in cases when it:

- ensures feedback;
- helps quickly find the necessary information that may be difficult to pinpoint in an ordinary textbook;
- considerably saves time in the event of frequent references to hypertext explanations;
- along with a concise text shows, talks, models etc. (This is where the possibilities and advantages of multimedia technologies are self-evident).

2.1.2. Prospects

The intensive development of training programs is carried on by enthusiasts and in the framework of programs on informatization of education, electronic textbook for higher schools, electronic textbook for secondary schools etc. So is the development of courses embracing the entire educational process during many years (for example the course entitled Information culture).

A large-scale certification of pedagogical programs originating in the Institute of Education Informatization (for secondary schools) has started. It is expected to expand it in the near future. The development of first multimedia training systems many of which will be applied in teaching humanitarian courses, is still underway.

2.1.3. Recommendations

It is necessary to continue the certification of pedagogical programs and publication of detailed information regarding the certified programs.

It is also vital to pursue experimenting in creation of training environments as cue of the most promising directions.

The major hurdle for developing pedagogical programs is the lack of purely pedagogical materials for implementation on computers rather than the lack of instrumental means. It is necessary to organize creative groups combined of teachers-practicing, teachers-methodologists, artists, writers, programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

The work of teachers must be assisted by the most user friendly computer (today this type of computer is represented by Macintosh). The objective is not the installation of computers in educational facilities, but their lucrative application for teaching purposes. It needs to be emphasized that teachers value not the processing speed of the processor or frequency of it etc., but the fact of computer being user friendly and the complex character of the offered solution. Teachers must not waist time choosing the computer configuration that suits his course the most.

2.2. MULTIMEDIA

2.2.1. Current condition

Due to the fact that in the previous years there was a lack of powerful computers for designing multimedia systems in Russia, such systems rarely fall under the consumer goods category. The major surge got underway in Russia in 1994-95. About 80 compact disks were created in Russian mostly containing cultural and historical data.

Multimedia technologies are linked with the process of creating and using multimedia products, i.e. electronic books, multimedia encyclopedias, computer films, databases etc. The primary characteristic of these products is a combination of textual, graphical, audio and video information and animation in the computer. The secondary one is the volume of information offered to users. The category of multimedia products may include the ones with the data volume totaling approximately several hundred megabytes. As opposed to ordinary programs, in this case information itself is a factor. It may be represented in several ways and most importantly, it is always structured - both the textual and the graphical ones. Thus, from the terminological perspective, it implies not only a multimedia environment but also a hypermedia one to draw a parallel with the hypertext technology.

Hypermedia products (despite that the term multimedia product is usually used) of this type may be used during classes, students may also process a large amount of materials represented in a form other than the textual one. All of it is possible in the interactive (dialogue) regime when not only do teachers (or students) passively watch and listen, but also participate in the process of selecting materials, making notes and preparing the proper summaries.

2.2.2. Prospects

The goal "Humanitarization of education via informatics" becomes quite achievable with the help of multimedia computers and such programs as computer encyclopedias, tourist guides, electronic books, reference software on literature, art, music. A good case in point here (as far as the Russian-language programs are concerned) would be the "Hermitage", "Russian Treasures", "Moscow Kremlin, directory", "Cathedrals of Moscow" etc. The process of informationalized education given the use of multimedia technologies depends above all on the human factor, that is to say on how the teachers will take the innovations suggested.

It takes simple instrumental (author) means for teachers to prepare something and use it during the class. Nothing better and easier than Macintosh hypercard has yet been invented. It was the hypercard that could bridge the gap between a computer and teachers in the United States. Certain difficulties might be encountered when using the hypercard in Russia, since there is a language used in it which is close to the original English, but Alas!, to English and not to Russian. This, in turn, calls for an adequate Russian-language equivalent of the author means.

The development of the first multimedia training systems is still underway, many of them will be applied in teaching humanitarian topics. Most of electronic textbooks and encyclopedias must be designed not by the teachers operating given local conditions but by qualified designers including specialists in humanitarian arts and natural sciences. Teachers may base their preparations to concrete classes on these materials.

2.2.3. Recommendations

It is time that we reject the complex of computers as the only model applicable in educational organizations which is even more dramatic since schools can rarely afford buying 10-15 latest computers at a time.

In this case, a new model of using one or several multimedia computers in schools might come in handy. One computer a school is an electronic board for teachers, telecommunication unit for connecting with the rest of the world, practice for groups of students, a desktop publishing device in schools, electronic library or art center in schools (center of culture and information). Naturally, it is impossible to use one computer for all of the above-mentioned purposes, but any educational facility may chose the one that is the most adequate for meeting their requirements whereas other model may be purchased in the form of acquiring additional computers. The most important aspect of it is that computers (a computer) installed is schools should immediately provide feedback and not be locked up in a classroom with no software installed. This scheme allows to use multimedia options of computers that meet the standards not lower than MPC-2.

The best computer for these purposes is Macintosh which according to 1994 estimates, is easy to handle for librarians and teachers specializing in particular topics. Macintosh is deemed as the world's best multimedia machine - it is reliable and simple. The extra price is compensated by the options it offers and low maintenance costs In the event that IBM PC compatible computers are chosen for this purpose, it is important that educational organizations are oriented at using multimedia computers that meet the standard not lower than MPC-2.

Libraries in schools must become multimedia centers contributing to informatization of schools and should serve as a source of information both in the printed and electronic forms for teachers and students. It is also possible to rename this facility into media library (mediateka), electronic gallery etc. The name is not as important as is the fact that libraries should become information centers that avail processing multimedia information, instill in students skills required for living and working in the modern information-oriented society. Such electronic libraries in schools should also offer modern multimedia encyclopedias, art galleries, tour guides describing sights of different countries and a set of additional materials on educational topics etc.

The major obstacle in the way of developing pedagogical programs is not the lack of instrumental means but 1) the lack of exclusively pedagogical materials to be implemented on computers; 2) the lack of specialists-"directors" - somewhat similar to movie directors, capable of combining the source pedagogical and education materials in one attractive multimedia product. It is important to organize creative task forces combined of teachers-practicing, teachers-methodologists, artists, writers, "directors", programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

2.3. OPTIONS FOR APPLYING NETWORK TECHNOLOGIES IN EDUCATION

No matter how complex the essence of telecommunication means is, what ideas are used in that field, only the following options are available for users:

- retrieve (read) information;
- transfer (send) information;
- place information;
- search (scan) information - an option that only recently became available disc to the rapid growth of INTERNET.

That is why the options of using network technologies in education are in the first place determined by the contents and methodological essence of telecommunication systems rather than their technical characteristics [17].

2.3.1. Electronic mail

Application of telecommunication in education was initiated in our country in the end of the 1980-scientific in the form of E-mail [18]. Primarily it became clear that E-mail may not be used as a base for individual or collective correspondence between students. All attempts of that sort gradually entailed the fact that all contacts were ceased. However, in the early stages of contact, within a limited period of time, this correspondence may be used as a way for students to meet each other. The principal result obtained during the initial years of using E-mail in schools is confined in the fact that success may be achieved only through specially organized and coordinated educational activities of students based upon E-mail.

The result of secondary importance may be considered the understanding of the fact that the program employing E-mail can fit the limits of system of classes with great difficulties.

The third result is confined in the fact that E-mail is an economizing means of education process informatization since it requires only one inexpensive computer per school. In a number of cases, when schools did not have any computer available the authors had to organize and support the course of educational activities via E-mail. In terms of operation, [19] E-mail may be naturally used in schools according to a collective project model.

2.3.2. Teleconference

In the Western countries, where the development of telecommunication is somewhat ahead of our achievements, on-line conferences became one of the major means of distance education [20], Teleconferences assist in organizing collective work of students, implement methods of business games and brain attack. All of it becomes possible due to the implementation of a virtual class based upon teleconferences. This technology is almost unknown in our country - only a handful of publications [21-24] took place as well as several attempts of the department for education informatization problems of the IIP RAS to implement an educational course employing teleconferences. Nonetheless, this technology has a vast potential with regard to education and hence, is presented in the survey in the form of a separate section.

Participants of teleconferences may be divided into groups for working on particular topics and their access to certain topics may be limited. In general, there are broad horizons for organizing the educational process. At this point it would be appropriate to mention that off-line teleconferences. The problem is that it takes a certain period of time (hours and even days) to send a sentence and place it via off-line conferences and to read it at the teleconference and obtain it on your computer. Thus, applying to off-line teleconferences you will every time retrieve only a part of the information contained there at the moment when you receive the information on your computer. That is why your sentence may be outdated, repeated, inappropriate in the event that the discussion unfolded in a new direction and so forth. Another weak point of off-line teleconferences is the impossibility to select new materials for reading.

Working at on-line conferences, each participant may scan the contents of the conference and determine what he wants to familiarize himself with, after which he obtains only the required information on his computer. Participants of off-line conferences never know in advance what new materials became available and subsequently they have to order all of them. The more intensive work is the worse off-line conferences are. In case of a slowly evolving conference with a small number of participants application of this conference may be deemed justified to the extend of considering justified slowly evolving education.

2.3.3. Database

Means of telecommunication make information stored in distant from users databases accessible to them. A fine example of distant databases is the information stored in INTERNET servers. One of the most interesting functions implemented in INTERNET is the option of browsing or surfing the information. Users search for information in INTERNET either for particular reasons or just for looking around and finding out what is available. INTERNET contains enormous amounts of information so it may take a very extensive period of time just to switch from one sector into another scanning the available information. The emergence of such means of conducting the search of information as GOPHER and WWW had a bomb effect.

2.3.4. Potential and prospects

According to facts set forth above, we may draw the conclusion that the major methods of working with network technologies are confined to firstly project activities and secondly - distance education. Distance education is implemented in this case either in the form of self-studies using the education materials stored in distant servers or on-line teleconferences. On-line education is obviously different from the traditional one which is based upon personal contacts. Some of the most significant differences are:

- people from geographically distant places can be "present" in classes without physical transportation to one place;
- it helps save time and transportations (which basically means financial benefits, although it requires initial and current costs to participate in on-line education);
- participation in conferences is possible within a certain period of time - it may be accessible either within a definite period of time (for example one month) or within an unlimited period (for years);
- interaction (responses to messages etc.) is not simultaneous and immediate;
- participants may contribute to the conference at any moment when they feel it appropriate i.e. they do not have to wait for their turn and cannot interrupt others;
- contribution to the conference may be maid 24 hours a day, seven days a week;
- participants of the conference may contribute to it from any geographic location which means that the participants who due to their occupation travel a lot may communicate from basically anywhere;
- interaction between the participants takes place (not necessarily though) in a more regular, slow manner;
- all contributions to the conference are automatically recorded and may later be used as a database;
- participants may also use other sources of information of the system not determined by the program they are participating in;
- social aspects of participation, process and results of teleconference usually differ from those in case of personal communication;
- the possibility of collective work in groups is increased - teleconferences may sustain collective education via such means that may not be achieved in case of meetings in person.

INTERNET offers unique education options. Although there are no general methods of using INTERNET in the educational process, they are likely to emerge in the near future. It allows us to draw the conclusion that it is necessary to take into account the possibility that systems worked out for the education system which are currently designed and projected may be plugged in INTERNET in the future.

3. TEACHERS

3.1. INFORMATION TECHNOLOGIES IN EDUCATION AND NEW POSSIBILITIES IN TEACHING METHODOLOGY

The education technology in Russia implies a means of implementing contents of education stipulated by educational programs and representing a system of forms, methods and means of education that ensure the achievement of the set didactic objectives.

The peculiarities of the new information technologies in education are the following specific environments in which they are implemented and components related to it:

- technical (type of the applied equipment);
- program and technological (software catering for the implemented education technology);
- organizational and methodological (instructions for students and teachers, organization of the education process);
- subject matter of knowledge.

Automated computer-supported training courses serving for one or several education purposes gained popularity. These courses include programs, methodological and educational materials (photo slides, printed, audio and video materials etc.) required for different types of educational work.

Various works in the sphere of didactic programming considerably developed as well. In pedagogical literature this term is sometimes referred to regarding the issues of selecting and structuring educational material as well as optimal organization of the education process. One of the major objectives of didactic programming is a combination of a target system regulating optimal education administration actions under the implementation of which the condition of knowledge and skills reaches proximity with the required standard.

Currently, there is a growing trend of developing and applying author integrated environments supporting different information components such as texts, dialogues, schemes, pictures and including analytical and imitative models of the studied objects and phenomenon, databases and bases offering expert knowledge, support systems for implementing particular professional actions such as scientific, engineering and technical calculations, automated projecting etc.

Modern information technologies grant students access to nontraditional sources of information, increase the efficiency of self-reliant work, offer totally new opportunities for applying creativity, acquiring and mastering different professional skills, allow to implement principally new forms and methods of education using means of conceptual and mathematical modeling of phenomenon and processes.

Educational modeling creates illustrative effect for the studied object thus increasing the interest of students to this form of education and studies of processes in their dynamics results in a more thorough processing of educational materials.

Since modeling itself becomes an educational objective with regard to a number of subjects, instrumental software is being developed in Russia that assists teachers and students design and modify training models in the interactive mode thus eliminating the necessity of programming.

Information technologies in education make it possible for teachers to use both particular types of educational work and entire sets of them for achieving didactic goals i.e. to project a training environment. Teacher-oriented instrumental means allow the user to quickly renew the contents of automatic training and controlling programs keeping up with the emergence of row knowledge and technologies.

Teachers are offered additional options for supporting and directing the character-building process of the trainees, creative thinking and organizing their cooperation, designing and selecting the best variants of education programs. Teachers become the major suppliers of the education subject goals taking into account the varying character and significance of educational courses (humanitarian, economic, natural science etc.) in a concrete educational facility. There is also a possibility to reject the routine types of teachers' activities intrinsic to the traditional education, offering them an intellectual form of labor. Information technologies release the teacher from the necessity of setting forth a considerable part of educational materials to students and routine operations related to polishing skills and abilities.

Due to the access to telecommunication networks, not only do teachers considerably increase their information stock, but also get a unique opportunity to communicate with their colleagues basically all over the world. This creates perfect conditions for professional communication, conducting joint educational, methodological and scientific work, exchanging educational projects, software, data etc.

For this purpose banks of data and knowledge are created that accumulate normative, reference, instructive, photographic and other types of information. Means for analyzing business and other information related to activities of educational facilities are also being created.

In the framework of the specified directions at the level of educational institutions, interlinked computer systems are being created that ensure automation of functions related to educational process management which above all will allow to reduce the pending expenses for organization of education process administration in educational institutions. This project implies the development of electronic means of access to library and reference information, rating calculation of each student and educational facility.

3.2. CONVEYANCE OF SKILLS AND KNOWLEDGE VIA INFORMATION TECHNOLOGIES

Conveyance of skills and knowledge may theoretically be divided into two pans - intellectual (creative) and technological. The intellectual part includes collection of knowledge, their systematization (structuring), generalization (separation of major knowledge aspects within a subject sphere), conveyance of knowledge in the form of "lively" communication of teachers and students (lectures, seminars consulting). The technological part includes testing, training in order to determine eligibility for studies, examination of the amount of knowledge mastered as well as self-control of the depth and knowledge of the mastered information. The border between the specified parts is quite hypothetical and possesses flexibility.

In the course of accumulating knowledge and perfecting the methodology of teaching an evolution shift of the border takes place with expansion of the technological border and simultaneous expansion the subject sphere outer border by means of including into it new knowledge (skills) or depth of their understanding.

The creative origin in the sphere of conveying knowledge and skills is the human prerogative. information technologies in this sphere ensure the information support of the process in the form of profession-oriented databases, means of data telecommunication, means of their visualization for perception as well as in the form of auxiliary means of systematization and generalization of knowledge.

The technological part is implemented via device and program means and directed to ensuring testing and training in all forms.

The concrete combination of means and techniques of both parts of the knowledge and skill conveyance process in all of the numerous subject spheres determines the paradigm of the national education system.

A considerable role is played by the technological component in sustaining the self-study process -compilation of training programs, schedules of classes, transparent topics for training specialists in peculiar subject spheres. The last direction may include models of training systems, models for evaluating the efficiency of funds invested in the education system and other components of modern information technologies.

Russia possesses a world famous higher education and professional training of average qualification specialists system. There are centers for computerization of the higher and secondary education supported by the state. The specified Centers offer methodological projects and test samples of program complexes in particular program spheres (in separate subject (curses). There is also an extensive list of training software for practicing and perfecting professional skills in technically complex professional spheres.

Prospects for development of information technologies in the sphere of knowledge and skill conveyance

The modern condition of information technologies in the sphere of education support may be characterized by the fragmentary structure of components. There are components that solve particular private issues of specialist training. The major direction of expanding the sphere of information technologies application in the field of knowledge and skill conveyance may be regarded the creation of complex system for education informatization.

Such system may include:

1) Creation of profession-oriented databases containing scientific, professional and educational information on industrial basis,

2) Setting standards in the sphere of presenting and transferring information related to the education support process;

3) Creation of a concept, principles and functional structures that ensure actualization of information used in the educational sphere;

4) Design of technological means for overcoming language barriers when distributing information for education purposes;

5) Creation of an industry manufacturing applied program packages serving for the major elements of conveying knowledge and skills (creation of quite versatile program nutshells for introducing automated elements into the education process).

6) Creation of sets for information and technological support of education m the most spread out subject spheres.

Russia's contribution to the development of information and technological components of the education process

Russia possesses personnel, knowledge and generated expertise in training highly qualified specialists. This expertise may be used when creating:

1) Databases containing scientific, professional and educational information in profession-oriented spheres where positive results were achieved;

2) Uniform program components and program systems catering for particular functions of the education process.

3) Standards of presenting and distributing profession-oriented information.

4) Methodologies for applying means of automation and information technologies in the sphere of conveying knowledge and skills.

5) Computer training programs for perfecting professional skills in technically complex professional spheres.

Expanding the sphere of more effective application of information technologies in the field of conveying knowledge and skills requires international coordination and joint efforts of different countries directed toward creation of information and technical means of education.

3.3. PRACTICING INFORMATION TECHNOLOGIES IN SCHOOLS AND PREREQUISITES FOR RESHAPING

The massive introduction of computers in secondary schools in Russia that lasted for more than ten years did not live up to the expected informatization of the education process. Reasons for that are quite obvious now. The major method for organizing work places of students was regarded the computer lab. The major topic implying the use of computers has become the course of informatics and computer basics. Thus, it appeared that computers were used mostly for the purpose of studying them. Informatics teacher combined their ordinary responsibilities with the material ones for the computer lab. Computerization of the education process was restricted to the computer lab in the framework of a single course.

Starting in 1985 deliveries of computer sets for equipping laboratories were centralized. Each school of this type endured the necessity to hire a teacher of informatics. Since the large-scale training of teachers had lagged way behind, the most natural and probable way out was requalification of programming engineers into teachers of informatics. The major educational activities during informatics classes became studying one of the programming languages - Basic as a rule. This situation still persists in many schools despite thê emergence of a large number of programs designed for studying particular topics in the framework of other courses as well as such programs especially designed for versatile application of computers as instruments as text and graphics processors, desktop publishers, electronic tables and databases. Event the transition from the eight-bit mode computers to the sixteen-bit mode ones had a slight impact upon the commitment to Basic.

Thus a typical situation would be the one when the only person is an average school who was capable of using computers and knew their target purpose was the informatics teacher. Since all computers were concentrated in the lab they were used only during informatics classes. In this event, the class was divided into two groups because the number of computers was limited to 10-15 units. If a school acquired computer programs for studying other courses, these rare classes were held in the computer lab with the informatics teacher obligatorily participating in them since he was the only teacher capable of starting these programs and the one who assumed the material responsibility for computers.

Educational programs and curriculums were centralizedly approved and set as standards throughout the country. No initiative was allowed. Now we can witness more favorable conditions for practical implementation of new organization models for using computers in schools. These models include the following:

1) Independence of schools. Each school may decide as to what educational programs teachers will use. Some schools even jumped at the class-lesson system and declare a transition to new means of educational process organization.

2) Readiness of teachers. Presence of computers in schools could not pass unnoticed. More

and more teachers feel the necessity of applying information technologies in studies of their courses. Meeting these needs, a course of mastering and implementing a project method for teachers was developed in the Institute for Informatics Problems RAS.

3) Change of teachers' role. The process of gradually transferring knowledge from people's heads into magazines and books and then into computers which is underpay all over the world involved schools as well. Now teachers become more and more aware that they no longer represent a source of knowledge for students. Teachers' role of a source of information is substituted by the role confined to methodical organization of the process implying self-reliant acquisition of knowledge by students from various sources.

4) The economic situation. The economic situation played an important role in arising the necessity to overhaul the organizational form of using computers implemented in schools. The project collective model requires considerably lower costs for computerizing the education process. The same approach may be applied to the model of individual activities.

5) Civilized methods. Several years ago school were supplied computers according to directives of the party and the government. Now schools acquisition of computers is based upon sponsor investments. The further step toward civilization would be to apply for sponsorship not only for providing the given school with computers but also for implementing certain education projects that will bring in particular results. The transition to financing projects is getting closer. This is the way science is financed. The transition to the collective project method of organizing the use of information technologies may create advantages for schools in getting the proper financing.

4. STUDENTS

4.1. MODELS FOR APPLICATION OF INFORMATION TECHNOLOGIES IN SCHOOLS

It can hardly be expected that in the near future schools will be able to equip every working place of students with computers. It is also unlikely because neither the teachers nor designers of educational programs can offer students a constant substantial work on computers at least in certain courses except for informatics basics. It seems that the class-lesson model of using computers reached the limit of its possibilities. Hence, the task of informatization of the education process must be solved through other ways.

As one of these ways it is possible to propose to start implementing other organizational models for interaction of students with the information technologies. Let us view what options it presents. In order to do that we will have to list the mechanisms of educational interaction between students and computers and evaluate the possibility of their implementation in the framework of certain organizational models. We can map out the following models of using information technologies applicably to computers:

1) Model of studies. This model is designed for studying and mastering computer user interface and programs. An instrument or a working tool is being mastered. The model is characterized by the immediate communication with computers for a consequent implementation of actions and test for the correct reaction of software. This model plays an auxiliary role as a preparation stage providing a possibility of implementing other models for applying computers. In the overwhelming majority of cases this model is used in schools.

2) Model of existence. Programs featuring certain artificial environments via modeling (simulation) or creation of virtual reality have gained more and more significance lately. Multimedia means are used as well. Under these circumstances, the user of such a program - a student in this case - views this artificial environment as reality in which he exists within a certain period of time. The purpose of such programs may vary. Most frequently this model is used in computer games and training programs. Another fine example would be INTERNET. Some of its features make it possible to implement a collective model of existence in artificial environments. The model of existence has a paramount importance because it provides the greatest impact upon the user. This model is implemented in the conditions of direct communication of the user and the computer. The education application aspect may be represented by such "construction" games implementing macroeconomic and social models as SimCity, MotorCity, Civilization and others.

3) Model of managing one's own information. This model is implemented when as a result of work with a computer, the user accumulates certain materials that require particular attention in terms of storage, renewal organization etc. This self-reliant work requires personal memory resources. The simplest version of the model of information management is implemented when students create their own subcatalogues featuring results of their activities such as texts, charts, tables etc.

4) Model of managing technological process. This model features application of computers as an intellectual interface between the controlled process and the operator. As far as the education process is concerned, this model may be used in case of computerized control of physical and chemical tests. There are projects on managing such physical characteristics in the classroom as temperature, humidity, light etc. They may form part of the education process when dealing with such courses as physics, geography and nature studies.

5) Model of creativity. In the event that computer is mastered as an instrument, students may face a situation that requires a certain portion of creativity. Computers make it considerably easier to write essays, enables students to format the created texts providing them with polygraphic quality. Creation of computer pictures and programming may also be regarded as creativity. The process of creativity requires a special creative atmosphere which can hardly be achieved during the classes and especially in the situation when all students must do the same work.

6) Model of communication. Modern computer

networks feature the function of transferring messages among the users. These possibilities are so immense that they turned into an important element of human culture during the last years, which may not be implemented via other mechanisms of transferring messages across a distance (mail, telephone, telegraph, fax). Computer networks just like ordinary every day communication may feature educational projects containing along with the materials for educational purposes element- of motivation for students. These means also allow to execute distance education implementing the parable of a virtual classroom.

7) Model of browsing (surfing). Those students that are computer wizards usually familiarize themselves with a new computer not starting with solving the task in hand, but with finding the contents of the computer memory. They scan catalogues, starts the programs he is interested in and scans files that may be of interest for him. This scanning or browsing is a rudimentary example of the behavior that may fully be realized in INTERNET. An analogue of these activities may be represented by scanning books with a free access in the library. This model is implemented both for satisfying one's curiosity and as a method of browsing information. In this case it does not matter whether the person engaging in scanning knows what he looks for. Currently, no experience of practical application of browsing model has yet been generated. However, there is so great an interest shown toward such a possibility that we may soon expect publications of methodological materials on its application.

8) Model of retrieving information. This model may be outlined as an independent mechanism for computer interaction because in the event of a straightforward search of information other programs are employed than the ones used for implementation of the browsing model. This model may be executed in case of educational use of electronic encyclopedias and tour guides on CD-ROMs, for example, when preparing summaries or reports.

9) Model of intermediary interaction. Among many education projects there are ones that do not require direct communication between the computer and all participants of the project, although, the information retrieved from the computer considerably determines studies related activities [1]. A fine example illustrating that model may be the description of a project entitled "Holidays" that got underway in 1992-93 in the framework of an E-mail pilot project for schools in Great Britain and the CIS. Students of schools exchanged descriptions of national holidays and then picked one of the holidays celebrated in the other country for doing so in their school. After settling on a particular holiday, a detailed study of the chosen holiday took place in the school including the behavioral scenario, clothes and national cuisine. The closing event was the celebration of the chosen holiday with the further exchange of videocassettes containing a recording of it. The direct work on the computer was accomplished by a small group of students and in some schools this role was played by the teacher alone. However, the intermediary interaction of practically the entire school with their counterparts lead to a significant for the schools event. The project materials increased motivation during geography, literature, history world culture classes, because it inspired studies of both British cultural traditions and those of their own country.

All of the described models may appear useful when implementing educational activities of students employing computers. However, the modes of organizing students should conform to the applied models. Let us view organizational models of interaction between students and information technologies.

1) Class-lesson model This model is characterized by the fact that all of the working places are equipped with computers as well as that of teachers'. It is also assumed that all computers are plugged into a local network and supported by a server. The interaction with computers during the classes is organized so that all students engage in similar or same actions. The teacher's task is simplified. He presents problems, shows how to solve them and controls the process. It is fairly easy to control same tasks just like it is to comparatively evaluate the results. This organizational model provides the best implementation for the model of studies which is auxiliary with regard to the rest of them. The model of browsing would probably also fit the profile of such a computer class in the event that no concrete goals are set before the students and the process assumes the form of mastering the browsing procedure. All other models require individual actions of students thus not fitting the class-lesson system.

2) Collective project model. This model is based upon a project method well known in pedagogic. One of the major controversies of modern schools is that goals of pedagogues are different from those pursued by students. Low rating of pedagogues' goals among students does not increase their motivation and leads to a general decrease of interest taken in the studies and hence to a decrease in the level academic achievements. One of the effective methods increasing the motivation of students is creation of goals important for them and which can be achieved by obtaining particular knowledge. In this case achieving the pedagogical goals becomes a means of achieving the goals that were artificially presented to students. It appears probable enough that this famous pedagogical situation may find a second chance due to the emerging possibility of using computer based information technologies is schools. Perfecting the project method teacher concentrates on pedagogical issues and on planning changes in the educational process of character building. Employment of information technologies plays an auxiliary role in ensuring the planned changes. Since project activities implies different roles of participants, the use of computers becomes momentary and takes place to the extend of being necessary according to the distribution of roles among participants. If there are several, from six to eight project groups in the classroom one or two computers may be enough for supporting the entire work. In this case every group may use the computer differently than others. Naturally, teacher's task in such a class becomes more complex. However, because of the intensive motivation of students one may be assured that everyone is occupied with a task. Subsequently, it becomes harder to evaluate the academic achievements of every student. In order to avoid this complication, the evaluation procedures should be planned when working on the project. Apparently, depending on the contents

of projects any of the models employing information technologies may be implemented, with the possible exception being the model of studies. The collective project model may be employed when using a single computer in a school. Some of the projects may not require a computer in the classroom at all. In this case it is the education process that undergoes informatization but not the operation of studying the computer itself. Practical application of the collective project model requires that teachers possess new knowledge and follow the special procedure.

3) Model of individual activities. This model finds its best application when using a computer at home, however it may be replaced by an analogue represented as single computers located in a school library, for example. This organizational model allows to apply any of the models employing information technologies including the model of studies. In order to employ it, both time during the class and off the class may be used. In the event that students have a computer at home, the accent may be replaced on the homework.

The major conclusion that may be drawn from this material suggests that the class-lesson model of interaction between students and information technologies is depleted. It should be replaced by the collective project model and the individual model The main advantages of the offered models are represented in the fact that they allow to subject the education process to informatization, achieve this goal with lower costs and suit the modern school better.

5. SOCIAL, ECONOMIC AND CULTURAL ASPECTS

5.1. TECHNOLOGICAL INNOVATION IN THE SOCIAL SPACE AND INFORMATION TECHNOLOGIES

One of the major principles of the modern society development is the great degree of technological innovation in the social space [25]. The technological development level of the society determines today its capability to produce high quality competitive goods, makes the country economically powerful and socially stable, determines living standards of the overwhelming majority of our planet's population. This is exactly why a brand new type of the world market has been forming lately - a market of promising technologies where the information technologies play more and more considerable role. In other words, information technologies become such an important product of social activities as manufactured goods, products and services. A characteristic example of it would be Japan - the first country to give informatics and information technologies a priority status in their national policy of social and economic development.

The strategic role of information technologies as a factor of social and economic development in the modern society may be deemed generally acknowledged today with no room for doubts. It is determined by the following major peculiarities of information technologies that stipulate the necessity to give them the priority status both in national scientific and technical policy and the sphere of education [2].

1) Information technologies make it possible to activate and efficiently utilize national and the world information resources of the society that today represent such an important factor for the development of the civilization as mineral resources, raw materials, energy and human resources.

2) Information technologies allow to optimize (and in many cases - to automate) information processes that have occupied larger niches during the recent years in different social activities spheres It is a common knowledge that the development of the civilization assumes the direction toward informatization-oriented society in which objects and results of the work accomplished by the majority of population are not tangible values but mostly information and scientific knowledge. Already now in the developed countries a large part of working population (more than 60% in the United States) are closely linked in their activities with the processes of preparing, storing, processing and transferring different types of information and therefore, it has to develop and practically apply the proper information technologies. Thus, the rapid development of the information sphere in the society had a considerable impact upon the structure of population's occupation and requires the proper orientation of the education system. For example, the development of personal informatics means and the telecommunication system provide new options for providing jobs for handicapped at home, pensioners capable of working and women raising small children. And these are quite vital and important social problems for many countries in the world.

3) Information technologies are often important components of other types of technologies both industrial and social. In this case they implement the most vital "intellectual" functions of these technologies. Characteristic examples may be systems of automated projecting of manufactured products, flexible automated and robotized types of production, automated systems of technological process control, modeling complexes for conducting tests of complex technical systems etc.

4) Information technologies play an extremely important role today in providing information interaction between people as well as in the systems of preparing and distributing mass information. Today, in addition to the customary means of information communication (such as telephone, telegraph, radio and television) systems of electronic communications gain more popularity in different spheres of social activities. These systems may be represented by E-mail, facsimile communication of information and other types of telecommunications. These means are rapidly assimilating in the culture of our society since not only do the) create certain conveniences and save social time but also facilitate solution of many industrial, social and routine problems entailed by the globalization and integration process the world community is undergoing, expansion of national and international cultural and economic ties, migration of population and more dynamic transportation across the planet. The level of development and distribution of modern information technologies determines the extend to winch a country enters the world community space. This is one of the critical conditions for developing not only the economy but also for efficiently developing its science, culture and

education.

5) Information technologies are pivotal in the process of intellectualization of the society and development of educational and cultural systems. Practically in all of the developed countries and in many developing ones computers and television equipment, education programs on optical disks of CD-ROM types and multimedia technologies become customary attributes of not only higher education institutions but also ordinary schools that form the system of secondary and elementary education. The application of information technologies became also an efficient method for education systems, continual education as well as for qualification advancing systems and retraining of personnel. Thus, the issue of developing and distributing progressive information technologies in the society is most closely related to the problem of qualitative development of human resources and intellectualization of the society.

6) Another promising direction in the process of safe and stable development of the civilization is the development based upon knowledge. It implies that both global and regional knowledge should be rationally developed and actively knowledge that reflects the historical experience and peculiarities of development in particular countries and regions of the world [26].

In this regard it is appropriate to emphasize especially the key role if the information technologies in the processes of generating, distributing and effectively using new knowledge. Today, the traditional methods of supporting scientific research confined to basically computerization of mathematical calculations, employing methods of statistic modeling and in distributing scientific and technical information within telecommunication networks does not satisfy scientists anymore. These methods are replaced with the new ones based upon application of rapidly progressing options for means of informatics and promising information technologies.

It should be primarily noted that such methods as teleconferences, assigned scientific task forces as well as methods of complex information modeling of complicated natural processes and phenomenon that allow scientists conduct a sort of a "calculation experiment". In this event, the characteristics of the researched processes may be selected the ones that often may not be implemented given the conditions of natural modeling due to its great complexity, high cost or danger post to those conducting the experiment. This direction created and actively developed by academician A. Samarsky from RAS was widely acknowledged by both Russian and foreign scientists [27].

The second prospective direction is formed by methods of artificial intellect that assist in finding solutions to ill-formalized problems as well as problems with incomplete information and blurred initial data. In this case the logical sequence of the automatic search for the type of problems specified above reaches in its character that of metaprocedures used by the human brain [28].

The next promising direction is represented by methods of multi-dimension cognitive computer graphics that make it possible to present various mathematical formulas and principles in spacious form. With the help of them Russian scientists managed to observe several new principles even in such an abstract field as the theory of figures.

It is necessary to underline that fostering research in the field of theoretical informatics and philosophic perception with which the Russian scientists deem the role of information in the evolution process help form a new picture of the world around us, which appears considerably more informative than it was thought before [29].

5.2. INFORMATICS AND CULTURAL ISSUES

Development of means of informatics and information technologies make it possible to find new solutions to a number of pressing problems of modern culture. One of them is the problem of how to save cultural legacy of different peoples, represented by ancient books, manuscripts, pictures, photos, sound recordings, films, videos, etc. Another problem is how to provide a wide access to this data to all interested users, with no threat to their good condition in future. Both these problems can be effectively solved by creating electronic encyclopedia, reference books and data base of the works of culture, where their electronic copies are kept in high-fidelity computers and can be easily accessible to many distant net users. Necessary distribution, as well as local use of this data, for instance, for research work, studies, culture education activities, etc., are also possible.

Invention and application of digital copies of the works of culture, as well as recent development of integral multimedia technologies have become the main instruments of the fast-developing art trend - screen art. Dozens of thousands of CD-ROMs, which have already become an industry trend, popularize world's cultural masterpieces, which have been accessible only when in museum, palaces, picture galleries, art exhibitions or private collections.

Multimedia technologies let not only link the picturesque and detailed images of the works of architecture, sculpture and fine art item by item, but supplement them with diverse reference and scientific data, as well as music, movies, video, animation, etc., if needed. All this strongly influences the audience emotionally, develops its sense and interest in art and, simultaneously, lets it obtain the necessary knowledge in culture, art, human history.

Opportunities of this trend of informatics means and information technologies development are so promising that Russian culturologists have good reasons to say that a new cultural trend, i.e. screen culture [30], is being born. Most important is to ensure that this trend is fully applied in the area of humanitarian education.

It is worth mentioning that there is one more type of promising information technologies. Its appearance will provide absolutely new opportunities for the realization of human creative talents. This is the so-called creative technologies which are intended to exercise information support for human art processes with the help of computers, TV and other information equipment.

Application of these technologies is especially effective when the art process implies combinatorial tasks, searching for necessary combination of space, color and other elements of the work. This is rather typical for architects, designers, modelers, arrangers, animators, sound engineers and some other art professions.

Creative technologies are new. Therefore their opportunities are not widely known yet. Though they will have a good future. If digital TV and sound-recording studios already exist, the specialized computer centers for the data support of other types of creative activity are the matter of the near future of information.

That is why one of the tasks of the modern education system is to properly update both teachers and students on the main opportunities, problems and peculiarities of this fast-nearing future, which gives us no time to get ready for it.

5.3. INFORMATICS AND OF NATIONAL SECURITY ISSUES

Informatics and information technologies are the necessary and rather effective means of ensuring national security, many of which are of a mostly information character [31].

Paying no particular attention to the well-known problems of military security, which is impossible without strong computer base, we will consider three basic problems, which people meet at the door of XXI century and which pose a serious threat to their future existence.

The first among these problems is the problem of environment and its greatest part - human environment. Ensuring of chemical safety of a person under modern conditions of the himself-made artificial world is becoming one of the most pressing and urgent problems of national security. The ways to find a solution to this problem are closely connected to the use of modern information technologies.

As a result of the rapid growth of chemical industry and insufficient toxicological control over production of many artificial substances and materials, dangerous to health and sometimes life, our society is now living in an undeclared chemical warfare, having no idea about this fact.

Man is surrounded by toxic substances: paints, lacquers, plant and anti-insect strays, furniture varnishes of different kinds, building structures, etc. There are thousands of them already and they keep increasing in number [32].

The problem is even more dramatic due to the fact that different toxic substances influence human body in different ways, not only according to the type and the quantity of the substance, but to the individual peculiarities of the organism as well.

Thus, today diagnosis and treatment of acute chemical intoxication are not purely medical but mostly information tasks, which solution demands the use of such means as automatic toxicological data base, expert systems for doctors-toxicologists, telecommunication networks, etc.

Another serious problem of national security, demanding the use of the latest inventions in the area of informatics, - is the fight against crime, especially Mafia. The problem of co-interacting the crime in its traditional forms, as well as in form of new types of crime against individuals and society (environmental and computer crimes) can be effectively solved only on the basis of creation and wide application of latest means of informatics and information technologies in the activities of internal affairs bodies. Personal identification, ballistic tests on weapons, tests on document and money bills authenticity, operative connections and transmission of criminal data - these are just some of the problems, which security services and police institutions have to face nowadays. Besides, the problems increase in number every day.

One more new and, probably, not enough realized problem is the necessity to ensure information security of man and society. This is a complex problem, involving such components as ensuring sufficiency, accessibility and authenticity of the data, used in society, prevention against personal information control and other no less important and complex social problems. They all need careful study in terms of information approach, as well as development and introduction of appropriate information technologies in social practice.

5.4. PROSPECTS FOR THE DEVELOPMENT OF INFORMATICS AS A SCIENCE

One of the most important conclusions of modern science is the conclusion that information and scientific knowledge are the main factors, representing not only general potential of the society, but the prospective of its further growth. In this situation it is extremely important to introduce into education system new principles of information study which is to be considered as a fundamental natural science discipline, which will study features and laws of data motion and transformation within nature and society.

Today, on the threshold of information civilization, it is inadmissible to treat informatics as a purely technical science on methods of data computer processing. This approach does not already conform to the fast-growing subjective sphere of modern informatics and its part in the process of further social development.

The above examples of the use of information technologies in the different areas of social activities and the important part of society in solution of urgent social, economic and cultural problems witness the necessity of substantial reconstruction of traditional informatics study courses under the motto, set forth by academician A. Ershov: "From computer literacy to information culture of society", which is to become an inseparable part of its culture.

This would comply with the one of the main principles of Russian modern educational policy - to ensure the leading position of educational system as opposed to other means of social, economic and cultural development of our society [32]. Top priority, given to education, is a contribution to the future of Russia.

6. TRANSPARENT TOPICS

6.1. DISTANCE EDUCATION IN RUSSIA: OBJECTIVES AND PROSPECTS

In the last two years the term "distance (or distant) education" became quite trendy. It is mentioned at every conference dealing in the least with the issues of using information technologies in education. Each author with a fair amount of self-respect writing about the application of information technologies in education can hardly keep silent when it comes to this topic. The reason for this is quite obvious - for our huge country with the intrinsic to it pour infrastructure system and significant concentration of scientific and educational centers, the possibility of obtaining education without suspending the major activities is extremely critical. It is apparent that the existing system of extra-mural education due to a number of circumstances fails to meet the pending requirements.

The meaning of the term "distance education" is confined in the realization of the possibility to obtain education without suspending the major activities and without physical transportation to the location of the educational institution The fact that this term is broadly used reflects understanding that there is a growing necessity of emergence of such an opportunity rather than possession of techniques and methods for its implementation.

It would appropriate to say several words about the system of extra-mural education that formed in our country. It feels like the more extra-mural education resembles the standard one the better it is. The entire information interaction between teachers and students is carried out during an extensive session. Outside the limits of the session practically no programs exist. In this form, the extra-mural education will always lag behind the standard one which causes quite a negligent attitude toward it.

On the other hand, extra-mural education has a paramount importance for such a huge country like Russia and its perfecting based upon new technological options may appear quite promising. That is why, apparently there was an explosion of interest toward Distance Education. In this case everyone deems the distance education as he pleases. This includes television education, extramural programmed education, videoconference education and self-education using the means of information technologies. It is worth mentioning that the system of extra-mural education is much more rich in options than in our country which may be explained by the absence of the strict centralization which we all witnessed and participated in. That is why a certain confusion took place. If any specialist is lucky enough to familiarize himself with an existing system of extramural education that is considerably different from the one in our country, under the slogan Distance education, then with a certain degree of probability one could assume that he will take it for the distance education everyone is talking about. Especially if the system employs such technical means as computers, television or satellites. Let us try, though, to outline the most important aspect that entitled this term to exist. We propose that the distance education shall be considered the forms and methods of education that offer a possibility to exclude any direct personal contact of teachers and students regardless of the nature of the applied technical and other means. In this event, it is not the issue to obligatorily dispense with any possibility of personal contact. In each concrete cases only the methods that suit the education purposes the best should be applied. Thus, if as a result of education an issuance of a certain certificate or a diploma is implied of certain importance then undoubtedly the final stage which is graduation exams and thesis hearings shall be accomplished in personal contact. The education related to working with special equipment is also conducted at the location of this equipment. However, the preparation and theoretical stages may be implemented distantly.

Thus, the successful implementation of distance education requires the following:

- supply of the educational materials to students,
- presence of interaction with the teacher,
- ensuring collective distance work where needed.

In this context it is necessary to bear in mind that students are physically left to themselves. That is why the educational materials, tasks and the consequence of their studies and fulfilment shall be worked out more in detail than it is usually done in case of a standard education.

In essence, the real distance education takes place if there is a distant feedback. The regular mail plays the primary role in this case (historically). One can easily imagine a written exchange of information between teachers and students. Of course we are not trying to point out that each teacher has to respond to every student's letter. Terms for accomplishing particular tasks, form of material presentation, form of consulting organization (everyone knows his questions but each gets a complete set of answers) mechanisms of evaluating the submitted results shall be determined. In certain cases telephone and facsimile communications may be used. However, it should be admitted that the most prospective and convenient for distance communication is the telecommunication in the form of E-mail or teleconferences

In the events when organization of a collective work of students is required, teleconferences would be the only acceptable solution Videoconferences solve such problems as well however, currently they can hardly be widely used. Distance education based on computer (telecommunication) networks and videoconferences feature the parable of a virtual class, the possible variations of which depend on the age of students and level of education. All of them to a significant degree depend on the role assumed by the teacher or a group of teachers like in a normal class situation. I cases when the teacher educates and evaluates the contribution of students there may be different styles of interaction in the group with each member of it who possesses knowledge and skills sharing it with the others. Teacher in this context acts as an assistant.

Thus, the application of distance education methods allows to obtain (provide) a complete education at the location of residence or work without suspending major activities. Depending on the advanced character of the communication means and the proper scope of financial resources available, particular technical means may be preferred It is worth mentioning at this point that everything concerning the possibility of obtaining distance education specified above applies to teachers as well. He may also teach without suspending his major activities and do that from his home or office regardless of the location of the educational institution that provides the training. This fact is rarely paid attention although implementation of these options may be as important for teachers as it is for students.

Such options offered by the distance education as:

- collective (group) work;
- employment of distant educational materials;

operative (in the course of education process) exchange of information between all the links

are fully demonstrated when using telecommunication. That is why they may be considered the main and systematizing feature of distance education [33-39].

We can map out at least four ways of applying distance education methods:

- for complete substitution of personal contacts;
- as an addition to personal contacts,
- as information-oriented approach toward the education process,
- when using a fully integrated method.

Full substitution

Methods of distance education are used for replacing the traditional methods of education that require personal presence or ensuring these contacts via electronic means across a distance with regard to geographically isolated regions or offering them a constant (permanent) alternative for extramural courses. A good example may be represented by the application of teleconferences for implementing distance on-line courses in the New school of social research in Manhattan. The school offers complete courses based on that technology. The traditional college atmosphere is represented at these courses the following way: traditional classes are formed as separate teleconferences, there are conferences for an electronic campus cafe for students and teachers, recreation room for students, electronic library and board of announcements. This program serves for students from any state of the US, Tokyo, Singapore or Great Britain just like it does for those from the closest to this are of New York.

Addition

The technology of distance education is also applicable as an addition to the traditional education based on personal presence. Electronic seminars may introduce a useful and motivating aspect both in standard and extra-mural education. Materials covered during the lectures may be supplemented and commented on during the teleconference. Students may ask teachers questions, require additional information for ensuring success of the entire class. Personal contacts may be continued during the simultaneous teleconferences for carrying on discussions on the raised issues or topics that were not possible to discuss during the personal meeting.

Information-oriented approach

Distance education methods are used for ensuring an education based upon information resources. In thus event different types of delivering and using information may be used. An example of such approach is the course in the Open University on information technologies. In addition to the traditional materials used in education (texts, audiocassettes, television, lectures, additional materials, course programs etc.) students are also granted access to teleconferences for such activities as exchanging information of the course, renewal of information, consulting and collective self-reliant preparation. Thus, teleconferences are one of the several alternative ways of providing education within a course. In this context, the variety of available education means meets the various needs of students.

Completely integrated method

In case of the integrated approach each means of education offers the advantages that it may add to the education. Lab works are carried out according to the traditional way. The types of work that do not require personal presence are accomplished via distance education methods which become an important and organic part of the course but not some overtime addition.

As a rule, authors writing about distance education accentuate that it is vital for Russia. This really is vital factoring in the vast size of the country, inefficiency of transportation means and "concentration" of scientific and educational centers. On the other hand, the expel Use generated in the world flowing into our country related to organization of distance education systems may be considered adequate for its practical application. Nonetheless, the actually operating models of distance education may be counted by fingers with none of them being completely Russian. Organizations specializing in distance education mainly provide Western education in Russia. The Russian national education is neither "exported" to other countries nor does it work in Russia.

The Institute for Informatics Problems of the RAS, possessing the technology of distance education and persistently offering it to organizations visibly concerned, faced unexpected and interesting circumstances. Educational institutions, as a rule, are not prepared for introducing distance education. This applies both to higher education institutions and commercial education departments of large companies. As far as we can judge, the reasons for such an altitude toward distance education are:

1. Serious obstacles in obtaining state financing supporting this type of education. Western grants support the introduction of Western courses in our country. That is why Western course are offered in Russia but not vise versa. Educational organizations as a rule, face the choice whether to seek a grant or to pay themselves Usually grants are the choice that is favored

2. Absence of technical possibilities both at the education facility and students of distant courses. This controversy is encountered when trying to introduce distance education in higher education institutions and branch systems of advancing the qualification of personnel. The technical side of this issue still remains an expensive effort. Since it actually deals with the application of computer networks, the organization minimally has to purchase computer and a modem for the teacher, become a client of a telecommunication system and make sure that students possess the proper equipment as well. In a number of cases it appears to be an irresolvable problem.

3. Teachers possess an experience of working with standard education and it is uncustomary and undesirable for them to switch to the new teaching methods.

All what was mentioned above, seems sufficient enough to understand that distance education may successfully integrate into the existing educational systems such as extra-mural and standard education, open education, education at home or without suspending major activities. However, today we can mostly speak about the distance education in subjunctive mood or in the future tense. Creation and introduction of a federal program in Russia entitled "Development of the uniform system of distance education in Russia" has to upgrade distance education to the category of practical activities.

7. ABOUT PROSPECTIVE STRUCTURE OF EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

The general prospective structure of the educational course "Fundamentals of informatics" is offered for the system of secondary and higher education in Russia. This structure is built upon a problematic module principle and therefor is quite flexible. It is designed that the contents of this course should contribute to practically ensuring the leading role of education in the process of intellectual development of the Russian society. For this purpose, a section of the course entitled "Theoretical informatics" was expanded and a new section called "Social informatics" was introduced, in which social aspects of the society informatization process are reviewed.

7.1. MODERN CONCEPT OF THE SUBJECT SPHERE STRUCTURE OF INFORMATICS

In Russia's National report entitled "Policy in the sphere of education and new information technologies" which will be presented in July, 1996 at the Second International congress "Education and informatics", shows a structure scheme illustrating the modern concept of the subject sphere structure of informatics (Table 1). This scheme according to authors of the report, shall lay the foundation of the modern course c "Fundamentals of informatics" that is to replace the traditional course in the Russian education system called "Basics of informatics and computers".

The offered course is undoubtedly an advancing step as opposed to the traditional one. The very title of this course "Fundamentals of informatics" already orients pedagogues and students at studying informatics as a fundamental scientific discipline and not solely as a course aimed at obtaining elementary computer literacy. It seems that this is a very critical structural shift in orienting the Russian education system applicably to this subject sphere.

The course contains three major sections which are "Theoretical informatics", "Means of informatization and "Information technologies". The section "Theoretical informatics" includes only studies of mathematical and information models and algorithms as well as methods of designing and projecting information systems and technologies. Naturally, this dot's not make up for the entire number of problems intrinsic to this vital section of the course which shall contribute to formulating a modern world perception among students. It seems to be the **first serious remark** on the contents of the proposed course.

Another serious remark is that the content **of the course practically completely fails to cover the issues of information support** of informatization means which of course is unacceptable

The problem of structuring in section "Information technologies" does not seem quite appropriate either, for there is no distinct boundary between the versatile (base) and problem-oriented technologies.

And finally, the course does not deal with the issues related to the studies of social and economic aspects of society informatization at all, which are exclusively vital and are more and more brought up to the surface by the very development of the modern society. That is why such important notions as "information resources", "information infrastructure" and "information environment of the society as well as its "information potential" and "information safety" will remain ill-understood by the students that will successfully master the offered basic course of informatics. All of it takes place in the conditions when the global process of society informatization is increasingly affecting its social and economic structures and the role and position of people in the society.

It seems necessary that this weak point of the offered course is corrected as soon as possible.

7.2. PROSPECTIVE STRUCTURE OF THE SUBJECT SPHERE IN EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Paragraph 7.3 describes the general prospective structure of the subject sphere in educational course "Fundamentals of informatics" in which all the remarks concerning its contents are factored in as it seems.

The course contains three major sections which are "Theoretical informatics", "Technical informatics" and "Social informatics" each of which contains several problem modules representing components of the educational program.

The section entitled "Theoretical informatics" contains six such modules: "Philosophic fundamentals of informatics", "Basics of general information theory", "Basics of computer semantics", "Fundamentals of information modeling", "Information intellectual systems" and "Information and knowledge".

The listed titles of problem modules as well as the essence of issues described in them proves that this section primarily aims at forming a modern scientific world perception among students in which information is regarded as a fundamental semantic feature of nature and the information processes - as critical intellectual components of the functioning processes of any technical, social and natural systems including processes of perceiving the world by humans.

Apart from this philosophic task, this section contains issues related to studies of the modern scientific methodology in informatics and primarily theoretical basics of information modeling. It stipulates studies of statistic methods, methods of conducting "computing experiments" (according to A. A. Samarsky) as well as methods of solving ill-formalized problems and problems with incomplete or blurred initial data.

The second section of the course - "Technical informatics combines four problem modules: "Technical means of informatization", "Program means of informatization", "Information support of informatization" and "information technologies"

Contents of this section covers basically all problems that are proposed for including into the basic course of informatics in Russia's National report (Table 1). In addition, it specific, an important problem module entitled "Information support of informatization", and the problem module called "Information technologies" sets forth their more distinct division into versatile and problem-oriented.

The third section of the course called "Social informatics" contains four problem modules which are: "Information resources", "Information potential of society", "Information society" and "Man in information society". Their titles and the contents of the issues described in them proves that the major objective of this course is to render the students a broad perception of the information-oriented character of the modern society development process as well as arising from it of problems and methods of solving them based upon the information approach and prospective information technologies.

Studying this section is extremely important for universities and humanitarian higher education institutions as well as in the system of advancing qualification of state officials and those occupying administrative positions.

7.3. STRUCTURE OF THE SUBJECT SPHERE IN PROSPECTIVE EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Section 1. Theoretical informatics

1.1. Philosophic fundamentals of informatics

• Concept of information as semantic feature of matter. A triad of substance-energy-information.

• Information and evolution in living and non-living nature.

1.2. Basics of general information theory

• Methods of measuring information. Micro- and macroinformation.

• Information and self organization. Synergetics of information processes. Information approach.

1.3. Basics of computer semantics

• Information and knowledge. Semantic aspects of intellectual processes.

• Semantic concept of information systems.

1.4. Fundamentals of information modeling

• Stochastic methods in informatics.

• Computing experiment as a new methodology of scientific research.

1.5. Intellectual information systems

• Artificial intellect information systems. Methods of rendering knowledge.

• Methods of expanding poorly formalized problems in indefinite conditions.

1.6. Information and knowledge

• Knowledge and creativity as information processes. Creative information systems in science and culture.

• Social intellect. Basics of social cognitology.

Section 2. Technical informatics

2.1. Technical means of informatization

• Means of data processing: PCs, workstations, input/output devices, computation complexes and systems, computer networks.

• Means of telecommunication: technical means and links and computer telecommunication systems, audio and video systems, telematic systems.

2.2. Program means of informatization

• System program means: operation systems and environments, systems and languages of programming, user languages, systems of user interface, service nutshells.

• Means of implementing versatile (base) information technologies: text and graphics processors, processors of electronic tables, SUBD, means of object, rocess and system modeling.

• Means of automation of calculations, SAPR, GAP, ASNI, means of solving information and analytical problems and problems of organized administration.

2.3. Means of information support

• Information languages and formats of data and knowledge presentation, dictionaries, classifiers.. thesauruses.

• Means of information protection from elimination and unauthorized access.

2.4. Information technologies

• Versatile (base) information technologies of: integration and collective use of various information resources, their "electronization". Technologies of text processing, that of video and audio information, multimedia technologies.

• Problem-oriented technologies of: training, diagnostics, administration, projecting, modeling.

Section 3. Social informatics

3.1. Information resources

• Methods of formation and quality evaluation of information resources, their structure and topology. National and regional resources.

• Information resources as a factor of social economic and cultural development of society based upon knowledge.

3.2. Information potential

• Information technology. Methods of activation of information resources.

• Information infrastructure and social information environment. Information culture.

3.3. Information society

• Principles and problems of development and evolution of information society Major features of information society. Peculiarities of the transitional period.

• Informatization as a global process. Its impact upon social structures of society. The issue of information safety.

3.4. Man in information society

• New options for character building in information society. Problems of democratization in information society and ways of their solution.

• Information culture and information safety of identity.

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Table 1.

Subject sphere structure of informatics - modern concept

FUNDAMENTALS OF INFORMATICS

<table>
<tr><td colspan="4">THEORETICAL INFORMATICS</td><td>Mathematical and information models, algorithms. Methods of designing and projecting information systems and technologies</td></tr>
<tr><td rowspan="5">MEANS OF INFOR-MATIZA-TION</td><td rowspan="2">technical</td><td colspan="2">data processing</td><td>PCs. Work stations. Computing systems.
Input and output devices</td></tr>
<tr><td colspan="2">data transfer</td><td>Computer networks. Complexes. Technical means of communication and computer telecommunication systems, audio and video systems, multimedia</td></tr>
<tr><td rowspan="3">program</td><td colspan="2">system</td><td>Program means of intercomputer links (systems of teleaccess), computing and information environments
Operation systems. Systems and languages of programming
User languages, systems of user interface, service nutshells</td></tr>
<tr><td rowspan="2">implemen-tation of tech-nologies</td><td>versatile</td><td>Text and graphics processors
Database administration systems
Processors of electronic tables
Means of modeling objects, processes, systems</td></tr>
<tr><td>profession -oriented</td><td>Publishing systems
Profession-oriented systems of implementing technologies of calculation automation, projecting, data processing (accounting, planing administration, analysis, statistics etc.)
Systems of artificial intellect (databases, expert, diagnostic, training systems etc.)</td></tr>
</table>

<table>
<tr><td>INFORMATION TECHNOLOGIES</td><td>Of input/output, collection, storage, transfer and processing of data
Preparation of textual and graphical documents, technical documentation
Programming, projecting, modeling, training, diagnostics. administration (of objects, processes, systems).</td></tr>
</table>

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UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

VOLUME II

NATIONAL REPORTS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 2nd VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 2nd volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics" held in Moscow on July 1-5, 1996. The volume contains texts of national reports presented at the request of the UNESCO Secretariat by the official education system control bodies from 32 countries. Most of these reports have been submitted to the Congress before its onset, printed and distributed among the Congress participants as the working materials.

The contributed national reports are in full agreement with the objectives of the Moscow Congress. They represent examples of collaborative experience and joint use of limited resources, examine national tendencies and experience in introduction of information and communication technologies into education systems, set forth peculiarities of national policies pursued by various countries in the education sphere, and suggest recommendations concerning international cooperation.

Significant differences in the content of national reports seem to be quite natural because all countries are now at different stages of developing education systems and using new information technologies in education.

As with preparation of other volumes of the Congress Proceedings for publication, we met in this case with a wide variety of approaches to the problems discussed at the Congress - in ideas, terminology, style and completeness of presentation of particular sections and topics. Based on common principles of forming the Congress Proceedings, the compilers and editors of this volume seek to retain, where possible, original texts and avoided in most papers editorial corrections and especially changes in the content. At the same time, some lingual nuances are possible in the issue of national reports in three official Congress languages - English, French, and Russian, which were difficult to avoid with the best will in the world.

The editors would be grateful to authors and readers for corrections and suggestions. Your references will help to continue discussions started at the Moscow Congress, to approach to the unification of terminology and notions used in this area, and to enhance exchange of information on the topics discussed at the Congress.

The present state of the art of using information and communication technologies in education systems of various countries will serve as a good reference material in the activity of the UNESCO Institute of Information Technologies in Education (IITE) set up in Russia in line with recommendations of the Moscow Congress.

Analysis, selection, and preparation for the issue of this volume were accomplished by the IITE and the International Center of Systems

Analysis of Higher Education and Science Problems (the UNESCO associated center). Readers' references, comments and suggestions will be accepted with thanks by the Editorial Board.

They should be sent to the Center's Address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, General Director of the Center, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2nd INTERNATIONAL CONGRESS "EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION,

V. G. KINELEV

NATIONAL REPORT OF AUSTRIA

INFORMATION TECHNOLOGY IN THE AUSTRIAN EDUCATIONAL SYSTEM - THE STATE OF THE ART AND BEYOND

1. INTRODUCTORY REMARKS

Both modern societies in the industrialised world and developing countries are moving towards the so-called information age which is symbolised by the transition from an industrial society to an information-processing society. Information and telecommunication technology plays a vital role in economic, commercial, social and also classroom activities nowadays. The informatization of society seems to take place as a "cultural mutation" affecting not only life styles around the world (Vitalari, 1990), but also our way of thinking (Turkle, 1984). It is a matter of fact that the New Information and Communication Technologies (usually abbreviated as NICT), in particular the computer, have already found their way into schools considered as revolutionary in many aspects (see OECD/CERI, 1986 and 1987; OECD, 1988 and 1989).

Seymour Papert [1] philosophised in his keynote address at the international conference "Children in the information age" in Sofia (19-23 May 1987):

"So we are entering the computer future, but what will it be like? What sort of a world will it be? There's no shortage of experts, futurists, and prophets who are ready to tell us - only they don't agree. The Utopians promise us a new millennium, a wonderful world in which the computer will solve all our problems. The computer critics warn us of the dehumanizing effect of too much exposure to machinery, and of disruption of employment in the workplace and the economy". (Papert, 1987, p. 3/4)

Governments in almost all developed countries have introduced computers into the educational system, meanwhile *"an increasing number of parents are feeling more and more guilty if they do not buy a computer for their children"* - as Jacques Hebenstreit sarcastically pointed out at the 8th international European Conference on Computers in Education (24-29 July 1988) in Lausanne (Hebenstreit, 1988, p. 4). What is now (1996) available to schools would have been unthinkable ten years ago. And while the technology advance in the field of microcomputer and new transmission technology continues - and is even accelerated by the convergence of several technologies [2] including satellite technology to produce even more powerful uses - educationalists and politicians have to accept that the demands for investing in educational hardware and software will go on. Even one of the greatest critics of computers, namely Joseph Weizenbaum admitted at the UNESCO -Congress "Education and Informatics: Strengthening International Co-operation" in Paris (12-21 April 1989) that

"another reason given for installing a lot of computers in schools, ..., is that computers are everywhere and that it is very important for children to learn about computers because the world in which they grow will be full of computers. Almost every job will be somehow laced with computers and so they had better know about them". (Weizenbaum, 1989, p. 7)

On all sides, thus, the computer has been invading our lives, changing our human relations and our relationship with the world. There is no doubt that whether or not we use computers in our jobs or in private life the main thing is to become familiar with and acquire a knowledge of computing. In the information society of today a familiarisation with computers has become a fundamental need of the citizen. The growing significance of information technology was also taken into account in the Austrian educational system (EDP/Informatics 1991; Fischer H.F. (ed.), 1988; Reiter A./Rieder A. (eds.), 1990;) that will be outlined in the following chapter.

2. PROFILE OF THE AUSTRIAN (NON UNIVERSITY) EDUCATION SYSTEM

The sector of pre-primary education consists of crĕches for the very young, day nurseries for one and two year old, and kindergarten for children between the ages of three and six and is not compulsory. As a rule children start with compulsory education at the age of six, attending primary school (Volksschule) for four years, if physically or mentally retarded a special school (Sonderschule). After the fourth year of school children either go to the four-year main general secondary school (Hauptschule) with streamings in German, Mathematics and Foreign language (predominantly English) or the four-year first stage of a higher general secondary school (allgemeinbildende höhere Schule, AHS). The syllabi of Hauptschule and AHS differ very little, transfers of pupils on a comparable standard of knowledge are possible. In the ninth year of compulsory schooling choices must be made again. Pupils from the Hauptschule often opt for the pre-vocational year (Polytechnischer Lehrgang) before entering apprentice training colleges. These colleges are specialised institutions for vocational or craft qualifications. An alternative route to vocational qualifications from the ninth year onwards up to five years offer the intermediate and higher technical and vocational colleges (berufsbildende mittlere und höhere Schulen, BMHS). They train students for skilled industrial, commercial, business and agricultural occupations and can also qualify them after having passed the final matriculation examinations (Reifeprüfung) for university tertiary admission. Tertiary education is the aim of the three categories of higher general secondary school (Gymnasium, Realgymnasium and wirtschaftskundliches Realgymnasium) with Reifeprüfung which takes the form of written examinations or project assignment and orals for university entrance. Alternative two-year non-university tertiary technical and vocational (Kolleg) courses (leading to qualifications equivalent to those of the BMHS), specialised technical courses (Speziallehrgang), teacher training colleges (Padagogische Akademie) or specialised university (Fachhochschule) studies as additional tertiary options for AHS graduates and BHS graduates.

Sources for Students: Anticipated Outcomes and Unexpected Challenges, in: MC Dougall A. and Dowling C. (eds.) [1990], Computers in Education, North Holland, Elsevier Science Publishers B.V., pp. 19 - 23.

The institutes of education, organised in four departments (compulsory general, apprentice training college, higher general secondary, intermediate/higher technical and vocational college) carry out the vast majority of in-service training for all teachers. An important sector of education and training in Austria is adult education offered by special adult education departments at higher technical and vocational colleges, at universities, federal adult education centres and "popular universities" (Volkshochschulen).

Education system

AGE		YEAR
5 6	PRE-PRIMARY STAGE	0

AGE			YEAR
6 7 8 9 10	SPECIAL SCHOOLS	PRIMARY SCHOOLS	1 2 3 4

AGE					YEAR
10 11 12 13 14	SECOND STAGE SPECIAL SCHOOLS	SECOND STAGE	MAIN GENERAL SECONDARY SCHOOLS	HIGHER GENERAL SECONDARY SCHOOLS FIRST STAGE	5 6 7 8

AGE					YEAR
14 15 16 17 18 19	PRE-VOCATIONAL YEAR TECHNICAL AND VOCATIONAL APPRENTICE TRAINING COLLEGES	INTERMEDIATE TECHNICAL AND VOCATIONAL COLLEGES	HIGHER TECHNICAL AND VOCATIONAL COLLEGES	HIGHER GENERAL SECONDARY SCHOOLS SECOND STAGE	9 10 11 12 13

Table of the Education system in Austria (BMUK 1993, Dep. of Educational Economics and Statistics)

3. EDP/INFORMATICS IN THE AUSTRIAN EDUCATIONAL SYSTEM

The first preliminary attempts at incorporating electronic data processing into school curricula took place towards the end of the 'sixties and, in the following years, it became more and more widespread at the individual types of school (see also Kerner, 1994).

The development of EDP/informatics in Austrian education was closely moulded on its classic approaches; The machine orientation of the late 'sixties was replaced in the 'seventies by the algorithm-orientated model of thought, which promoted the application of programming languages. Since the middle of the 'eighties it is the user-orientated approach that has been put to the fore in many cases in EDP/informatics. This approach sees man and society in a reciprocal relationship with the new technologies and emphasises the aspect of computers as a working tool. Today, the main concern of information technology education in Austria is to acquaint each pupil with the new information and communication technologies (NICT) in the course of his or her general education in such a way that they are able to use them in a purposeful way. In this process, they are to be shown the opportunities and the limitations of the NICT; groundless fears are to be dispelled in the same time as blind faith in technology is to be countered.

Basic education in information technology for all pupils in the 7th and 8th forms is continued in the 9th form at general high-level schools with the subject informatics and complemented at medium and high-level vocational schools with profession and application-orientated EDP knowledge. To help comply with the specialised job profiles that have emerged in EDP and informatics, vocational education offers a five-year education course at high-level secondary schools for electronic data processing and organisation as well as the subject informatics, which is firmly established at several universities.

3.1 BASIC EDUCATION IN INFORMATION TECHNOLOGY

At the start of the 1990/91 school year basic education in information and communications technology (informations- und kommunikationstechnische Grundbildung, ITG) was introduced for pupils in the 7th and 8th forms. All pupils, boys and girls, had now direct access to the new technologies by the age of 13. The so-called "Integration Solution" was chosen as the means of anchoring this basic education. It includes teaching educational elements of informatics within the framework of existing school disciplines.
(see Reiter, 1990, p. 130)

This integration not only complies with the holistic approach to information and communication technologies but also contributes towards reaching the objectives of basic education in information technology, namely:

- Pupils are to gather their own experience with the new technologies in general and the computer in particular and in so doing acquire basic skills and abilities
- They should be capable of analysing with a critical mind the experience acquired in the past and of situating it in a broader context
- The newly acquired knowledge of information and communication technologies should first and foremost be of a general nature; specialist knowledge is not a priority
- An essential element of ITG is to take into account the opportunities and the limitations of the new technologies, their effect on the individual person and the development within society as a whole.

In practice the Integration Concept provides for an introductory phase in the 3rd and 4th class of the "Hauptschule" [compulsory junior secondary general school] and the "AHS" [high-level general secondary school] (7th and 8th forms), with thorough preliminary information in the 7th form and a project phase in the 8th form. Computers are used according to the specific nature- of the subject matter in the subjects German, English, mathematics and geometric drawing.

This basis education places special emphasis on affording boys and girls a like the same opportunities of access to the new information and communication technologies, irrespective of sex. In this connection it has to be taken into account that existing prejudices, which would have it that females are less gifted for technology than males, have in many instances already taken hold of EDP (Clarke V.A., 1990: Sanders J., 1990; Schulz-Zander R., 1990; Brown 1995). For this reason the Federal Ministry of Education and the Arts has outlined an area of research on the social aspects of access to computers and on the matter of interactions in the classroom itself. An independent task force is working on drawing up proposals for ways in which to perceive and dismantle the sex-related obstacles that hinder access to information and communication technologies.

3.2 HARDWARE AND SOFTWARE FACILITIES AT GENERAL SCHOOLS

To implement the Integration Concept a second classroom with 15 AT computers (14 286-microprocessor based pupil workplaces /1 teacher workplace on a 386-basis, VGA monitor...) and laser and/or matrix printer(s) had been set up at 189 state AHS by the 1990/91 school year. Most of the state AHS schools have opted in favour of a network variant (Novell network), which offers a number of advantages for instruction. A videotext workplace is also part of the basic AHS equipment. By the 1990/91 school year the 1,200 "Hauptschulen" [compulsory junior secondary general schools] had acquired between 6 and 8 computers with the same features per school location.

In terms of software a basic package comprising word processing, spreadsheet and CAD (Computer-Aided-Design) programs has been compiled for the general secondary schools to be used in German, English, mathematics and geometric drawing. This basic equipment also includes an integrated package. In the school year 1992/93 the equipment standard at AHS schools has been partly replaced and extended with PCs with CD-ROM-drives and soundcard specially geared for the subjects of physics, chemistry, music and sculptural education. Compulsory junior secondary schools are also aiming to expand their present facilities.

3.3 INFORMATICS AT THE "POLYTECHNISCHER LEHRGANG"

The purpose of the "Polytechnischer Lehrgang" is to prepare pupils for their professional careers upon completion of the "Hauptschule" or (seldom) the first cycle of the AHS. Here again, special emphasis is placed on informatics. Since the 1989/90 school year pupils at the "Polytechnischer Lehrgang" are also given instruction in informatics as part of one of the seminars of their choice (the choice consisting of social studies and biology, economics, natural science/technology and agricultural science). Informatics as a subject of instruction is also part of the alternative compulsory subjects such as bookkeeping or typing, and is also taught as an optional subject with one to two hours a week.

3.4. INFORMATICS AT THE SECOND CYCLE OF THE AHS

With the coming into effect of the reformed second cycle of the AHS during the 1989/90 school year, informatics as an existing practical subject became a two-year compulsory subject. Instruction is aimed essentially at teaching the uses of application software and at working out structured problem solutions taking into account the general laws on which information processing is based. The social aspects of HDP uses are also looked into. In the 6th, 7th and 8th classes of the AHS, informatics is available as an elective compulsory subject and as an optional subject. In this way existing knowledge and skills can be improved and additional knowledge gained. In many cases instruction is project-orientated.

3.5. EDP AT MEDIUM AND HIGH-LEVEL VOCATIONAL SCHOOLS

Practical considerations are the main priority for EDP education at the vocational schools. At the technical and trade schools for instance, CAD instruction is a priority subject along with the compulsory subject "EDP and applied EDP" while at medium and high-level business schools the use of EDP in the commercial area is a focal point of instruction.

At the high-level vocational schools for humane studies (secondary schools for domestic science, tourism as well as fashion and clothing techniques), EDP is incorporated as a main point of emphasis in the subjects "accounting", "stenotyping and word processing" and as practical subjects in practical company courses at the secondary schools for tourism and catering or the practical application of the newly-developed data technologies for the textile industry: CAD, computer-aided cutting design and cut-layer optimisation.

At the high-level secondary schools for agriculture and forestry, EDP instruction aims to familiarise pupils with the function, organisation and purpose-orientated use of EDP installations.

The subject-specific use of EDP in medium and high-level vocational education in Austria is rounded off by syllabus adaptations aimed at strengthening, also at vocational schools, the instruction in EDP knowledge and handling that is necessary for the vocation concerned.

3.6 INFORMATION TECHNOLOGY FOR THE EDUCATION OF HANDICAPPED CHILDREN

Priority is given that all children in Austria should get the same opportunities to apply information technology. Handicapped and disabled pupils should be prepared for the private and professional use of computer-assisted learning and communication aids. There is the increasing use of the computer as a communication aid for helping children with a severe sensory impairment or a motor disability, (see Reiterer/Tjoa/Wagner, 1989)

In addition there are also school pilot projects aimed at giving a fundamental education in information technology, taking into account the individual abilities and development of the handicapped child (Busby/Wagner/Zagler, 1994).

3.7 TRAINING, ADVANCED TRAINING AND FURTHER TRAINING

In the course of their studies at teacher training colleges future teachers of elementary schools, compulsory junior secondary general schools and special schools are given an insight into the new information technologies; they learn how to use them in practice and how to draw up useful application possibilities in class. The optional subject "informatics" is available for those wanting to acquire an additional qualification.

The specific EDP/information training requirements for teachers at vocational schools who do not have university or college education are provided by the vocational teacher training colleges. Most of the advanced teacher in-service training for high-level general schools and the vocational medium and high-level schools takes place at the institutes of education. At EDP/informatics courses lasting several semesters they continue to provide teacher training until a sufficient number of teachers with university informatics education are available. Work is still in progress on drawing up a general regulation for university education in informatics for candidates to the teaching profession. Certain universities offer the possibility of acquiring the qualification to integrate computer instruction in the teacher's specific subject.

4. COMPUTERS IN THE DAILY LIFE OF AUSTRIAN SCHOOLCHILDREN

At the start of 1991 a scientific study entitled "Die Spaß-Maschine - Der Computer im Alltag österreichischer Schüler/innen" ("Fun Machines - Computers in the Daily Lives of Austrian Schoolchildren") was submitted by the sociologist Dr Walburga Gáspár-Ruppert, which offered interesting insights into the attitude of youths of both sexes to computers. Her findings have shown that for the majority of schoolchildren of both sexes, computers are primarily an interesting and, compared with other instruments, extremely flexible "toy-cum-tool". While the interesting aspect is further strengthened by informatics lessons at school, in most cases the initial contact with computers usually takes place before tuition is given at school.

The study also revealed that the fact of installing a computer in a child's room is by no means a way for concerned parents to keep their child happy at all costs; indeed, in nearly all of the cases it was the children themselves who asked for the computers to satisfy their curiosity and their craving for "novelties".

Noticeable differences in the attitude objectives in relation to age are due to a large extent to the fact that among the lower age groups the novelty of the computer results in a more intensive involvement with it. The main incentives for schoolchildren, children and youths are curiosity, play and risk-free trial and error. Sometimes there are also instances where children experience a sensation of power as a result of "dominating" a machine.

A direct consequence of "instrumental competence" is the prestige that appears within a group of friends whenever a child or youth becomes expert at handling computers. However, it has been shown that the appeal of computers wanes the more it is integrated in the daily lives of young people. As instrumental competence increases with age and as activities adapt more and more to future careers, computers lose their function as toys or games to become professional tools, which in general are no longer fun. According to the study conducted by Dr Gáspár -Ruppert this is primarily a pragmatic decision on the part of the adult-to-be and not a quality inherent to the computer.

The sex-related differences were also identifiable in the survey. However, they cannot be attributed to the fact that girls are less interested in or not as competent with computers "by nature". Rather, family conditions play an essential role in shaping their behavioural patterns. Girls are as uninhibited and as unprejudiced as boys in their attitude towards computers provided their interest and their curiosity (which are as pronounced in girls as they are in boys), are stimulated and promoted accordingly. It could well be a sign of frustration if girls lose interest quicker than boys. In this case it can only mean that clearly less is done to satisfy the requirements of girls. Possibly another factor is that girls clearly attribute less importance to computers for their future professional activities than boys. The material collected with the questionnaires does not support the assumption that involvement with computers at school and at home will give rise to a generation of "compulsive programmers".

Nor are there any indications that computer technology is causing a loss of social competence; on the contrary, by virtue of its toy or game character, it can even promote and considerably strengthen contacts between children of the same age. A possible withdrawal from social relationships might occur in the case of socially and/or psychologically impaired children; however, the appropriate data is not available at present to substantiate any such claims.

The usually effortless processes of habituation and adaptation, among schoolchildren and children in general should not however conceal the fact that there might be repercussions in the longer term that are not even assessable at present. For this reason it is essential that the possible consequences and effects of using computers be discussed and processed, as is intended by the school curricula. Whenever possible it is not just the social aspect as a whole - as stipulated by the curricula - but also the psychical and psycho-social area that should be integrated. Under these prerequisites the teaching body should in future devote closer and also special attention to the clear difference in behavioural patterns among boys of the lower age groups; certainly it would seem that parents have not yet been able to acquire a sufficient degree of competence to be able to assume tasks such as these, which imply a very intensive involvement with computer technology.

5. PERSPECTIVES OF THE FUTURE: MULTIMEDIA AND TELECOMMUNICATIONS

In the Working Document "Multimedia Educational Software: First elements for reflexion", published in Sept. 1995, the European Commission (EC) states:

"The true convergence of telecommunications, television and computer technology, thanks to a widespread digitisation of data, is ushering in a new era, that of multimedia telematics ... Being aware of such promising perspectives, the European Council has confirmed 1995 that education and training must be considered as priority domains for information and communication technology." (EC, p. 9)

A main challenge for education aside communicating culture, disseminating knowledge and transmitting information is to prepare young people with the technological skills for demands of the future. It has become necessary to promote awareness, understanding and use of information and communication technologies both in regard to learning and teaching and for the future employability of the citizens:

"The future of Europeans - and of their jobs - depends on education and training methods being suitably adapted to new requirements as regards qualifications and the new technological, economic, social or cultural environment of the information society. This adaptation will be facilitated by the introduction and use of interactive multimedia products and services in education or training activities." (EC, p. 21)

Under these perspectives the EC demands that by the year 2000:

- every primary and secondary school should have at least a room of multimedia microcomputers allowing access to remote educational services;
- every university should have access to high speed networks needed for exchanging multimedia educational materials in training activities;
- every firm should be served locally by a centre for multimedia educational resources, an "open university for industry", every town hall, library or Chamber of Commerce should offer free of charge the means of access to telematics tools and services so that all citizens can benefit from information, education and training facilities. (see EC, 1995, p. 6)

Undoubtedly Information Technology (IT) will go on transforming the educational system, by "supporting the learning process at all educational levels and in all curricular areas" as Allan Martin (1995, p. 646) pointed out at the World Conference on Computers in Education (WCCE) in Birmingham (23-27 July 1995). IT has created various instructional possibilities for education. Teachers and learners benefit meanwhile from a broad spectrum of information tools (databases, spreadsheets, DTP, word processing, programming, computer graphics, simulations, input devices etc.) More powerful hard and software combined with rapid advances in multimedia [3]) and communication are providing further potential resources.

Ten years ago the educational systems put computers to the classrooms, recent initiatives concern the implementing of networking. Susan Merrit noted at WCCE 95 the following:

"The telecommunications revolution is about to profoundly change our lives, and is just beginning. It will necessarily affect our schools and perhaps our rooms. In terms of computer applications in the education telecommunications is the most significant development beyond the standard productivity tools which are word processing, spreadsheets, and databases." (Merrit 1995, p. 484)

As a representative of the EC Luis Rodriguez-Roselló described in his keynote-address at the IFIP WG 3.4 Working Conference "Computer Mediated Education" in Soest, Germany (12-16 July 1993) the future scenario of telecommunications:

"Telecommunications will equally make possible new forms of networked training such as linking peers to carry out co-operative learning at a distance by sharing powerful information processing or creating different configurations of groups of tutors and learners by means of advanced interactive telecommunication services giving raise to what we may call the "virtual classroom." (Rodriguez-Rosello 1993, p. 6)

But Multimedia and networking are new to schools and teaching in general, sometimes they are not directly applicable to teaching and learning because of being far removed from the realities of classrooms. To be aware of the technological developments that have an impact on education across a wide range of curriculum subjects pilot experiments on the use of multimedia educational products and projects on networking of schools to promote virtual mobility and exchange of information and experience have to be established and continued. We also need qualitative research that proves the effectiveness of the newest technologies and their integration into the classrooms, the faith that technology will work well is not enough. Pupils and students have to learn first-hand how a computer with a modem and a telephone connection can lead them to a wealth of resources and information far beyond the schools walls and they may even participate in distance learning courses via satellite later.

[3] Martin Hoogeveen doubted the benevolent effects of an overoptimistic multimedia paradigm at ED Media 95 in Graz (17-21 June 1995): "The multimedia paradigm is a dominant conviction that adding multimedia functionality to information systems (ISs) leads to improved information and knowledge transfer to people." (Hoogeveen, 1995. p. 348)

5.1 THE INTERNET AS COMMUNICATIONS MEDIUM FOR TEACHERS AND LEARNERS

The Internet (see Eastment, 1996; Lake, 1995; NCET, 1996) has become one of the most fascinating resources for telecommunications by linking together former separate networks and using a common communication protocol called TCP/IP (Transmission Control Protocol/Internet Protocol). Estimations suggested that there were some 35 million users in 1995 in the world and its use is still increasing. Even though it is not managed by any particular organisation it gives people access to a wide range of material and information. To be able to access it in the cheapest form a computer, a modem connected to the telephone-line and a service provider is necessary. Apart from the registration fee there is the cost of the telephone calls and the (monthly) charge from the service provider. The growing number of people with Internet e-mail addresses indicate its potential as a communications medium. Users of the Internet have access to

- electronic mail
- bulletin boards and computer conferencing systems
- on-line databases (data files)
- catalogues and illustrated guides from museums, art galleries, libraries etc.
- free software (public domain)
- newspapers and books
- graphics, etc.

But the Internet *"is more than an information delivery system-it is also an intellectual environment within which we are beginning to create "places"... it is a place that is not yet here, hut is quickly becoming a world of places.* "(Lake, 1995, p. 25) Since a couple of years the *"Internet has been undergoing a fundamental change that is allowing users to access* *multimedia materials such as digitised images, sound and animation. Ease of access has also been enhanced... users simply click highlighted hypertext links on the World Wide Web."* (Bull et al., 1995, p. 59) The keywords are Hypertext and Hypermedia being essential components of the so-called World Wide Web (WWW). Eastment defines hypertext as *"a system which allows you to click on a word or picture to jump to another part of the document... Once you have connected to a site, you jump to further information by merely clicking on icons... "* (Eastment, 1995, p. 13/14) Hypermedia has become the current buzzword in educational technology:

"A hypermedia environment is the user interface that allows to work with different elements as a whole: text, graphics, images, sounds, simulation software, external hardware, data bases, computer networks, etc. on the base of the specific application. The results of this approach are increased interactively and simplification of the use. Hypermedia technology is important not only for educational applications, because it may prove to become, in the near future, a powerful tool for managing information of all kinds". (Parodi/Ponta, 1993, p. 175)

A WWW page is a multimedia document created by HTML (Hyper Text Markup Language) that contains text, images, sound and even animation and movies. It can be viewed with a browser such as Netscape or Mosaic. In future word processors, telecommunication programs and operating systems will offer support for viewing Web pages that will become as ubiquitous as f. i. electrical service. Using the WWW learners are offered to navigate through, select, assess, manipulate and evaluate information and develop their own skills and network literacy. Educators can easily create their own resources by setting up collaborative projects and displaying their results on their Web page and sharing them with a "global audience". The Web allows immediate access to a world-wide information community and *"is a virtual meeting place to exchange information with distant partners who were previously inaccessible"*, Caroline McCullen notes in an article in the ISTE Journal of Educational Technology Practise and Policy of Nov. 1995, summarising:

"Using the WWW, teachers can develop collaborative projects with international partners, compare data with classes in other parts of the world, share the results on their own home page and get feedback from the global community on the Internet. The WWW makes the virtual classroom a reality." (McCullen, 1995, p.10)

5.2 PEDAGOGICAL RECOMMENDATIONS FOR HYPERMEDIA

Cognitive search has shown that learning in general is driven by the student's intrinsic need to make sense - learning is a natural activity. L.A. Rhodes explains that:

"From birth on, humans seek meaning-then try simultaneously to understand both the world and themselves. They take information in from their interactions with the surrounding environment, conned it to what they already know, and construct new knowledge and skills. These new skills are then tested through continuing interactions. Each interaction increases the individual's capacity to act intelligently in solving problems." (Rhodes 1995, p. 36)

The act of "doing" being essential for a new learning paradigm in the context with hypermedia [4]) develops many other learning skills and evolves a significant amount of intrinsic satisfaction on the part of the active participant. Pientti Hietala from the university of Tampere reported at the IFIP WG 3.4 Working Conference on Computer Mediated Education in Soest in 1993:

"Hypermedia is an exciting new avenue to pursue in the use of computers to empower learning and leaching. Possibilities not even dreamed of before can now be examined through this new concept, but it also requires a special hardware and special kind of pedagogy...The utilisation of this new equipment has to be based on the learner's active and creative engagement, not just passively watching video clips or guided tours chosen by somebody else. The sooner the learner herself is able to have her hands on the hypermedia, the better." (Hietala, 199.\ p. 169)

The pedagogical reasons are given by the cognitive learning theory:

"The findings ... seem to call for a more active and creative role for the learner which is also the message from the contemporary cognitive learning theory... This theory emphasises three primary principles. First, learning is a process of knowledge construction as opposed to knowledge absorption. Second, learning is knowledge-dependent, i.e. people inevitably use existing knowledge upon which to build new knowledge. And third, learning is highly tuned to the situation in which it takes place." (Ibd., 1993, p. 164)

Under these circumstances the role of the teacher will also change. A. W. Bates reported at the IFIP TC3 third Teleteaching Conference in Trondheim (20-25 August 1993) the new approaches of learning and teaching by telecommunications:

"Teacher ... will increasingly be advisors, and managers and facilitators of learning, rather than providers of information. Access to information will be primarily through telecommunications. The teachers' role will concentrate more on developing skills, and in particular skills of navigating knowledge sources, and skills of processing and analysing information." (Bates, 1993, p. 3)

[4] The term "hypermedia" includes also off-line multimedia (educational) products as CD-ROMs T. J. van Weert argued at the 13th World Computer Congress in Hamburg (28 August-2 September 1994) in the same direction:

"The use of open learning and technological support systems will mean that some or much learning will be outside the teachers sphere of influence. The teacher becomes a learning guide or a mentor for the students, co-operating with pupils in a learning experience." (van Weert, 1994. p. 624)

During the last two years several pilot projects on networking of schools have been established by the Federal Ministry of Education and Cultural Affairs in Austria. Many teachers who want to add telecommunications skills to their repertoire of teaching tools today are first introduced to the Internet via a simple modem and electronic mail software. But few schools have the luxury of a computer room where all the computers have Internet access. So only teachers or a small group of pupils/students under supervision of teachers have access. It should also be mentioned, as Eastment reports, that *"often a good deal of class time can be spent simply staring at the screen waiting for information"* (Eastment, 1995, p. 20) when using a conventional telephone line (you wait minutes until a photograph is downloaded) and not the still expensive digital and fast ISDN-lines. The real Information highway will become reality with broadband (fibre optic) connections usable also by the educational system.

6. COMPUTER BASED TRAINING-INITIATIVE AS CASE-STUDY

In order to evaluate the potential of the new educational technologies several pilot projects were established ranging from the "Austrian School Net" (with links to the Internet) via "Portable Computers in the classroom" to the production of "Multimedia Educational Software". As example the initiative "Mobile Computing" at a higher technical vocational school (HTL) in Vienna will be briefly presented.

Within a period of 18 months two classes of a 4th grade (18 years of age) of a HTL were equipped with notebooks (TravelMate 4000) with CD-ROM-dockingstations (SCSI-Interface, sound-card etc.) for multimedia applications in a ratio one portable per one student. During this so called pre-project phase a LAN was built connecting each working place with a router offering access to the Internet. As additional but necessary measure appropriate courseware was selected and purchased by the project-team. The crucial points of the project are the following:

- Availability of portable computers for curricula support;
- Use of multimedia educational software;
- Evaluation of the efficiency of computer based teaching and learning;
- Revising of valid standards of interactive courseware;
- Acquisition of knowledge through electronic networks.

After the creation of the infrastructure the schedule implies the start of the regular project with the objective of integrating newest information technology into the curricula in the school year 1996/97. The following main expectations put forward as working hypotheses are to be verified:

Is portability "a catalyst for cross-curricular Information Technology permeation" as Allan Martin reported a WCCE 95 referring to a project between June 1993 and 1994 in Leeds (Martin 1995, p. 645 ff.): *"One aspect appreciated by both teachers and pupils was the manoeuvrability of the machines... Not only could the portables be moved in and out the classroom; these could also be disposed within the classroom as the teacher wished. This offered teachers flexibility and subordination of the hardware to the learning objectives and organisational requirements of the lesson. "* (Martin, 1995, p. 650/651)

Does the new learning paradigm predicted by cognitive science and manifested by hypermedia bring improved information and knowledge to pupils? *("Knowledge as a result of the process of knowing, which can only occur as the learner actively constructs what he or she knows, using information in this process "* as Harris, 1995, p. 58, defines)

Does ubiquity in the information age by means of telecommunications enables schools, teachers and learners to share the virtual community that Howard Rheingold compares like that: *"It's a bit like a neighbourhood pub or coffee shop. It's like a salon, where I can participate in a hundred ongoing conversations with people who don't care what I look like or sound like, but who do care how I think and communicate. "* (Rheingold, 1993, p.66)

7. CONCLUSION

The so-called new information and communications technologies (NICT) have been introduced into the Austrian educational system in a broad context in the past decade. Since Austria has become a member of the European Community the integration of multimedia and telecommunications is considered as a major qualification aspect to be taken into account by schools for teaching and learning purposes in regard to the future labour market. A dominant role in this context play the Internet as herald of the information highway and off-line-multimedia educational products (hypermedia). The shortly outlined project initiative at a higher vocational technical school in Vienna by implementing CBT together with mobile computing using portables and direct access to the Internet gives an example of the future scenarios in Austrian schools. The aim is to establish further pilot projects on networking to promote virtual mobility and on the production of multimedia courseware applicable for the curricula.

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[1]

Seymour Papert created the programming - language LOGO which has been used in a variety of educational research projects related to children's learning, and the learning of programming in particular. It should be noted that even if LOGO had been grouped as a crucial theme of the sessions at the 1985, 1990 and 1995 IFIP World Conference on Computers in Education the interest in the LOGO environment seems to be decreasing. The ability to write simple computer programmes is now accorded less importance as standard software packages have become widely available.

[2]

The newest technologies in the field of multimedia and telecommunications (e.g. interactive video, interactive compact disc, CD-ROM, two-way cable and satellite communication, view data and others) offer enormous possibilities to teachers and pupils: in regard to CD-ROM see Baumbach, J.D. [1990], CD-ROM Information

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NATIONAL REPORT OF BANGLADESH

EDUCATION AND INFORMATICS: BANGLADESH PERSPECTIVE

The impact of the Information Technology and the computer on the life and civilisation of nation is very great. Its contribution towards the expansion of knowledge, education and research is surprising. Its revolution has also touched Bangladesh mildly. The Atomic Energy Commission of Bangladesh introduced the system in 1964 with the installation of the IBM 1620 computer. Gradually, the use of computers spread to some important research centres. Universities and administration bodies. Computer Science as an academic course was first introduced in the Universities, then in the colleges and recently in the schools. Short courses/training are also offered by the Government agencies and by private commercial firms. A number of Hardware and Software firms have been developed recently. Bangladesh Television, Radio and Telegraph and Telephone Boards are also contributing towards the generation and dissemination of information on various aspects of education and research. Although general consciousness has developed recently regarding the benefits and uses of computers in the search for knowledge and education, some major limiting factors like lack of specific national policy, shortage of funds, absence of necessary training centres, skilled IT manpower and inadequate information infrastructure are limiting the progress for welcoming the new inventions in the Information Technology. Please find as follows the brief description of the status of Bangladesh in the field of the New Information Technology (NIT). Some recommendations are also given along with the identification of the problems we are facing.

NEW INFORMATION TECHNOLOGY IN OUR EDUCATIONAL SYSTEM

1. Primary level

No course has yet been introduced in the primary level syllabus, i.e. from class I to class VIII.

2. Secondary level

Computer science has been made as an optional subject and a small number of candidates will appear in the Secondary School Certificate (S.S.C) examination in 1996. Moreover, computer science has been made as a compulsory paper of the S.S.C. Vocational course under the Technical Education Board. The Government has also decided to provide 317 Government schools with computers this year.

3. Higher Secondary level and Degree Pass Course

The Government has introduced computer science as an elective subject in the Higher Secondary Certificate (H.S.C.) class and also in the Degree (Pass) class in 1993. The Government has decided to install computer with modem in 136 colleges in the year 1996. NTRAMS, an institution under the Ministry of Education, has also opened a computer course as a paper (part of the course) of Business Management at the H.S.C. level.

4. Higher Education

Computer science has been introduced in the Bachelor's level in various Universities (Government and Private) and in an Engineering University:

- Dhaka University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Rajshahi University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Islamic University - B.Sc. (Hons) - 3 years recently introduced;
- Shahjalal, Syllnet University - B.Sc. (Hons) in Electronics and Computer Science (4 years) introduced in 1990;
- Khulna University - B.Sc. (Hons) introduced in 1989;
- Jahangirnagar University - One paper in the Hons course;
- National University ' B.Sc. (Hons) in computer science, 3 years, introduced in 1993.
- Two Private Universities recently have introduced a B.Sc. (Hons) in Computer Science with 4 years' duration;
- Open University introducing Diploma Course in Computer Application -1.5 years' duration;
- Teacher's Training College has incorporated computer Science in the B.Ed. course;
- NTRAMS, an agency of the Ministry of Education, provides short course in computer operation;
- Bhuyan Academy and Microland, both are conducting B.Sc. (Hons) in Computer Studies with 3 years' duration under London University;
- Bangladesh University of Engineering and Technology (BUET) introduced B.Sc. (Engineering) in computer science with 4 years' duration, introduced in 1989.

About 700 students in all are enrolled in the 1st year B.Sc. (Hons) B.Sc. Engineering course in different Universities/ Engineering Universities in Bangladesh in the current year. It indicates a good rise from the previous year's record (i.e. 475 students).

TRAINING FACILITIES

a. Computer Training

A number of Government, Semi-Government and private institutions and firms are providing training facilities. Bangladesh Computer Council (BCC) is the most important computer training centre in the country. Other centres are: BBS (Bangladesh Bureau of Statistics); NTRAMS, TTTC (Technical Teachers' Training College), BUET, D.U. (Dhaka University), Ministry of Youth and Sports, Ministry of Establishment, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and Public Administration Training Centre (PATC).

As many as 600 private firms are rendering training services in. the form of computer literacy, awareness programmes, programming and system design.

On the whole, training facilities are most inadequate in relation to our rising demand for computers. . It is very much felt here that training requires to be imparted not only to the computer operators and developers but also to the information users like the Secretaries, Directors and Executives.

The importance of training to the technically skilled persons like programmers and system analysts is not perhaps properly recognised by our administrators, as a result of which an insignificant amount is spent here for training.

b. Present Status of the Information Users in the Education Sector

It is observed that some of the top ranking and middle-level officers and executives of the Ministry/Directors and autonomous bodies engaged in educational pursuits have some training in the computer science and information technology, while others have little knowledge and experience in the current progress of the technology and computer science.

Inadequacy of training or absence of modern training compels them to be ignorant about the recent development in information technology and this may lead them to the wrong decisions at a given time. One gloomy picture in office management depicts that in most of the cases, senior officials are equipped with costly computers of the latest model, but they have neither ever used these devices nor have they any training or time to utilise their services. This is nothing but a sheer wastage of hard earned resources. Provision for Computer Appreciation Training on the part of the top administrators/Directors/Executives may be an appropriate solution for this issue since they have hardly any time for operating/developing or programming through the computer. Again, the middle level officers who may serve the Department for a longer period and who can afford some time for computer work may be trained adequately and properly in computer science. Such executives should be retrained from time to time to cope with the changing environment.

LEVEL OF COMPUTER HARDWARE AND SOFTWARE PROVISIONS

About 5 private firms are assembling micro computers. About 50 private firms are working for software development out of which 10 firms are well-established in the line. Increasing the number of firms need to be encouraged and patronised by the Government in the form of tax concessions and tax holidays. It is noteworthy to mention here that 35% taxis imposed on the import of computer and parts which is discouraging the development of the industry in the country.

POLICY TOWARDS STANDARDISATION

Uniform standardisation is lacking in the installation of hardware and the development of software due to lack of specific policy guidelines and dearth of expertise amount decision makers.

INFORMATION INFRASTRUCTURE

A. Broadcast Technologies in Education

(i) Radio and TV

The Bangladesh Radio and Bangladesh Television (BTV) broadcast are disseminate news (local and foreign) and speeches and organise educational guidelines, advice, lessons and instructions on regular/daily/weekly/ periodical basis on the following socio-economic and environmental topics: Population education (concept, planning and control), nutrition and health education, prevention of diseases (AID, HIV, etc.), academic courses on national and major international languages, special classes for Open University students and also for B.Ed. students, computer science and also provide guidelines, information and technologies involved in various branches of agriculture like cultivation, plantation, forestry, fishery, prevention of environmental pollution and also topics covering development of fine arts. It is viewed by many experts that our BTV and Radio programmes should henceforth be made in such an efficient and effective manner that it suits the current needs of present and future generations and be more capable of keeping pace with the Interment age.

(ii) YCR, VCP and Diss

The number of VCR (18,089), VCP (3,344) and Diss (1.660) is still not sufficient for such a populous country (about 12 crore).

B. Telephone Services

The telephone service in general does not appear to be satisfactory up to expectation, although BTTD is working to expand and improve its services. At present, 331,210 telephone lines are in operation out of which 147,500 are Digital phones. Three telephones are meant for one thousand person currently, which is much low compared to Indonesia, Philippines and Thailand (13, 17 and 47 telephone per thousand respectively). The BTTB's aim is to reach to the following targets (i) at the end of 1996: 503,840 connections including 317,100 digital phones, (ii) By 2000 year .8 million in all. The number of mobile phone is increasing rapidly. The present installation fees are probably discouraging from users' standpoint. These are: for Analog TK. 10,000 and for Digital TK. 20.000 when our per capita income is $ 230.

C. Processing Technology

Computers

Availability of computers in the country at present are as follows: Main Frame 15, Mid-Range 40, PC 50,000.

(i) Computer Literature

In order to popularise the computer science in the country, the Bangladesh Computer Society is functioning very sincerely. A number of monthly journals and periodicals are in circulation in the market (e.g computer Jagat, Computing, Computer Technology and Electronics, Shikhya Barta) and information like type and use of computers, make, origin, modern development of technology, Internet, etc. are being disseminated with a view to making our young readers and information users well-conversant with the modern development and changing environment.

(ii) Data Bank

Five organisations/agencies including University Grants Commission and Planning Commission have jointly developed a Data Bank in order to interchange information among themselves through network. The training of the concerned officers is progressing satisfactorily.

(iii) Database Development

The Bangladesh Bureau of Educational Information and Statistics (BANBEIS) has successfully developed Database of 350 thousand teachers and non-teaching staff and also 22 thousand educational institutions. Moreover, it has also developed teachers' profile of 232 Government Colleges and 9,500 of Ebtedayee Madrasah (religious institutions).

(iv) Computerisation of S.S.C. & H.S.C. Examinations

For the last two year's Secondary School Certificate (S.S.C) and Higher Secondary Certificate (H.S.C) Examinations of 4 Secondary Education Boards are being computerised where about one million examinees appeared.

Internet

Bangladesh is going to Internet very soon. Some obstacles seem to create barriers at the national level in respect of having the advantage of Internet, though it is not expected. Lack of initiative on the part of the Government in general and lack of capacity of the Bangladesh Telegraph and Telephone Board (BTTB) appears to be the major source for the absence of this important technology here. Nevertheless, some awareness has been developed among the citizens specially the younger generation and a number of enterprising private firms. Under the initiative of the University professors and private firms and professionals the Internet Week has recently been observed in order to raise consciousness among the younger generation and information users. Under the private initiative, 256 E-Mail connections are going to be made soon which are envisaged to connect educational institutions, research orsanisations at different levels. It will have access to the Internet.

FACTORS LIMITING PROGRESS IN THE ADOPTION OF NEW TECHNOLOGIES IN EDUCATION

(i) Financial constraints of the Government and other private organisation is perhaps the most important bottleneck.

(ii) Inadequacy of the infrastructural facilities is another major bottleneck hindering the progress of this industry.

Total electric supply is very much insufficient which is again disturbed by frequent voltage fluctuation and load shedding.

Telephone services and lines are still costly, inadequate, defective and irregular.

The total number of computers as noted below is most inadequate for the country as indicated earlier.

License fees are small for Radio owners but seem to be high for TV and VCP owners (e.g. TK 200 for Black and White TV, TK 400 for coloured TV and 500 for VCP).

(iii) Lack of well educated populace, skilled IT manpower and inadequacy of training facilities in the country are some of the most important factors limiting progress in the adoption of new technologies in the country.

(iv) Apprehension of the employees and labour union that they may face unemployment due to the introduction of computers.

(v) Lack of the Government commitment in respect of introduction of the Information Technology and its expansion within and outside the country is another major limiting factor.

PARTICIPATION INTERNATIONAL NIT PROGRAMMES

Bangladesh has already gained much through participation in the following Participation International NIT Programmes. We welcome very much to participate in such seminars/congress:

- GIIC (Global Information Infrastructure Commission);
- IIP (Inter Governmental Informatics Programme);
- RINSCA (Regional Informatics Networks for South and Central Asia).

Recommendations:

*1. **National Commitment**: Government commitment in the development of Information Technology should be considered as a prerequisite wherever necessary.*

*2. **Education and Training**: Provisions should be made for building up a well-educated populace.Provisions should be made for building up an efficient work, force including the operators, developers and users in general.Adequate training facilities be provided to ensure regular flow of skilled manpower and to equip them with the changing environment and new technologies.Provisions should be made for foreign training, study tours and attachment programmes in the relevant fields.*

*3. **Participation in International Seminars**: Government should take initiative to send their delegates to all the relevant international regional seminars/congress in order to exchange concepts and experiences.*

4.Development and patronisation of research work at national and international level is highly desired.

5. International cooperation for the development of Information Technology should be very much welcomed.

*6. **Infrastructure**: Adequate number of infrastructure facilities be provided with the national and international resources and cooperation.*

*7. **Financing:** Necessary financial assistance of the advanced countries, donor agencies, and well established computer companies will be very much welcomed and appreciated by the developing countries like Bangladesh.*

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NATIONAL REPORT OF BELARUS

INTRODUCTION

Today information is one of the most important strategic resources of a society's development. It caused the inflow of tidy investments in the creation of information systems and technologies. So, it became obvious, that the further society's development is widely determined by the level of its informing citizens in the field of their professional activity.

The acquiring of sovereignty by the Republic of Belarus and its economy transition to the market principles challenged the changing of the traditional principles of the society's organisation. This has touched the system of information supply of educational and scientific and research fields. In the conditions of the open economy, higher educational institutions, academic and branch institutions have to agree the level of their developments with the world standards. There has appeared the need for a new system of information services, based on the up-to-date means and new information technologies. This system should cover all the aspects of scientific and research activity and educational process and provide diverse information for consumers.

The former Soviet Union Republic of Byelorusssia was one of the leaders in the development and production of software and hardware, especially in the field of universal computers of the integrated system (ISC), personal computers, system and applied software. However, during the period of making the Belarus nationhood and its entering the new economic relationships after the USSR dissolution the situation had radically changed. Belarus sank in the wave of imported technique of various quality, there has emerged the regional producers of it. Our specialists skills and knowledge became useless.

However, regarding our experience in the field of information technologies introduction in different fields of activity, the advantageous geographical location of Belarus, high intellectual resources of education and scientific systems specialists, we can talk about the advantageous perspectives of information infrastructure creation and development in the field of education and in the Republic on the whole.

1. THE STRUCTURE OF THE NATIONAL EDUCATIONAL SYSTEM

The process of forming and development of the education system in the Belarus Republic is implemented according to the constitutional demands and guaranties in the field of education, providing equal opportunities for its acquiring, the integrity of the educational system and succession of all the educational stages.

The structure of the national educational system is based on the Constitution of the Belarus Republic, laws "About the education in the Belarus Republic", "About languages", "About national and cultural minorities", "About child's rights" and other normative documents, adopted during the recent years and regulating its activity. The structure is based on the principle of continuos education and training, including the following documents: pre-school education; general education; vocational education; family education; self-education.

According to Article 14 of the law "About the education in the Belarus Republic", all national and non-governmental educational institutions, situated on the territory of the Republic, belong to the national system of education of the Belarus Republic, which includes:

1) pre-school education;
2)general secondary education;
3) extra-mural forms of education;
4) vocational and technical education;
5) special secondary education;
6) higher education;
7) scientific and scientifically pedagogical training;
8) personnel qualification improvement and in-service training;
9) public self-education.

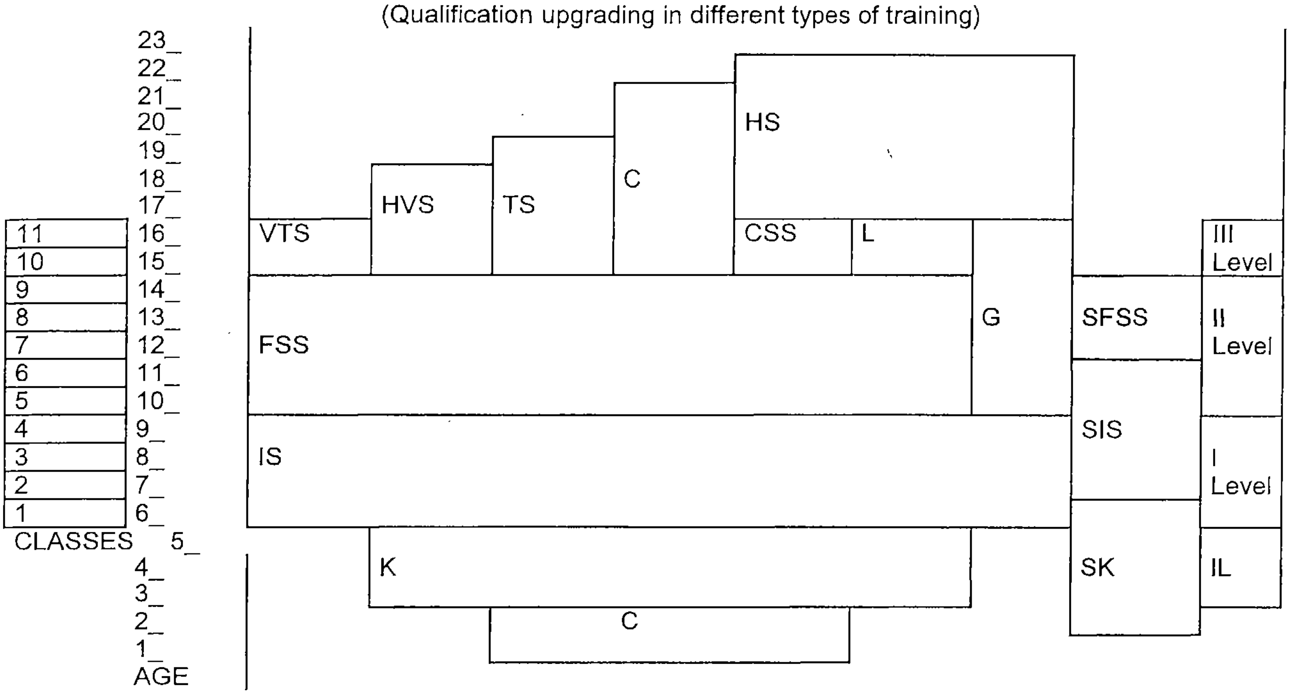
The educational system of the Belarus Republic includes various types of educational and educative institutions: children's pre-school (kindergartens, creches) and out-of-school institutions; general educational (fundamental and secondary schools, gymnasiums, lyceums); special institutions and boarding schools (children's homes, boarding schools, reformatories for minor delinquents, etc.); professional and technical schools and higher professional and technical colleges; secondary special (schools, technical schools, colleges) and higher educational institutions (specialised higher educational institutions, universities and academies); scientific and research institutes and institutes for personnel qualification upgrading and in-service training; the bodies of the educational system management (Ministry of education, the educational administration and departments of the Executive Committees of the Regional Soviets and submitting educational and methodological organisations.

The continuous nature of the educational system, its structure, stages of teaching and types of the educational institutions are demonstrated of the Scheme 1:

Scheme 1

Structure of education in the Belarus Republic

Further education
(Qualification upgrading in different types of training)



- IL - Initial Level;
- C -Creche;
- K - Kindergarten;
- SK - Special Kindergarten;
- IS - Initial School;
- SIS - Special Initial School;
- FSS - Fundamental Secondary School;
- SFSS - Special Fundamental Secondary School;
- G - Gymnasium;
- VTS - Vocational and Technical School;
- HVS - Higher Vocational School;
- TS - Technical School;
- C - College;
- CSS - Complete Secondary School:
- L - Lyceum;
- HS - Higher School (Universities, Academies, Special Higher Educational Institutions)

THE SYSTEM OF HIGHER EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the System of higher education in the Belarus Republic consisted of 39 state higher educational institutions (HEI), Management Academe under the President of the Belarus Republic and 20 non-governmental HEI:

The number of students

	The number of HEI	The number of their students
State HEI	40	174 189
Non-state HEI	20	23 192
Total	60	197 381

Academical staff:

Staff, total	15 153
including females	6 252
including doctors of science	843
including females	101
candidates of science	7 104
including females	2 312

THE SYSTEM OF SPECIAL SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of special secondary education in the Belarus Republic consisted of 146 state special educational institutions (SSEI), including 77 technical schools, 18 colleges and 51 schools. Besides, there are 3 non-governmental SSEI.

The number of students:

	The number of SSEI	The number of students
Govrnmental SSEI	146	121 560
Non-governmental SSEI	3	812
Total	149	122 372

SSEI staff:

Staff, total	10 838
Teachers on the staff	8 414
including females	5 768

THE SYSTEM OF SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of secondary education in the Belarus Republic consisted of 4808 schools of general education, 98 special schools and boarding schools for the children with mental or physical deficiency, 25 sanatorium boarding schools, 82 evening schools and 242 professional and technical schools, subordinate to the Ministry of Education and Science. Besides, there're 15 schools and 10 vocational and technical colleges, subordinate to other Ministries and institutions.

	The number of educational institutions	The number of their students	The number of teachers
Day-time schools	4808	1 538 068	126 489
Evening schools	82	20 911	788
Special schools	98	20 095	2 666
Vocational and technical schools	252	130 083	14 064

According to the acting law, the control after the education in the Belarus Republic is realised by *the body of state administration* (legislation - Supreme Soviet (the Parliament) of the Republic, laws execution - the Cabinet of Ministers) as well as the regional control administration.

The Ministry of Science and Education of the Belarus Republic has the control over the submitting higher and secondary special educational institutions, scientific and educational and methodological organisation, institutes of qualification upgrading, republican departments and organisations. It carries out the general organisational and methodological control after the activity of the educational departments and administrations of the regional Executive Soviets of People's Deputies, which are in charge of children's pre-school and out-of-school institutions, schools of general education, vocational and technical and pedagogical schools and colleges.

At the begging of 1996 there were 4 576 pre-school and 3318 different out-of-school institutions in the Belarus Republic.

2. THE REFORM CONCEPT OF THE SECONDARY SCHOOL OF GENERAL EDUCATION

A) THE FOUNDATION FOR THE REFORMS IMPLEMENTATION

The analysis of the general education school development in the Belarus Republic and the experience of its reforming in the 50-80s revealed its main drawbacks:

- the general education school orientation on students preparing to enter a HEI, and not to breed the citizen, which is the traditional aim of general education schools and it result in:

- the considerable students' overload, especially in the second half of the 80-s (the students of the high grades have pending 40 hours per week, while within the previous years the mean norm was 30-32 hours), the absence of a fixed *minimum, necessary for the life activity and* compulsory for every student comprehension.

The significant increasing of student's load conditioned the decision to refuse the idea of the overall secondary education and to accept to the conceptions of compulsory nine-years education. However, graduating fundamental school (9-years) doesn't mean acquiring the complete course of education, therefore it can not be considered as the condition for socialisation, which is its main difference from 8-years course. In the 60s 8-years course executed the similar functions. Besides, the 15-years old graduate from the fundamental school is not prepared physically, physiologically, socially and morally neither for self-sufficient activity, nor for making important decisions.

In the conditions of reforming the entire society on the whole, it turns out, that out of the educational institution graduate doesn't meet any support of his or her right to work and social defence.

However, the necessity to conduct the reform of general educational school is related not only with the sharp acceleration of the society's development, which consequent is the need for constant improvement of the general educational training and its corresponding with the world standards. The roots of the suggested reform are laying much more deeper. The home school can satisfy the demands of the new child only with the condition of solving the problems, preventing the development of the system of secondary education.

First of all, it is the necessity to overcame the internal contradictions, proper to Soviet school of general education.

Second, there is the necessity to bring to the logical end the Soviet school reform, carried out during the recent years.

The complex solution of the pointed problems provides the conditions for the individual's self-realisation, for the development of his or her creative abilities, for the increasing the level and the quality of training, for the transition to a new content and modern technologies of education.

B) THE MAIN FEATURES OF EDUCATIONAL INSTITUTIONS

According to the developing Conception, the national system of education in the Belarus Republic will consist of the following issues:

Fundamental (basic) school education

Kindergarten (age - 3-6 years)

the aim of it is to develop the inborn child's abilities with due regard of his individual and age features through his or her involving into the simplest spheres of social life. Usually, attending kindergarten at the age of six is compulsory.

Initial school (1-4 forms, age 6-10 years)

it is oriented at the further development of child's physical, intellectual and moral abilities, his or her studding the integrated educational programmes of literacy basis, necessary for learning the sciences' and arts' bases, during the period of his education in fundamental (basic) school. Teaching the program of the first form may be held either in kindergarten, or at school.

Fundamental (basic) secondary school (5-10 forms, age - 10-16 years)

it is oriented at children's preparing for their life activity (and not for entering the HEI) and for their acquiring the logically complete fundamental secondary education, which allows them to make their own decision of the way of the further educational, social, moral and vocational becoming. The basic secondary education provides thorough knowledge and humanitarian set of education, the necessary applied level of knowledge and skills, creative development of intellectual, physical and moral forces, which condition individual's development.

The implementation of the objective is realised through student's digestion of the basic component of secondary education. In 7-8 forms there is an opportunity to introduce different levels of training (specialised studding certain subjects). Education in 9-10 forms comprises profile training (natural sciences, humanitarians, polytechnics profile, arts and sports).

The successful finishing the 10th form and passing the state certification give a right for obtaining the school-leaving certificate and for continuing free education on the competition basis in a vocational and technical college, or in a SSEI, or in a lyceum.

Pre-HEI training

Vocational and technical colleges (initial vocational school)

- provides an opportunity to acquire a qualification, necessary for a certain professional activity, or in case of extension the period of education to 2-3 years students can take the courses of additional training of general education, preparing them to enter an HEI.

Colleges, technical schools (special secondary school)

- during the period of 3-4 years they provide the opportunity of acquiring a medium-level qualification, as well as the right to enter an HEI.

Lyceums, lyceum classes

- during the period of 2 years they provide general educational training, aimed at the further entering HEIs or technical schools and colleges.

There are supposed to be five types of lyceums: of general education, humanitarian, of natural sciences, aesthetic, polytechnics.

The successful finishing lyceum education provides an opportunity to obtain the document, giving a right to enter an HEI (college, technical school).

Higher vocational school (higher colleges, institutes, academies, universities)

- they organise training, different in content, forms and periods of education and provide specialists training in three levels: Bachelor, Diplomaed specialist, Master.

C) THE STAGES OF THE REFORM IMPLEMENTATION

1st stage: years 1996-1997 - the elaboration of the Conception and adoption of the National Programme of Reforming the Educational System; working out the scientific and methodological and normative and legal bases for the reform; definition of the content of education, development of the new curriculum and syllabuses.

2nd stage: years 1997-1999 - the carrying out of scientific and pedagogical examination of the new syllabuses and curriculum; organisation of experimental grounds for their testing.

3rd stage: years 1998-1999 - the introduction of a new curriculum in the 1st and the 5th forms of secondary schools of general educational in a few regions and cities.

4th stage: years 1998-2005 - the development and introduction of the new textbooks, teachers' pre- and in-service training.

5th stage: years 1999-2001 - gradual introduction of a new curriculum of the 1st and 5th forms of secondary school of general education. Its implementation depends on certain features and the level of fitness of concrete educational institutions and regions.

6th stage: years 1998-2005 - the creation of a updated network of educational institutions: vocational colleges, technical schools, lyceums.

7th stage: years 1998-2005 - the reform of higher education in the Republic, the introduction of the new content of education in HEI.

3. BASIC TRENDS IN INFORMATION TECHNOLOGIES INTRODUCTION

The basic trends of information technologies introduction into the educational system of Belarus are the following:

- using computer as a tool for teaching and the resource of information;
- using computer in managing the educational and scientific systems;
- the development of the means of communication in order to provide an access to the world information resources.

There is a number of groups of specialists and single developers, who are busy with scientific development in the field of information technologies implementation in education in Belarus. Their work is oriented at the creation of tool systems for the preparing educating and controlling systems, their complete software, modelling systems, educative games, etc. It's worth to mention, that most widely there are developed the software on natural sciences (physics, radio electronics) and foreign languages courses. Under the Ministry of Education there is a fund of software. The basic aim of the fund is to carry out the examination of the developments in the field of information technologies and their introduction in educational process.

4. INFORMATION TECHNOLOGIES IN THE SYSTEM OF SECONDARY EDUCATION

The creation of the national system of teaching the basis of information technologies application started in 1985, in the framework of the federal programme. First of all it was based on the introduction of the new subject "The bases of informatics and computers" in the existed curriculum.

The lack of the school teachers of the new subject caused the involvement of the teachers with the different level of informatics knowledge, various fundamental education and working experience. Within the period of two years (1985 - 1986) on the base of universities and pedagogical institutes there was organised the mass pre- and in-service training. In 1985 pedagogical institutes started to train teachers of informatics.

During the first six years the school subject of informatics developed in the republics of the former USSR in common directions and by the common programmes. The school course of informatics pursued the following objectives:

- the forming of student's notions about computer information technologies and their role in society's development;
- providing students with the simplest skills of using computer information technologies.

The achievement of the educational aims in the course *The bases of informatics and computers* was stipulated by learning the programming languages and their application in the solution of computing problems. The passed years witnessed the considerable progress, made in providing students with the skills of programming, and as the result was the successful participation of the Belarus students in the different Olympiads on informatics.

The development of computer hardware and software revealed the necessity of changing the content and the structure of informatics teaching at school.

The analysis of the teaching experience of the course *The bases of informatics and computers*, of computer hardware and software resources, of society's needs revealed in its turn the necessity of the division the process of students digestion the basis of computer literacy at school:

1. VIII -IX forms - the basic course, providing the minimum of student's general educational skills and knowledge.
2. X-XI forms - the specialised students training in informatics, different in its volume and content, depending on student's interests and school

resources.

In order to innovate the content of the course, in 1993-1994 there was developed and introduced the programme of the new basic course, called *Informatics.* The objectives of the new course ware almost the same, but the means of their achievement had radically changed. The content basis of the course consisted not of the programming languages, but of the universal programmes for information processing: text processing, computer graphics, DBMS, spreadsheets, etc.

The programme strengthened a general educational aspect of subject. The basic notions of the course are *computer, information, data processing, algorithm, model.* In 1994-1995 there ware published new textbooks for the course. Now, the specialists are working out the complete methodological set.

In 1995 there were developed the programmes of the specialised courses on informatics for the students of the 9th-10th forms with the extended training in informatics, in mathematics, physics and economy. There was started the preparation for the work with these programmes.

Nowadays, those who are involved in the process of secondary information technologies introduction in education, are solving the following problems:

- the equipment of the fundamental schools of general education (nine years schools) with computer hardware (today, the level of school equipment makes up only 6 % of the demanding level);
- teachers training for fundamental schools;
- the equipment of the specialised schools with up-to-date computer hardware and software;

At present, the situation with information technologies application in the educational system is determined by the three following factors:

- hardware;
- software;
- a professional level of the specialists in information technologies application in the field of education.

Nowadays, computers are used at school to form the basis of informational culture, to form students' skills of the practical work with computer and applied software. 84 % of the available computers allow to realise a basic course of informatics in practice. However, we should obviously take into consideration the fact that computers are more and more often applied as an educational tool in the process of learning the general educational and specialised subjects. And in this context, the capacity of the today available computers, installed in a mass school, is not sufficient. In this connection, educational institutions and organisations are oriented at the application of the IBM-compatible computers.

5. INFORMATION TECHNOLOGIES APPLICATION IN HIGHER SCHOOL

Higher school hardware is based on IBM-compatible computers. The modern multimedia computers are still rare nowadays. However, the software meets the level of the latest world developments.

The mass character of any technical innovation introduction in education depends on the evaluation of its three parameters:

- application effectiveness (reduction of time for studding, increasing of the efficiency of education, the reduction of irrational student's mental work activity);
- convenience of application (the reduction of student's work volume, the low level of special background, the innovation reliability in the educational process, correspondence with the aims of education);
- availability (the availability of purchasing and servicing).

In the present conditions the mass character of information technologies introduction in the system of education of the Republic first of all is restrained by the low level of availability, related to the present financial support of the educational system. The lack of the technical support stipulated the poverty of the other parameters (effectiveness and convenience), though it is also connected with psychological aspects: teachers are not ready to use information technologies.

The perspectives of information technologies application in the Republican system of education are first of all related to the increasing of the financial support of this process, to the propaganda of information technologies through the distribution of the information about the latest developments in this field, to the intra-Republican co-ordination of the home developments and international co-operation, to the organisation of teachers in-service training.

In 1995 the quarter scientific and methodological magazine *Information Technologies introduction in Education* started to issue in order to propagate the progress, made in the field of information technologies in the Republican system of education and science.

The number of educational institutions and organisations are involved in the experiments on information technologies introduction in educational process, scientific researches, the management system of education. The specialists of the Belarus State University (BSU) are now intensively working on the creation of an automated control system (ACS) of an HEI on the base of local and remote networks of personal computers. At present there is a computer network, functioning in BSU, which links

40 users and a network training classroom. Within this network the following subsystems of BSU ACS are exploited: *Matriculant, Students, Stipend, Staff, Salary, Fixed Assets , Control over the execution of the orders and directions,* etc. Data bases on servers contain information about every student of the university (including all marks, got during the period of education), teachers and academical staff, fixed assets, which are on the balance of BSU, etc. The subsystems *Matriculant - Students - Stipend* provide the non-paper technology of data processing about the students of the university since the moment of their entering BSU. The working stations are installed in every Dean's and in the Rector's offices. They are used for data processing and updating. The participants of the international workshop *Higher Education in Belarus: international co-operation and development,* held in Minsk in March 1995, where met the representatives of the leading HEI of the republic, pointed out that BSU ACS doesn't have any analogy in the Republic in the complicity of data bases and in the width of covering such an number of different aspects of a university's activity.

BSU consider the introduction of information technologies in librarian system to be one of the most significant directions in the modern computer technologies introduction. It is the field, where BSU has the long and active co-operation with the Moscow State University (MSU). At present the data bases of the library catalogues of MSU and BSU are functioning in the BSU computer network. This fact gains the special meaning in the conditions, when acquiring information and literature, issued in Russia was obstructed because of some reasons, generally of the financial character. Besides, the users of the university network have the access to the data base of the French Institute of Scientific and Technical Information (INIST), which contains the information on more than 4500 periodicals from all over the world. This data base was obtained by the university in the framework of the project, realised within the programme TEMPUS in co-operation with the Joule Vern Picardy University (France).

The University considers that the strategy of information technologies introduction in HEI on the modern stage should be departamental local networks integration into an integral information network, providing its users access to Internet, as well as their access to the bibliographic data bases of the university and other educational institutions. That is the aim of the developing project of the such a network creation on the base of the optical fibre communication lines, permitting to link separate departments of the university.

6. INFORMATION TECHNOLOGIES IN THE SYSTEM OF EDUCATION MANAGEMENT

In 1992 began the implementation of the project of information technologies introduction in the system of education management in the system of the Ministry of Education and Science of the Belarus Republic. This project is realised according to the Resolution of the Collegium of the Ministry of Education of 30 September, 1992, ? 10-n. The head organisation of the project implementation was fixed the Computing and Analytical Centre of the Ministry of Education and Science - the head organisation of the branch in charge of problems of the development and introduction of information technologies in the educational process, scientific researches and control system. The main results of its activity are the following: the development of the base project for the information technologies introduction in the education management system, as well as the development and installation of a local network in the Ministry machine. Now the following projects are realised: *Telecommunication, Documents turnover, Finances control, Statistics.*

The result of the carried out activity was the acquiring and systematisation of the information on the structure of education management system in the Belarus Republic. This information includes organisational structure, information flows, the functional model of the educational system. There was elaborated the programme set called *Document turnover.* the complex was created for the automation of the works, related to controlling document turnover, including document registration, the searching for a document, the route of transportation, control after execution, access control.

The result of the carried out activity in the framework of the project *Statistics* was the development of the complex software for the automation of processing data on the state statistic accounting, acquired from the regional educational departments and submitting educational institutions and organisations. It allowed to increase the efficiency of acquired data processing and of the taken management decisions.

7. COMMUNICATION TECHNOLOGIES DEVELOPMENT IN THE EDUCATIONAL SYSTEM OF THE BELARUS REPUBLIC

Computer telecommunications are the natural continuation of integration trends in the development of informational systems. The combination of computer techniques and means of communication emerge the new computer function - they become a means permitting to widen the scope of the information space of a given organisation, to expand the opportunities of the information interaction up to the scope of a city, region, republic and, finally, to provide entering the world information space.

In this case a personal computer user finds himself involved into a powerful telecommunication infrastructure, he or she becomes an element of a global computer network. The networks of this kind link, through the up-to-date means of communication (individual and switched telephone lines, telegraph network, radio, satellite communication, etc.), tens and hundreds of users, information resources, centres of data processing, separated from each other by thousands of kilometres. The global networks are covering schools and governmental establishments, public organisations and research centres, commercial companies and universities, etc.

The global networks are covering almost every country in the world, every sphere of one's activity. They don't have any boundaries and any censorship. Most of the networks are connected between themselves creating a global integral information space. The subscribers of a global computer network gains access to the world market of information services. The modern information market can be conditionally divided into several correlative areas.

1. INFORMATION.

Here, different types of information are represented. The sector of scientific and technical and special information comprises: bibliographic and reference information in every field of fundamental and applied sciences, education, culture and other fields of human activity; access to the originals through libraries and specialised services; provision of the opportunity to acquire text data, full size copies, micro-movies and origins, using inter-librarian subscriptions; professional information and special data for teachers, physicians, engineers, etc.

The sector of consumer's information comprises news and mass media information, references, encyclopaedias, mass character and entertaining information, oriented at home consumption instead of business one: regional news, weather forecast , transport time-tables, etc.

2. ELECTRONIC COMMUNICATIONS

The two systems of human interaction - individual and business - should be marked out on the market of electronic communications. First of all it is e-mail, providing quick transmitting and receiving different types of data (text and graphic information, software, data base fragments, etc.). It gives an opportunity to automate almost every operation of processing individual and business correspondence. E-mail laid down the foundations for the so-called teleconferences: mutual exchange of topical information between users - teleconference participants. The means of electronic communication permit to issue electronic newspapers and journals, to organise electronic advertisement desks and bulletins, clearing houses for publicly accessible software, etc.

The structures of all computer networks are similar and represent a system, formed by terminals, units and communicational environment (channels and communication lines). Network structure is implemented with regard of the discipline of connections and topology (geometrical structure).

The computers of national and international units, interacted into one network, offer their users the following services:

- access to remote data bases, programme libraries and applied processes;
- collective usage of the computing resources of network unit computers;
- massages exchange in the interactive regime;
- e-mail services.

At present, a lot of global networks and informational centres are functioning on the Belarus territory. They have different organisation and technique. The most significant among them are:

BelPAK - The state network for data transmission. It has the national status. It is based on the application of the protocol X.25. This network, as the other analogical national networks for data transmission in other countries, offers a powerful technical foundation and a wide range of universal services.

EUnet/Relcom - A commercial international network, offering the services of e-mail, teleconferences, access to Internet, Usenet, etc.

GlasNet - A public non-commercial international network, offering, first of all, e-mail services.

Sovarm Teleport - A powerful commercial network, offering rather expensive services of access to Internet and other networks, which are kept in with protocol X.25.

CITEC - A commercial information system. In fact, it represents the enhanced electronic advertisement desk BBS.

BASNET - The network of the Belarus Academy of Science. Besides servicing the Academy's organisations and institutes, it offers the services of e-mail and access to international networks.

At present, the mentioned networks do not offer the full size direct exit to global networks of Internet. This exit is realised ether through e-mail, which doesn't provide an opportunity to use the on-line regime in the work with information systems, or through protocol X.25, which emerges some technical problems, reduces throughput and increases the price.

One of the most developed computer networks of the Belarus Republic is the non-commercial network UNIBEL. It integrates the leading educational and scientific organisations of the Republic, offers the wide range of correspondingly cheap services. The main aim of UNIBEL is to provide access to the global community of Internet networks for the organisations of social sphere on the non-commercial base.

UNIBE network is a part of common scientific and research computer network (SRCN) of the Belarus Republic. The general system principles of it are the following:

1. SRCN should represent a complex of information and computing networks of the establishments, institutes and organisations, working in the field of education, science and culture. The complex should be based on the abidance of the common system of protocols and rules. The rules and protocols should be based in their turn on the world standards and should define the order of information creation, processing, storing and transmitting, as well as the order of using computing resources.

2. SRCN should be created on the base of supporting networks of different ministries and institutions of the Belarus Republic, on the preferential conditions for the budget organisation of communication channels.

3. SRCN should be organised on the condition of the maximum application of resources of the existing institutional networks.

4. There should be provided co-ordination of the projects, aimed at the creation of local systems and means of data transmission. These projects are the part of the national programme of information technologies introduction in the Republic.

5. In order to acquire access to international computer networks, and consequently to the information of different data bases, there is a necessity to strengthen the co-operation with such well-known organisations, as Executive Secretariat of CIS (Minsk), DFN (Germany), NASK (Poland), NORDUnet (Norway), SSC (Sweden), OSI (USA).

The creation of UNIBEL network pursues the following objectives:

- the overcoming the disconnection between universities, institutes, scientific centres, laboratories, groups of researchers and separate scientists, teachers and students. To provide them with the opportunity of free informational exchange;
- the solution of the problems related to the dissemination of new ideas, scientific results and publications in the field of education;
- the following general technical policy in the field of information technologies introduction in the educational system of the republic. It will allow to increase the efficiency of using the resource of an educational institution and of the concrete worker of education and science. It will provide the opportunity to use efficiently the national informational resources of the Republic;
- dissemination of information technologies; education and popularisation of computer telecommunications in the field of education.

The further stage in the development of the UNIBEL network is supposed to provide the full access to the services of the Belarus national network of data transmission BelPAK and of the other networks, created on the application of the protocol X.25. It is expected to provide the access to the complete set of the services of the protocols X.400 and X.500 and the other ones and of the standards of the pattern model of open system interconnection (OSI).

The development of the UNIBEL network is implemented in the following directions:

- the closer co-operation with the network of the administrative control system after the educational system of the Republic; the creation of an integral republic network on their base;
- promoting long term information programmes, first of all on the base of attaching to the network the largest libraries, archives, centres of scientific and technical information and the expert service of the Republic;
- the development of the connections and realisation of mutual programmes with scientific and research organisations (branch and academical);
- gradual attaching to the network the system of secondary special education and secondary schools, non-state educational institutions;
- attaching (the direct and through BelPAK) governmental and public organisations, funds, etc.;
- the organisation on the base of the central unit of the Centre for specialists training and an inter-HEI research laboratory of network technologies.

Today, the number of foreign organisations and funds are promoting the creation and the development of the educational and scientific network of the Republic. The Institute of the Open Society (USA) gave Belarus a grant for the creation of an optical fibre ring around Minsk - MINSK INTERNET PROJECT. The implementation of this project provides our educational institutions and scientific organisations with the full access to the global computer network Internet.

There was gained a grant from UNESCO for the attachment to the computer network of the educational departments of the Regional Executive Committees of the Belarus republic. Our activity was promoted by NATO Scientific Committee of the informational filling of the creating network.

The creation of a real information infrastructure has only started in the Belarus Republic. However, people realise that, that information is an extremely valuable and perspective commodity, and the information market is one of the most dynamic and roomy. Nowadays, many governmental, commercial, scientific and public organisations are promoting their activity in the field of computer communications and information technologies on the whole.

Regarding the considerable scientific and technical, educational and industrial resource of the republic, Belarus has real chances for the soon entering the world information space and becoming the competent member of the world community of global computer networks of Internet. In order to achieve the objectives, Belarus should increase the efficiency of the educational process through the wide application of information technologies.

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NATIONAL REPORT OF BOTSWANA

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES: THE CASE OF BOTSWANA

1. INTRODUCTION

Computers are becoming more and more common in all aspects of life. They are simply tools that help to be more productive. More and more jobs require applicants to be familiar with computers. As this new technology of computers has become so pervasive and thus more prevalent in everyday life and in the workplace, use of computer has gained in importance over the computer itself. Botswana like other countries has recognised the need to increas the technological background of its people to complete better in world markets. The new Education Policy is based on the general goals as stated in the Revised National Policy, which are to prepare Botswana for the transition from a traditional Anglo-based economy to the industrial economy to which the country aspires. The industrial worldwide economy is driven by Information Technology, which uses computer technology to process, analyze and communicate information in an increasingly efficient and effective way. Thus the contemporary society must be computer aware and likewise and workforce to make the best use of Information Technology. Computer technology, when used in education, encourages the development of problem solving, analytical and research skills. The revised National Policy on Education of 1994 has therefore made a call for the inclusion of a computer awareness programme as a requirement in all Community Junior Secondary Schools.

Botswana tertiary institutions are also commited to the provision of computer awareness courses for their students.

The introduction of the programme within the basic Education Structure ensures a basic level of computer competence for most, and in the long run, all young people throughout Botswana. Tomorrow's world of information Technology is one where information handing skills will be needed to improve the standarts of learning and living. The world is becoming connected electronically by the Internet world wide network through which we can all share information. The computer Awareness programme aims to incorparate section on Telecommunication later, when the time is ripe to enable young Botswana to use this giant network to communicate with the rest of the world.

2. REVISED NATIONAL POLICY ON EDUCATION

The development of the Computer Awareness Programme for the Junior Community Secondary Schoools was prompted by the recommendations made by the Revised National Policy on Education og1994. The process of the syllabus development was started with a consultancy which looked into the logics to be considered in the development and implementation of the programme. The consultancy consulted widely and reached out to a variety of stakeholders.

This is a new programme which is designed to inroduce pupils to the use of computers as tools which help to increase productivity by automating a lot of tasks undertaking in the world of work. Unlike a typewriter document, the computer generated document can be corrected without having it retyped, and this increases productivity. The intent of the programme is not to produce computer experts out of the students, but to give them computer literate. The programme will give them the basic skills to enable them to pursue computers studies without being intimidated by the computer.

The computer awareness programme is not a stand alone programme, but has to be infused into the other subjects in the school curriculum. It should be divided into global topics or modules as follows.

Computer skills

Productivity tools:

- word processing spread sheets
- databases
- graphics will have to be taught prior to the use of productivity tools.

The basic skills i. e. computer skills and keyboarding skills have to be created in order to accommodate this part of the Computer Awareness programme. The productivity tools will then be taught and used within other subject areas. These cannot be taught during specified times but they are best learned through practice over a period of time. The aims of the Nine Year Basic Education Programme are commited to the integration of computer skills as exemplified in the part that follows.

3. AIMS OF THE TEN-YEAR BASIC EDUCATION PROGRAMME

On completion of the Ten-year Basic Education Programme students should have:

1. *Developed compentency and confidence in the application of computational skills in order to solve day- to-day problems.

2. Developed an understanding of business,

everyday commercial transactons, and entrepreneurial skills.

3.Developed critical thinking, problem-solving ability, individual initiative, interpersonal and inquiry skills.

4. Developed desirable attitudes towards different types of work and the ability to assess personal achievement and capabilities realistically in pursuit of appropriate career/employment opportunities/possibilities and or further education.

5. Acquired knowledge, skills and attitudes in food production and industrial arts for self-reliance and self sufficiency.

6. *Developed awareness, and or literacy and understanding of the signififcance of computers in the world of work.

7. Acquired knowledge and understanding of their environment and the need for sustaining utilisation of natural resources.

8. Developed desirable attitudes/behavioral patterns in interacting with the environment in a manner that is protective, preserving and nurturing.

9. Acquired knowledge and understanding of society, appreciation of their culture including languages, traditions, songs, ceremonies, customs, social norms and a sense of citizenship.

10. Developed the ability to express themselves clearly in English, in Setswana and a third language both orally and in writting, using them as a tool for further learning and employment.

11. Acquired the basic science knowledge and knowledge of the laws governing the natural world;

12. Acquired a good knowledge, practice of moral standards and helth practices that will prepare them for responsible family and comunity life.

13. Developed their own special interest, talants and skills whether these be dexterity, phisical strength, intellectual ability, and/or artistic gifts.

14. *Acquired and appreciation of technology and technological skills including basic skills in handling tools and materials.

15. Gained the necessary knowledge and ability to interact with and learn about their community, the government of their country and the world around them.

*Note: The asterisks show the items associated with computer awareness.

4. OTHER RECENT DEVELOPMENTS

Recently a Task Force has been appointed whose main aim is to develop the syllabus that is to be used for computer awareness programme. The Macintosh Computer has been identified as the most appropriate computer to be used for the awareness programme. Four zones were established to provide maintenance as shown in Figure 4.1.

Table 4. 1

Established Zones for the Provision of Maintenance

Zone	Areas	Response Time
One	Gaborone and around	4 hours
Two	Lobatse, Molepolole	12 hours
Three	Mahalapye	24 hours
Four	Maun, Kasane, etc.	Bring in

To keep pace with the Information Technology explosion, the University of Botswana has developed awareness courses so as to provide its students with the required skills. The Faculties of Social Science and Humanities offer compulsory computer awareness courses to all their students.The Faculty of Education and Teacher Training institution likewise, are considering to fall in the same footing with the other Faculties of the University in providing their students with computer awareness courses. All these developments regarding the provision of computer awareness as both the secondary and tertiary levels is gradually gaining support from the Government of Botswana as indicated by recent policies.

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NATIONAL REPORT OF BULGARIA

I. CURRENT STATE OF TEACHING INFORMATICS AT SCHOOL

In 1981 the production of 8-bit Apple compatible personal computers was given a start. At the end of 1984 the Government took a priority decision to create conditions for training the youth in working with computer-based equipment. Following the State policy a new compulsory subject - Informatics - was introduced in the upper grades of the high school, vocational schools and high technical schools since the school year 1986/87.

Those three factors reflected the urgent social needs and speeded up the process of immersion of computers and information technologies in the Bulgarian Educational System. Although, these were necessary, they were not sufficient conditions for running the hardly-known and specific in kind Training in Informatics. Normal and effective realization of the educational processes leading to acquiring and using the computer and the information technologies in the social practice requires the presence of a system of mutually related didactic factors. Until 1986 no didactic system that could be widely used in the Bulgarian schools, existed for teaching of Informatics.

Despite the lack of experience (both Bulgarian and foreign), the Ministry of Education introduced Informatics as a compulsory school subject from the school year 1986/87 within the following restrictive conditions:

1. Informatics was introduced as a general compulsory subject. It started from the second term in the 10th grade (second year of the vocational and high technical schools) with two hours per week (for the total of 34 hours) and continued in the 11th grade (third year of the vocational and high technical schools) again with a two hours a week. The total number of hours allocated for Informatics in the curriculum was 98.
2. Schools were equipped with at least ten 8-bit Apple compatible personal computers, while not all of them with peripherals (disk drives).
3. The programming language was BASIC, and the Operational System was DOS 3.3

With the available technical, software and methodical facilities existing by that time in schools, the three developed and implemented variants of subject contents were restricted to studying the following topics:

1. Introduction in Informatics.
2. Principal structure of the computer and the computer system.
3. Algorithms and ways of expressing them.
4. Introduction in programming.
5. Drawing geometric figures and shapes and animation.
6. Data. Type of data.
7. Data Structures
8. Basic informational activities and algorithms for inputting, outputting, actualizing, processing, finding and sorting.
9. Stages of problem solving by means of computers.
10. Utilization of the computer and the information technologies for problem solving through computers.

During the first stage (1986 - 1991), the introduction of the subject contents is related to the computers and the information technologies and was motivated, introduced and acquired mainly in the process of solving a suitably chosen (by the authors the actual text-books by that time) system of specific problems.

The existing conditions, the ideas of the authors and the chosen educational strategy led to a groundless domination of programming in teaching in Informatics during the first stage of its introduction in the Bulgarian school.

It is known that the study contents reflects the level and needs of the economical, social-political, cultural and scientific - technical level of society. The deep social and political changes and the economic crisis in Bulgaria in the beginning of the nineties, affected the educational system.

Though slowly, the attitude and the aspirations of society towards education were changed. A tendency is observed towards decline of society' interest in education, that are expressed in the following:

- reduction of the relative share of funds, allocated for education from the national budget
- lack of motivation and common attitude of the youth towards the general and vocational training.

In the conditions of an economic crisis the educational system is gradually being re-oriented and reset in accordance to the changes taking place in the society:

1. Symptoms of decentralization have appeared, expressed in the emergence of private schools.
2. Since 1992 a new curriculum has been adopted, according to which part of the study time (number of hours per week) is used in conformity with students' interests and the priorities of the specific school.

As far as organization is concerned, the variable part of training is accomplished in classes through:

- compulsory elective preparation;
- profile training;
- free-elective training.

In the comprehensive schools in the 9th and the 10th grades the subject "Technologies" is studied. The subject contents is specified locally in accordance to the profiled technological trends, chosen by the relevant school.

3. The Ministry of Education, Science and Technology promotes a tendency for decreasing the relative share and level of the theoretical component of subject contents in the comprehensive schools

and increasing of potential possibilities of the study contents for acquiring skills, abilities and methods of learning.

The new curriculum dramatically changed the approach of allocation and use of teaching hours in Bulgarian schools.

The following is regulated for each grade in the curriculum:

1. Compulsory subjects and their weekly horarium. The number of these subjects and study hours defines the General Compulsory Training (GCT) for the students from the specific grade.

2. The number of hours per week, used obligatory for expanded study of one or a couple of disciplines. These are the hours for "compulsory elective training" (CET). The number of hours per week for the GCT plus the number of hours for CET specify the compulsory study time per week.

3. The number of hours per week, that can be used for additional training range. These are the hours for "free-elective training" (FET). In order to carry out a FET, groups of students (occasionally from different classes) with similar interests should be formed. The FET is not compulsory by nature and is carried out when supplementary funding is available.

4. The number of study weeks.

5. Scheme of allocation and usage of the study hours in GCT, CET and FET.

The CET appears in the curriculum with 2 hours per week in the 9th grade. In the upper grades the hours for CET are gradually increased.

IMPLEMENTATION OF THE TRAINING IN INFORMATICS

The new curriculum and the tendencies for development of the secondary education, launched by the Ministry of Education, Science and Technology offer possibilities for a differentiated introducing of subject contents, related to computers, Informatics, and its implementation in the various forms of education, existing in the schools:

1. Non-profiled education in general secondary and high schools.

1.1. Informatics is part of the GCT. It is studied in the 11th and 12th grades with 2 hours per week. Practically though, training in the subject in the 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

1.2. Part of the hours for CET can be used for training in Informatics. The number of hours and subject contents are specified locally for the school and the different groups in accordance to:

- equipment (hardware and software) in the computer classroom;
- teachers qualification;
- students' interests and potentials;
- orientation of the school.

1.3. In the frames of the GCT in the 9th and 10th grades the school subject "Technologies" is studied with the total horarium of 140 hours and under the following specific conditions:

- availability of at least seven 16-byte (or more powerful) personal computers;
- suitable software;
- qualified teachers;
- willingness of the students and the school authorities.

The study time defined for the subject could be used for acquiring some concrete information technologies knowledge in word processing, data base, spreadsheets, etc. at the relevant textual or graphical interface. Training is done on a modular principle, in study programmes approved by the Ministry of Education.

2. Profiled training in general comprehensive secondary and high schools

In the form of profiled training students choose (in 9th grade) and study (since 9th to 11th or 12th grade) extensively three school subjects, called the first, the second and the third profiling subjects. The name of the profile and its course are specified by the first profiling subject. In 9 - 11th (12th) grade hours for the CET are distributed according to a certain scheme between the three profiling subjects. Thus the number of hours for the GCT in the profiling subjects is increased and conditions for their extended and intensified study are provided.

When graduating high school, school-leaving examinations (matriculation) in two profiling subjects are taken.

2.1. Studying Informatics as a profiling subject

In this case training in Informatics and its implementation is carried out in:

- GCT in Technologies (Information Technologies) in 9th and 10th grades, in a total horarium of approximately 140 hours;
- the hours for profiled training in Informatics, that are formed from the GCT Informatics plus a part of the hours for CET in 11th and 12th grades.

2.2. Studying Informatics in a profiled training, when no profiled subject is chosen.

In this case Informatics is studied only in the frames of the GCT, with two hours per week in the 11th and 12th grades. Practically, training in the subject in 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

3. Training in Informatics in vocational and high technical schools

3.1. The compulsory general-educational training in vocational and high technical schools does not include training in Informatics.

3.2. The vocational training in some types of high-technical schools includes training in Computer Science and/or Informatics and its implementation. For example:

- all students in high technical schools in economics and high technical schools in trading study the subject "Informatics and computers" for the total of 140 study hours. Some specialties in these schools - "Machine processing of information" and "Business and administration" study Informatics and computers extensively or in other school subjects;
- vocational training in high technical schools in electronics includes the following subjects - "Programming" (approximately 140 hours), "Microprocessor-based equipment" (approximately 120 hours) and "Software applications packages" (approximately 70 hours).

3.3. Part of the study hours (classes) for CET (compulsory elective training) in the vocational and the high-technical schools can be used for studying and acquiring computer hardware, Informatics and Information Technologies. Training takes place where there is hardware, software, a teacher and most important - willingness in the students.

Equipment

1. In the period 1986 - 1989 computer classrooms were set up in almost all secondary and high schools in Bulgaria. They were equipped with 8-byte Apple compatible personal computers, but not all of them had floppy-disk drives.

2. In the period 1988 - 1992 some schools changed their equipment entirely (through self-funding or centralized purchasing) with home-made personal computers "Pravetz 16" (IBM XT compatible).

3. In the recent years the Ministry of Education has allocated almost nothing for the modernization and upgrading of the computer equipment. Schools are supplied with computers through self-funding, following an initiative of their own. The restricted sums given at their disposal force the schools to buy mainly particular, usually second-hand units. That is why a significant part of the computer classrooms were equipped with hardware and software that is different in kind and type, which makes specification of study contents and the actual training with up-to-date tools and means quite difficult and rather frustrating.

4. During the last 2 - 3 years some Bulgarian schools were supplied with high-quality up-to-date software at preferential conditions or as donations from world-known software companies, the Open Society Fund, or through International Educational Programmes.

4.1. Twenty-five computer classrooms and one Centre for Teachers' Qualification are equipped with 7 - 8 Macintosh computers (mainly LC II and LC III models). They are using the Bulgarian version of System 7. Basic education is carried out with the integral package Claris Works.

4.2. In May 1994 started the fulfillment of the contract "Educational Initiative of IBM for Bulgaria", signed between the Ministry of Education, IBM and Open Society Fund. Under the patronage of that very contract IBM practically granted 240 personal computers to Bulgarian schools as follows:

- 28 pieces IBM/APTIVA/486/DX/66
- 196 work-stations IBM/APTIVA/486/SX/25

This equipment supplied 27 modern computer classrooms in schools and one Centre for Teachers' Qualification. Open Society Fund completed the equipment in the classrooms by multimedia accessories, laser jets, modems and last versions of software. The Fund, the schools and the Ministry of Education allocated funds for the special training of teachers, working on the initiative.

In conclusion, it can be pointed out that by the end of 1995 almost all secondary and high schools in Bulgaria had their computer classrooms. Unfortunately most of the hardware and the software is old-fashioned and worn out now. This can be seen from the approximate data given below:

- 70% of computers in the classrooms are 8-byte, Apple compatible, with, or without disk drives;
- 21% are IBM XT compatible;
- 4% are IBM AT 286 or compatible;
- 3% are IBM 386 and IBM 486 or compatible;
- 2% are Macintosh computers, mainly LC II and LC III models.

Subject Content

The subject content in Informatics is determined in each concrete school, class or group, according to the curriculum, the interests of the students (identified through the choice of compulsory electives or free electives), the equipment and software available and the expertise of the teachers in the school. The wide range of factors influencing teacher and student activities in the classroom call for variety in choosing the subject content. The concrete topics, their scope and depth, and the structuring of the subject content is done by the teacher on a modular basis. Teaching the different modules follows syllabuses designed and approved by the Ministry of Education, which act as broad frameworks.

1. Subject content within the core curriculum.

1.1. When the school has provided only 8 byte PCs (with or without floppy discs), the subject content in Informatics is being introduced in the process of solving appropriate sets of tasks (or problems) and generally covers the following themes:

- introduction in Informatics;
- algorithms, basic algorithm structures and ways of describing them;
- introduction in programming (Basic or versions of Logo in Bulgarian are explored);
- Database. Type of data. Symbols, logic and numeric types of data. Compound types of data - one-size bulk (Basic) or linear lists (Logo);
- Basic algorithms for input, output, accumulation, search and sorting information;
- Drawing out geometry figures. Moving simple geometry objects;
- Applications - DOS, electronic sheets or word processors.

The following software is in use in schools:

- File study system - a didactic tool for introducing and learning topics related to creating, editing and data processing saved on files;
- Programmme study environment in informatics - it is an adapted programming environment which imitates the basic opportunities available with MS DOS, study text editor and symbol editor.

1.2. When the school provides 7 16-bit PCs at least (or more powerful than this type), learning Informatics is organized in two stages:

- theory - within a school term;
- applications - word processing, electronic sheets, database, graphic design, etc.

Bulgarian versions of widespread and used software are used - Word, Lotus 1, 2, 3, DBase, etc.

2. When Informatics is among the subjects in the group for extended study, about 60% of the time (over 180 teaching hours) is set for compulsory study of the following topics:

1. Structure and basic elements of the

computer. Classifying. Historical ,information.

2. Arithmetical and logical basis of computers. Countable systems. Representation of information in computer memory.

3. Algorithms. Properties. Ways of describing. Programming languages.

4. Operational systems. mS DOS;

5. Algorithms and programmes (PASCAL).

5.1. Outlines of PASCAl.

5.2. Simple data types.

5.3. Basic algorithmic structures.

5.4. Compound data types.

5.4.1.Array. Basic algorithms.

5.4.2. Records. Basic algorithms.

5.5. Procedures and functions.

5.6. Recursion.

5.7. Problem solving with the aid of computers.

5.8. Files. File types. Basic operations. Algorithms for working with files.

About 40% of the teaching hours is devoted to introducing and learning the subject content, determined in the schools. The topics to choose from vary within:

1. Application of Informatics in mathematics - using the Plane Geometry System GEOMLAND.

2. Programme packages - word processing, electronic sheets, database, computer graphics, etc. under DOS and /or Windows.

3. Numeric methods. Close equation problem solving. Close functions.

4. Combinatory algorithms.

5. Dynamic data structures - lists, stacks, tails, dual trees. Basic algorithms. Applications.

II.COMPUTER SCIENCE IN THE SECONDARY SCHOOLS - TODAY!

1. INTRODUCTION

Whenever we treat and discuss the future of teaching Informatics in the secondary school, no doubt we have first to pose the problems and to report the results obtained in this field today. That is why our report is concentrated on those problems, approaches and methods used at present which will be applied to teaching Informatics in the secondary school in future as well.

The implementation of computer technologies in modern society is unthinkable without well educated people in this field and no doubt this sort of education should start in the secondary school. Some of the basic notions of computer science and computer applications are studied in Bulgarian secondary schools in the Informatics classes.

Those who study Informatics as a subject according to the curricula offered by the Ministry of Education, namely ({1,2}, {3,4}, {5,6}, {11,12}, {13,14}) are supposed at graduating from the secondary school to have acquired knowledge on:

- computer hardware, principles of computer operation and some computer applications;
- some types of software and the ways of using a certain operating system in order to write and execute simple programs and programming systems;
- the main methods of coding and representing data, some data types and data structures, the principal management structures. In addition, pupils are expected to be skilful in creating algorithms and programs for solving some unsophisticated problems.

2. USING MODULES AS A METHOD OF TEACHING INFORMATICS IN THE SECONDARY SCHOOL AND AN INTRODUCTION TO THEIR IMPLEMENTATION

The process of introducing Informatics as a school subject in secondary school in 1986/87 was accompanied by some problems which we could summarise as follows {15}:

- As a "new" subject, Informatics had to "be inserted" in the high school curriculum among the other, well established subjects, which naturally resulted in decreasing the number of classes in some of them. Some of the experts in the Ministry of Science and Education adopted a negative attitude towards the new subject which led to a multiple shifting of the place of the classes in Informatics in the curriculum from one grade to another and to a crucial decrease in their total number. That inevitably resulted in destabilising the attitude of most teachers, primarily mathematicians. The latter insisted on classical teaching of Mathematics pleading the new Textbooks and School Aids to be introduced in other school grades within another syllabus.

Also we cannot assume that "blurring " Informatics knowledge into Mathematics classes is a successful attempt. As an argument we can point out that not all Mathematics teachers have the qualification needed to teach Informatics as well and for this reason we could hardly expect any achievements in teaching Informatics in this way.

- The available computer technique (both in quantity and quality) does not prerequisite a general and unified Informatics teaching, even when the education is integrated. This impression could hardly be influenced substantially by the recent changes in equipping some schools with new computer classes. One of the possible ways to solve the problems caused by the great diversity in teachers' qualification, in the computer technique available as well as the very lack of computers in some schools, is to teach Informatics at two levels, namely:

- *first level* - all pupils graduating from the secondary school should acquire an obligatory minimum of Informatics knowledge;
- *second level* at which the knowledge acquired by the first one is upgraded by including additional knowledge which may vary in topics and in volume depending on the desired professional qualification of pupils and on the hardware and software available. The teaching materials supporting such an education could also be created according to the module principle. The idea of module approach is a prerequisite for differentiating Informatics teaching

with the obligatory minimum as its lowest boundary and with a free upper boundary which may vary according to the desires of pupils and the hardware and software available.

The changes of the syllabus for specialised and non-specialised education in the secondary school introduced recently have shown in practice how Informatics might be taught in different ways.

The textbook "Informatics II" {6} is an attempt to illustrate the real implementation of this idea; it comprises some modules {7}, {8}, {9}, etc. oriented to practice. Next follow the basic parameters of three of them. The modules given are TEXTPROCESSING, SPREADSHEETS and DATABASES and they comprise three modern, popular and simple (as far as the hardware required is concerned), programming systems, namely WORD, LOTUS 1-2-3 and dBase III+ in their Bulgarian versions. The modules are unified in structure and reveal both the basic and the specific facilities of the systems under consideration. Also some practical examples have been given so as to illustrate how these systems can be implemented for solving real problems. Each topic ends with a Topic Summary. Next follow the main topics of the modules:

Textprocessing

I. Introduction to Textprocessing Systems
1. Computer Texts
2. Starting with MText
3. MText Commands
4. First Computer Text and Text Writing and Correcting
5. First Steps to Formatting Texts
6. Text Printing

II. Specific Facilities of Textprocessing Systems
7. Screens, Windows and Operations with Them
8. Table Creating and Editing
9. Calculating Expressions; Text Sorting and Searching
10. Formatting through Masks

III. Implementation of Textprocessing Systems
11. Staff File of a Company
12. Mail Automation of a Company

Spreadsheets

I. 1. Introduction to Spreadsheets Management Systems
2. Starting with MPlan
3. Creating Spreadsheets
4. Editing Spreadsheets
5. Fields and Operations with them. Addressing
6. Additional Information about Calculations in MPlan

II. Some Specific Facilities of Spreadsheets
7. Displaying Spreadsheets Data
8. Business Graphics in MPlan
9. Databases and Spreadsheets
10. MPlan mosaic ... or Something else about MPlan main Commands

III. Implementation of Spreadsheets
11. One Hundred Levs Today is More Than One Hundred Levs Tomorrow
12. Each Loan is Paid Back with Interest

Databases

I. Introduction to Database Management Systems
1. Databases
2. Relational Systems
3. Starting with dBASE
4. Creating a Main File
5. Up-dating a Database
6. Using Restrictions at Processing a Database

II. Some Specific Facilities of DBMS (Database Management Systems)
7. Sorting and Indexing Files
8. Operations with Two Main Files
9. Introduction to Programming in dBASE
10. Management Structures in dBASE

III. Implementation of DBMS
11. A Card-Index of Addresses and Telephone Numbers
12. Stock Control of a Store for Building Materials

3. INFORMATICS AS A SCHOOL-LEAVING EXAMINATION SUBJECT

The problems mentioned above have already been solved and standardised for the cases when Informatics is studied as a chosen obligatory or specialised subject. The Ministry of Education approved a syllabus for that type of education in 1993 and in May 1994 a Textbook was approved by anonymous competition {10}.

Principal ideas observed when writing the textbook

The classes of Informatics envisaged are 216, distributed as follows:

- classes for new lessons about 70
- exercises in class about 40
- drills and practice in a computer classroom about 90
- tests about 5
- revision about 10

a) Structure of the textbook.

The textbook consists of Introduction, where some historical notes are given, four Sections and a concluding part. Each Section covers several topics comprising one or more lessons. Wherever possible lessons begin with some examples or problems. Thus an introduction to the root of each topic is made. The basic headings of each topic are:

- autotests;
- questions and answers;
- topic summary

The autotests comprise one or more problems enabling students to test what they have learnt by themselves. Thus some additional problems whose solutions are given at the end of each topic are added to the lessons.

b) Why PASCAL is chosen as a programming language in the textbook?

PASCAL is a universal programming language. The first idea of its author, Professor N. Wirt, has been to use this language as an educational one. The passed twenty years have shown that he was right. During that period PASCAL has proved not only to be the most taught programming language but also the one most often used in different programming systems. Probably this is due to the fact that it is:

- a programming language with a wide scope of problems which can be solved through it;

- a structural programming language;
- a module programming language;
- a standardised programming language ;
- a language supplied with relevant media for programming on almost all models of large computers, mini- and microcomputers.

c) Didactic features of the textbook.

The main guiding principles at creating the different methodological units of the textbook have been systematisation, consecutiveness, scientific rigour, simplicity, visuality. New notions are introduced relying on pupils' intuition and wherever necessary they are formally defined as well. Topics are ordered so as to enable the implementation of the following three parallel types of activities:

- teaching new lessons;
- class exercises;
- practice in a computer classroom.

d) Brief content of the textbook.

The History of a Dream which Became Reality - instead of an Introduction

1. Mathematical Foundations of Computers;
Numerical Systems;
Predicate Algebra
Algorithms
2. Computer Systems
Structure of Computers
Operating Systems
Programming Media and Applied Systems
3. Introduction to Programming
Structure of a PASCAL Program
Numerical Data Types
Use of Standard Subroutines
Conditional Operator. Boolean Data Type
Loops
Character Data Type. Multiple Choice
Simple Types: Completion and Generalisation
4. Subroutines and ...Data Types:
Functions
Procedures
Arrays and Character Strings
Computer Graphics and PASCAL Programs
Recursive Definitions and Programs
Records
Files

How Fast Can Computer Programs be Run? - Instead of Conclusion

School-leaving examination in informatics.

Pupils will sit for a school-leaving examination in Informatics this year. Naturally they feel excited and embarrassed. What will a school-leaving examination topic in Informatics look like? Though there exist a number of opinions in this field, the problem is not clarified yet. Let us even add another one.

The school-leaving exam in Informatics will consist of two parts called conventionally theoretical and practical.

The theoretical part will be a written exam consisting of a test and a problem. The problem will be formulated so that its solution should be written as a PASCAL program. The topic for the written exam will be one and the same for all graduates and it will be given by the Ministry of Education, Science and Technologies.

The practical part of the exam will be absolutely independent of the theoretical one. It will aim at testing the actual skills of pupils to implement a certain applied system, for example, a textprocessing system, spreadsheets, a DBMS, a computer graphics system, etc. The use of different hardware and software in high schools will hamper the formulation of a unique practical topic at first. Teachers might be given the opportunity to prepare these practical topics in the form of exam tickets. If the number of computers in a school is not sufficient, the practical part of the school-leaving examination might be carried out in several consecutive days but it should precede the written examination and only pupils who have passed it would be admitted to the theoretical one.

Next follow some problems which might be items of a test included in a topic for a secondary school-leaving examination. More detailed information about tests in PASCAL can be found in the journal "*Mathematics and Informatics*, 1994 {see 16}. In 1995 on the pages of the same journal under a new heading called Info Secondary School Leaving Exam will be published some exemplary topics for such an exam.

Three hot points.

1. No more than 10% of the high schools in the country possess 16-bit PCs. Then, can we talk about Computer Free Informatics in the secondary school in Bulgaria at all? Does not this percentage mean that studying Informatics without computers in the secondary school is still a hot problem?

Note: The authors of this paper make a distinction between the notions of "Computer Free Informatics" and "Studying Informatics without Computers"

2. Are the 11th and the 12th grades the most appropriate ones for studying Informatics? How could we introduce new technologies in schools if future teachers do not face the problems of Theoretical and Applied Informatics while being school or university students?

3. The obligatory minimum of Informatics to be covered by pupils in the non-specialised schools is not formally determined yet. This is an essential obstacle for teachers and especially for pupils who would like to sit for a secondary school-graduating examination in Informatics. There are such pupils.

WHAT ABOUT TOMORROW?

Informatics as a school subject is entirely dependent of computer (hardware and software) technique available in high schools. That is why no essential changes are expected in the near future. But since the necessity of implementing information technologies is undoubtedly growing, then the position of Informatics in the secondary school will be strengthened. And if we have to answer the question "*What shall we do tomorrow*", the reply inevitably will be: *Tomorrow we are going to implement what we experiment today in secondary school and in training future teachers in Informatics.*

III. INTEGRATING INFORMATION TECHNOLOGIES IN THE HIGH SCHOOL CURRICULUM

I. DEFINITION OF THE NOTION OF INFORMATION TECHNOLOGIES

The term *information technologies* is comparatively new. It became popular in the 80s and in the early 90s in connection with the rapid development of microelectronics and the implementation of personal computers in administration, economics, technology, etc.

In general, the term *information technologies is used to denote the set of technical devices, tools,* methods, knowledge and skills required for data processing.

Thus defined, the scope of the notion of *information technologies* is very wide. Since we are interested in the specific purposes and problems of education in the high school, further on information technologies would mean computer-based information technologies in the high school defined as follows:

Technologies related to developing and/or using software products and systems for computer-based automation of the main information processes (compiling, processing, displaying and distributing data).

This definition is used to narrow the scope of information technologies to those used in the secondary high school and it enables us to determine some educational criteria.

Next follow some corollaries of these definitions:

1. Technologies directly connected with hardware and its elements are excluded from the high school syllabuses (they are not supposed to be studied in high school).

2. *Primarily ready-made software products* are to be studied, in the secondary high school since we suppose that most pupils should be well qualified users of computers and some often used software packages such as textprocessing systems, spreadsheets, DBMS, etc. In this case information technologies appear to be an object of studying in high school and they are not treated as a tool through which this process is optimized (as a tool for optimizing this process)

3. Except as an object of studying, some information technologies can be treated as a tool for optimizing the learning process in some school subjects.

4. The scope of studying information technologies in high school is reduced to those which presuppose an extensive use of computers (the computer-based ones). Thus the basic idea of studying information technologies in the high school is concentrated on training pupils to be skillful in working on computers, i.e. to become well-qualified computer users, who on the one hand, can operate with the most often used representatives of software packages and on the other hand, are capable to learn by themselves how to use some new software products.

Is such an education necessary for pupils in high school?

In my opinion - yes, because nowadays, the use of computers in the above-mentioned manner *becomes an element of mass culture typical for the* end of the 20th century (due to the implementation of PCs) and it is no more (it is far from being any more) an occupation of special groups of experts.

That is why from now on the problem will be not whether to study computer-based information technologies but what and how should be studied - topics, their volume, methods, organization of the learning process, etc.

II. SOME POSSIBLE SOLUTIONS FOR ORGANIZING THE EDUCATION IN INFORMATION TECHNOLOGIES

The possible ways of organizing the study of information technologies in high school are two - either through integrating them into the school subject of Informatics or by separating them in another subject.

In the second case the study of Informatics should include some fundamental knowledge in information technologies as well, but at a more principal, conceptional level, while education in the other subject should focus on implementations and applications.

What is the present situation in the high school?

Informatics is studied as a school subject in the 11th grade of the high school twice a week. The syllabus envisages pupils to acquire knowledge on some fundamental notions of Informatics and some information activities and processes; on algorithms and their representation; on some essential constructions of a given high level programming language and to use them to write some elementary programs. Also, in addition, pupils are supposed to get some idea about the essence and the functions of the operating systems and the description of the functions and structures of the main types of software products such as textprocessing systems, spreadsheets, data bases, data base management systems (DBMS), etc.

Evidently, pupils could hardly acquire any stable practical skills for operating with software products with such a curriculum and for such a period of time and probably that should not be the main purpose of studying Informatics in the high school.

Starting from 1993/1994 the curriculum envisages studying information technologies as a school subject twice a week in the 9th and 10th grade of high school.

A special guide for studying information technologies in high school was worked out in 1994/1995.

In conformity with this guide and with the general guide for the organization of work in high school in 1994/1995, each school could choose the concrete trends and technologies to be covered by the school subject of information technologies. Thus information technologies could be one of the probable choices and some syllabuses for them had been worked out.

Does such an approach to the organization of education give any advantages?

In my opinion, yes, because it is up to each school to judge and choose to study information technologies. But they should meet some requirements concerning the number and model of computers available, the qualification of staff, etc. At present asking all the schools to study information technologies as an obligation might fail because of their inadequate conditions in school computer studies.

III. GOALS, ORGANIZATION AND SYLLABUS OF THE EDUCATION IN INFORMATION TECHNOLOGIES

The main goals of education in information technologies are as follows:

1. To enable pupils to acquire knowledge and skills needed for using computer systems and ready-made software products in different fields of economical and social life.

2. To help pupils in the high schools for natural sciences and Mathematics to extend and deepen their knowledge by applying some special information technologies to studying other school and special subjects.

3. To stimulate pupils in the specialized classes in Mathematics in combination with those in Informatics to get knowledge in programming and to use modern programming media in creating applied software products.

A main organizational approach to fulfilling the above-mentioned aims is the creation and development of separate modular syllabuses in information technologies to be approved by the Ministry of Education and each school might combine them in one or two-year course in information technologies, according to its profile, or through including them in the extracurricular or optional subjects.

Education in information technologies should be based on the names of concrete information technologies and types of syllabuses, approved by the Ministry of Education. Education in other syllabuses or other information technologies may be accomplished only in extracurricular or optional classes but only if the school meets the relevant computer and staff requirements.

The principle of the obligatory minimum of required computers and teachers is observed when permitting education in a certain information technology and these requirements are described in the relevant syllabus so as to avoid education where no adequate base is available.

Education on each module terminates with pupils' course reports which aim at testing their knowledge and skills acquired on the respective software product.

Types of syllabuses had been worked out for the following modules in 1994/1995.

Names of the information technologies for which there are syllabuses	
1. Operating Systems with Text Interface	36 classes
2. Textprocessing	36 - " -
3. Spreadsheets	36 - " -
4. Databases	36 - " -
5. Computer Graphics	36 - " -
6. Information Technologies for Research in Mathematics (for mathematical investigations)	at least 36 - " - minimum

A module of 72 classes or a combination of two modules of 36 classes, chosen by the teacher form the syllabus for a school year.

It is planned to work out syllabuses on: programming techniques; numerical methods; operating systems with graph interface; network and multi-user operating systems; pre-printing systems; graph processing; multimedia; information technologies in education, etc.

The planned variety of concrete information technologies aims at enabling schools which have the equipment and teachers needed to make their choice according to the profile of the school and pupils' desires.

IV. SURVEY ON SOME OTHER EDUCATIONAL PROJECTS AND MODELS

I would like to review the work of the two centres for training teachers founded in conformity with two different agreements.

These centres are located in the Department of Information Technologies at the Faculty of Mathematics and Informatics at the University of Sofia.

In 1993 a Centre for Training Teachers to work on Macintosh was founded according to an agreement among the Ministry of Education, the Department of Mathematics and Informatics at the University of Sofia and the company "Bulgarian Business Systems" in connection with equipping some with Apple-Macintosh computers.

In the summer of 1995 an IBM Centre for Training Teachers was founded in cooperation with IBM Bulgaria and the Fund Open Society under the terms of the contract "Educational initiative of IBM in Bulgaria".

The goals, the work and the perspectives of the IBM Centre are treated in details in the report of Mrs. Iliana Nikolova. I would like to add that the Ministry of Education considers that the activity of these two centres and especially the work on "Educational Initiative of IBM in Bulgaria" might be a good chance of experimenting with some models of organization and interaction in the field of School Informatics and the application of information technologies to studying other school subjects in some schools, namely: developing and experimenting some syllabuses and educational projects, creating a system for permanent training of teachers, on their working places as well - through modern systems of communications, connecting the schools they work in and the educational centres.

If, in this two-year period of work with the agreement with IBM, some useful school projects and models of organization occur, they could be submitted to the Ministry of Education for approval and further implementation in high school.

At present a project for implementing the well known system "GEOMLAND" in the High Schools for Mathematics and Informatics and in some other specialized classes has been worked out. In the beginning ten High Schools for Mathematics and Informatics and some specialized classes in different schools in the country would participate in the experiment.

In conclusion, I would like to point out that further study and use ofinformation technologies in the learning process would inevitably develop with the growth of their applications to different fields of economic and social life. This perspective and the equipment of schools with modern computers and tools would result in some more efficient changes of the organizing the process of education in the high school related to widening the scope of studying and using information technologies in the high school.

IV. STUDYING INFORMATICS IN THE MATHEMATICAL SCHOOLS IN BULGARIA

In 1970 several schools specializing in Mathematics - the so-called Mathematical schools- could be found in Bulgaria. Informatics was started, being taught together with an increased number of lessons in Mathematics. At that time courses of Numerical Methods and Programming were presented. At the end of the 1970s computer laboratories using computers type IBM-360 were present in some of these schools. In 1983 the pupils in the Mathematical schools were given the opportunity to specialise in Computer science as "Operator-programmers for computers".

It is known that teaching Informatics depends to a large part on the computer equipment. In this connection the present study focuses on teaching Informatics in the Mathematical school in Plovdiv which has traditions in this sphere. This school is known to be outstanding with:

- its own computer laboratory, the first of its type in Bulgaria established in 1975;
- its computer laboratory on the basic of APPLE-computers first found in the country in 1982;
- its teachers - authors of textbooks and curriculum in Informatics for the secondary schools, etc.

At the present time the Mathematical school in Plovdiv has 4 computer laboratories with 68 IBM PC computers, 1 laboratory with MACINTOSH computers, 1 laboratory with BBC computers and a lab in Robotics. Informatics is studied every year in this school - from the first-preparatory class to the end. In the first four years of education the pupils have two Informatics lessons a week.

The program includes:

•Introduction on Using a Computer;
•Introduction to Operating Systems;
•Introduction to Text Processing;
•Introduction to Working with a Spreadsheet;
•Introduction to Robotics;
•Introduction to Programming in BASIC and PASCAL.

In the final year of education the emphasis is on the professional training of the pupils as Operator-Programmers for computers. This training includes 470 teaching hours. The working plan for school terms and subjects is as follows:

Professional Training	I Term	II Term	Lessons
School Weeks	17	15	
1.Theoretical Training:			
1.1. Programming and Algorithmic Languages	5	3	130
1.2. Operating Systems	2	1	49
1.3. System and Applied Software	-	5	75
2. Practical Exercises:			
2.1. Programming and Algorithmic Languages.	2	2	64
2.2. Operating Systems.	2	1	49
2.3. System and Applied Software	-	3	45
3. School practice			60
Total:			472

Thematic Plan: "Programming and Algorithmic Languages":

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
I. Introduction to Programming		
1. Historical data. Algorithms and programmes. Programming languages. Classification. Metalanguages. Solving problems with the help of a computer.	3	-
2. Basic objects in the programming languages-identificators, variables, expressions, arrays, functions.	3	1
3. Operators in the Programming Languages. Sub-programmes. Structure of the programmes.	4	1
II. Algorithmic Language Pascal		
1. Introduction to the Pascal language-historical data, alphabet, key words, integer and real numbers, strings. Structure of the programmes in Pascal, classification of the operators. "Turbo Pascal 7.0" system.	8	2
2. Data types in Pascal.	3	2
3. Constants, types and variables.	4	2
4. Standard functions.	5	3
5. Expressions.	5	5
6. Input and Output in Pascal.	5	5
7. Driving Operators-IF .. THEN .. ELSE, CASE, FOR, DO..WHILE etc.	15	8
8. Procedures and functions.	15	8
9. Records, Files, Sets.	15	10
10. Additional functions of the "Turbo-Pascal" System 7.0.	15	10
III. Programming Technology		
1. Programming style.	4	1
2. Program design.	10	2
3. Program verification.	8	2
4. Program documentation.	8	2

The basic textbook used is: *Informatics with Pascal,* Pavel Azalov, Fanny Zlatarova, Sofia, 1994.

Thematical plan "Operating System" (OS)

Name of the Theme	Lessons: Total Number	
	New knowledge	**Exercise s**
I. Introduction to the OS		
1. Operating systems-role, importance, types.	2	-
2. Stages of development of the OS.	1	1
3. Basic functions of the OS.	4	2
II. Functions of the operating system MS DOS		
1. Starting MS DOS.	1	2
2. File system.	2	4
3. Command classification.	1	1
4. Command description:		
4.1. Commands for working with directories.	3	3
4.2. Commands for working with files.	3	5
4.3. Commands for working with disks.	3	4
4.4. Other commands.	3	3
5. BAT Files.	3	3
6. Service Programmes.	3	2
III. Other Operating Systems		
1. Operating System VMS.		
1.1. General information.	1	-
1.2. File system.	3	1

1.3. Terminals. Command characters.	-	2
1.4. Starting VMS.	1	2
1.5. A general format of the commands.	1	-
1.6. Basic commands.	5	2
1.7. Exit of the system.	-	1
1.8. File editing.	1	1
1.9. Basic work schemes.	1	1
2. Operating system Apple DOS		
2.1. Basic commands.	2	2
2.2. Sequential files.	2	2
2.3. Direct files.	3	3
2.4. Other functions.	2	2

The basic textbook used is *Operating Systems for 11th Class*, A. Hachikyan, A. Rachnev, K.. Garov, Sofia, 1990.

Thematic plan: "System and Applied Software"

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Mathematical and Logical bases of the computers-number systems, logical operations and functions, realisation and application of the logical functions, logical schemes.	8	4
2. Representation of the information in the computer memory and operations with it.	15	4
3. ASSEMBLER for IBM PC.	15	10
4. Applied Software.		
4.1. Working with Database. Working with "WORKS" package.	15	10
4.2. Text processing. Text processor WORD.	12	10
4.3. Spreadsheets. Working with the spreadsheet LOTUS.	10	7

At the end of the school year the pupils work out and defend their projects in Informatics.

The extracurricular work in Informatics is very-spread in the Mathematical Schools. Talented pupils are organised in study groups. A system for working with talented pupils in the Mathematical School in Plovdiv has been functioning for 20 years. Here is a thematic plan for working with talented pupils in Informatics.

Thematic plan for working with talented pupils in Informatics

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Numeric problems-arithmetic of the real numbers, computing of formulas. Fibonacci, Bernoulli and Stirling numbers.	8	8
2. Arrays, matrix algebra, sorting and searching, polynomials.	10	10
3. Geometry and Programming.	10	10
4. Data structures-stacks, decks, tables, hashing methods.	15	15
5. Elements from the theory of the Graphs.	20	20
6. Combinatorial algorithms.	15	15
7. Methods for constructing algorithms.	25	25
8. Algorithms and games.	15	15
9. Numerical methods.	25	25
10. The Theory of Coding. Fano, Shenon, Huffman codes.	15	15

Besides the participation in the Olympiads in Informatics every talented pupil works upon a particular problem in Informatics and prepares a report. Here we offer a list of such reports which gained prizes at national conferences and competitions.

"*MDL-System for Processing Mathematical Objects*"- a system for input, support and processing of the mathematical objects. The programmes are written in Turbo C and Scheme Lisp.

"*OOEP-Object-Oriented Extension of Pascal*"- that is a language extension of Pascal by means which show the main characteristic features of object-oriented languages. The programmes are written in Turbo C.

"*A Program System for Modelling 3-*

Dimensional Objects." - a graphic system for modelling 3-dimensional objects.

"An Information System for Computer Service of Bridge-Tournaments"-this system was used at the European youth championship in 1989 in Plovdiv.

"Interpretator Lisp-8 for Computers APPLE-8".

"Program Model of the Post Machine and its Application in the Lessons in Informatics."

"A Package of Programmes for Computer Teaching in Mathematics,Biology, Chemistry."

"Program System for Working with Polynomials"

The analysis of the results of our pupils shows that the Mathematical Schools train young people who can successfully use the modern Information Technologies.

V. THE STATE-OF-THE-ART IN INFORMATICS EDUCATION IN THE BULGARIAN SCHOOLS AS PROVIDED BY THE IEA COMPED SURVEY

INTRODUCTION

Teaching informatics at school has a long history and tradition in Bulgaria. The first steps were made in the late sixties when some optional informatics courses were taught for secondary school students in mathematics and in vocational schools. In 1979 the Research Group on Education (RGE) under the Bulgarian Academy of Sciences and the Ministry of Education started an experimental teaching of informatics in twenty seven schools both at elementary and secondary school level. Informatics has been taught as a compulsory school subject for all secondary schools in Bulgaria since 1986. The procedure for introducing computers into the secondary schools, the relevant stages, objectives and tasks, were part of a Program for the implementation of computer technology, was worked out and approved by the Higher Council for Education at the Ministry of Education in Bulgaria in 1985. Since then a large number of computers have been delivered to schools, a compulsory course on informatics has been introduced in all secondary schools, several informatics textbooks have been published, a great number of teachers have passed computer education courses, many scientists and university teachers have done valuable research in the field of computers in education. However no significant research on present situation in using computers in education has been undertaken in Bulgaria so far. The International Association for the Evaluation of Educational Achievements (IEA) Computer in Education (Comped) Study, Stage 2, gave us an opportunity to draw up a realistic picture about application of information technologies in Bulgarian schools and to compare it with the situation in the other participating countries.

1. SOME GENERAL FINDINGS OF COMPED STUDY

The study showed that the integration of computers in classroom practice is being impeded by obstacles of which the most important are [1]:

- lack of good educational software;
- restricted access to computers at schools;
- teachers do not receive enough support and do not have the necessary training for computers to play a meaningful role in the classroom.

The IEA has drawn a number of conclusions from the study:

a) Having a computer at school does not mean in itself that it will be used regularly in the classroom. The effective integration of computers into lessons demands more time and targeted activities, such as the provision of information on the added value of integrated use of computers, software development and training. It can already be concluded that progress will be slower than originally anticipated when computers were first introduced into schools.

b) It is essential that teachers receive full training and support and that more hardware and software is available.

c) For students who do not have a computer at home, the school is an important provider of equal opportunities to learn about information technology.

National educational systems will have to work hard to keep pace with the social changes caused by further digitalisation of information flows. There has been a striking increase in the availability of computers at school in recent years but the computer is still marginally used as a tool for teaching and learning.

Schools, parents, and policy makers should be aware of the differences in knowledge and attitudes between boys and girls towards using computers. Lack of familiarity and experience with computers could be socially disadvantageous for girls.

Any participating country could benefit a lot by analysing the data available according to its concrete needs so that to answer many questions related to computer education. Some findings based on the analysis of Comped data made by the International Co-ordinating Centre [3] and by the Bulgarian Comped research team follow.

2. ACCESS TO HARDWARE AND SOFTWARE

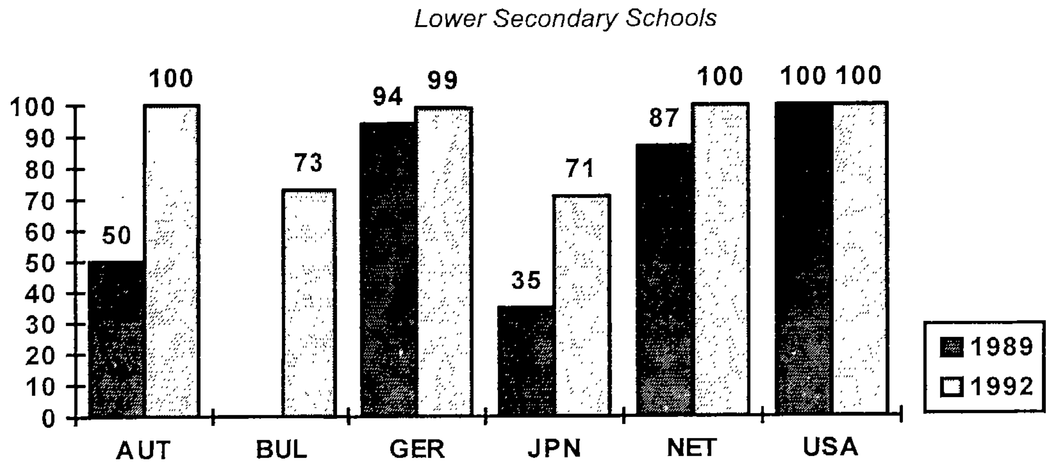


Figure 1

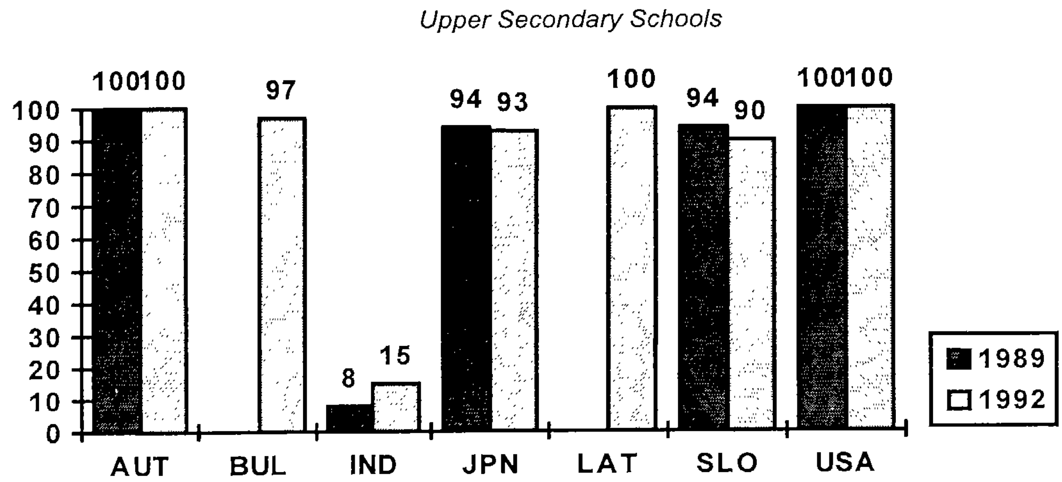


Figure 1 (cont.)

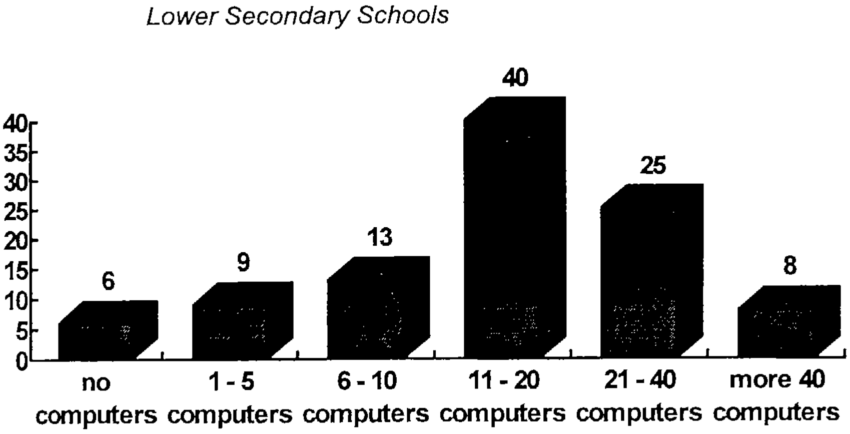


Figure 2.

Upper Secondary Schools

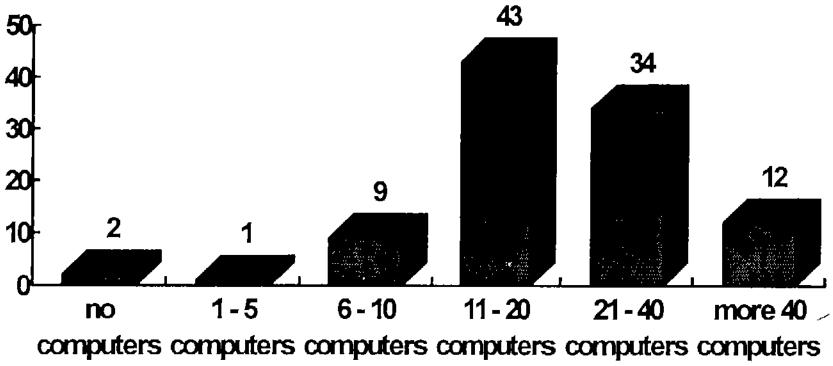


Figure 3.

As it could be seen from Fig. 1 the percentages of Bulgarian schools having computers in use for instructional purposes by the end of 1992 are: 73 % at LSS and 97% at USS. Only in Austria, the USA, and the Netherlands (at LSS) and in Austria, the USA and Latvia (at USS) all schools are supplied with computers. Fig.2 and Fig.3 show that most of the schools both in LSS and USS have more than 10 computers available and can rely on a well equiped computer laboratory. The median number of computers at computer using schools in Bulgaria is 17 in LSS and 18 in USS.

Table 1

Country	School + Outside	Only School	Only Outside	Not	At Home	Hours
Lower Secondary Schools						
AUT	62	28	6	4	43	5.2
BUL	15	24	14	47	5	4.9
GER	59	18	16	7	58	7.0
GRE*	55	41	1	4	31	5.5
JPN	13	19	24	44	21	1.9
NET	60	17	16	6	57	4.0
USA	74	21	2	3	51	2.1
Upper Secondary Schools						
AUT	62	26	7	7	53	4.7
BUL	18	61	2	20	6	5.6
IND	2	6	3	89	1	4.4
JPN	23	26	16	35	27	2.3
LAT	27	53	3	17	11	6.6
SLO	40	29	12	19	28	4.2
USA	77	19	1	3	51	2.2

Notes:*Students in computer using schools only.

All data mentioned above give the impression that the Bulgarian schools are very well supplied with computers. However in order to find out the real access of students to computers we could analyse Table 1 which shows that many of the Bulgarian students (e.g. 61% at USS and) rely only on using computers at school while a great number of the students do not have access to computers at all, e.g. 47% in LSS and 20% in USS. Another indication of the real access of students to computers is the availability of computers at home. Only 5% of the students in LSS and 6% in USS in Bulgaria report that they use computers at home. According to this indicator Bulgaria is far behind the well developed countries. It is behind the other Central and Eastern European countries participating COMPED - about 28% of the students in Slovenia and 11% of students in Latvia in USS report of using computers in school. The reported high number of computers in LSS are mainly due the fact that a lot of the Bulgarian schools are so called Unified Secondary Schools and they comprise students from 1st to 12th grade, i.e. these schools cover both LSS and USS level and the students there share the same equipment. Great problem for our schools is the quality of the school computers. As it can be seen from Fig. 4 and Fig. 5 about 30% of LSS and 39% of USS report that they have more than 6 computers out of order. The percentages of computers with 16 bit processors offers a good indication for the extent to which the schools keep the quality of their equipment close to the recent technological developments. According to this indicator (see Fig.6) Bulgaria is at the last place among all participating countries - the mean percent of 16 bit computers is only 3% for LSS and 4% for USS. The quality and variety of computer peripherals are also quite low in the Bulgarian schools. Very few schools have local area networks and the access to Internet or Bitnet is still (almost) impossible. The majority of the computer teachers report that they face problems like: "insufficient peripherals available" (58% in LSS and 62% in USS), "difficulty with maintenance" (66% in LSS and 74% in USS), "limitations of computers" (64% in LSS and 70% in USS), etc.

Lower Secondary Schools

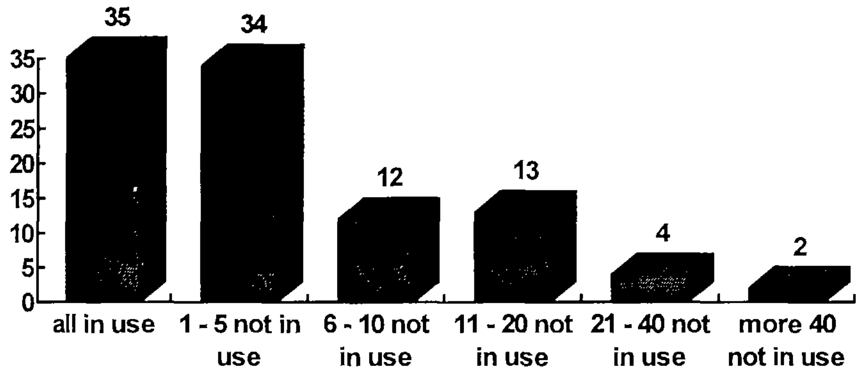


Figure 4.

Upper Secondary Schools

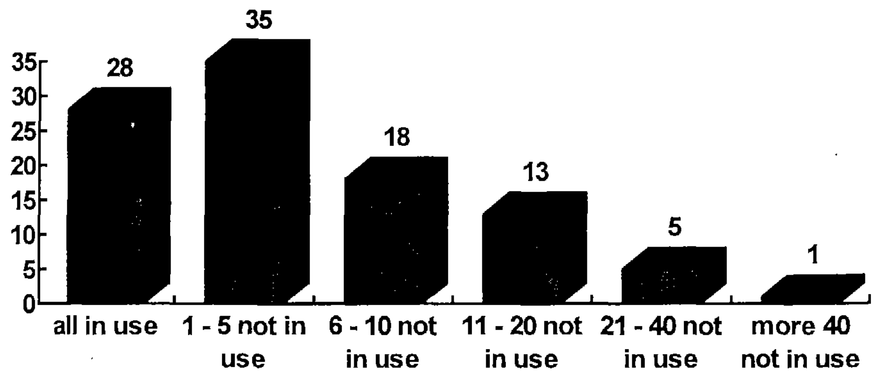
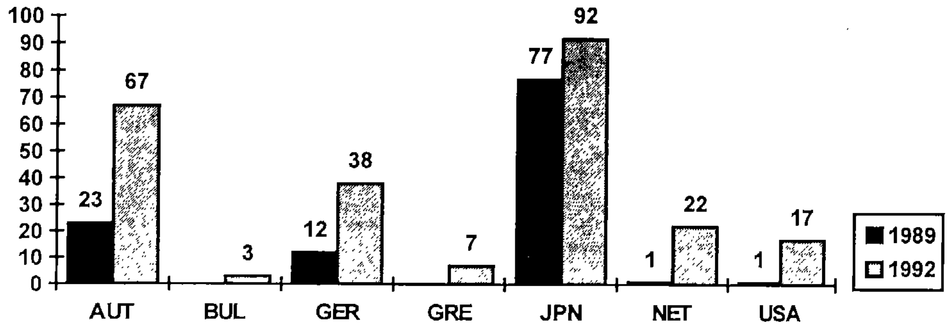


Figure 5.

Lower Secondary Schools



Upper Secondary Schools

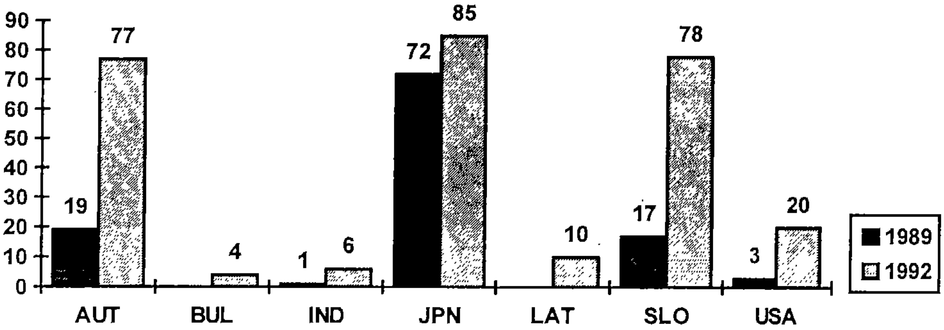


Figure 6.

Although the availability of educational software is reported to be relatively high in Bulgaria compared to other participating countries, 64% of the computer co-ordinators in LSS and 67% - in USS find that "insufficient instructional software" is among the major problems. According to our personal impression and the interviews with school teachers the amount of legal software used at schools is not much and after the Low for Copyright and Author's Rights has been approved by the Parliament the situation is expected to be dramatically changed to worse. The quality of the educational software available or which is possible to be run on the school computers is also very poor and this software is usually written by teachers or by students.

Some conclusions for introducing computers in education in Bulgaria can be drawn:

- there are not enough funds for computer education;
- there are not enough peripheral devices;
- there are many difficulties in hardware support;
- computers are not powerful enough (mainly 8-bit)
- the teachers do not have enough time for computer lesson preparation;
- the teachers face great difficulties in integrating information technologies into other school subjects;
- there is not enough educational software.

A new national computer in education programme should be launched in order to help schools keep the quality of their equipment, software and education close to the recent developments in that field..

3. HOW ARE COMPUTERS USED AT SCHOOL

The information concerning application of computers at school should be interpreted in the context of why schools started to use computers [3]. The reason most frequently mentioned by school principals was: *To give students experience with computers that they will need in the future.* Another reason: *To keep curriculum and methods up-to-date.* was ranked at the second place. Many school principals in Bulgaria (78% in LSS and 84% in USS) consider computers as tools for improving quality and effectiveness of education. This purpose implies a very deep integration of computers in all school subjects and activities. However Table 2 (p.33) shows that computers are used mostly for computer education (*learning about computers*) and a real integration in the other school subjects (*learning with computers*) is still expected in the future. We can also infer that the level of integration of computers little depends on the number and quality of hardware and software available - the students in both well developed and developing countries report that they rarely use computers in mathematics, science, mother tongue, and social studies.

Table 2.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	90	52	78	96	49	78	95	87	81	40	52	80	73	96
B.	71	52	81	71	10	86	67	84	84	51	73	86	90	83
C.	7	13	15	9	2	7	7	2	5	20	2	4	3	6
D.	2	5	M	8	2	M	2	1	4	13	5	2	3	4
E.	5	6	9	8	1	7	9	0	4	8	1	2	0	9
F.	1	M	M	7	1	12	3	0	3	8	1	0	0	2

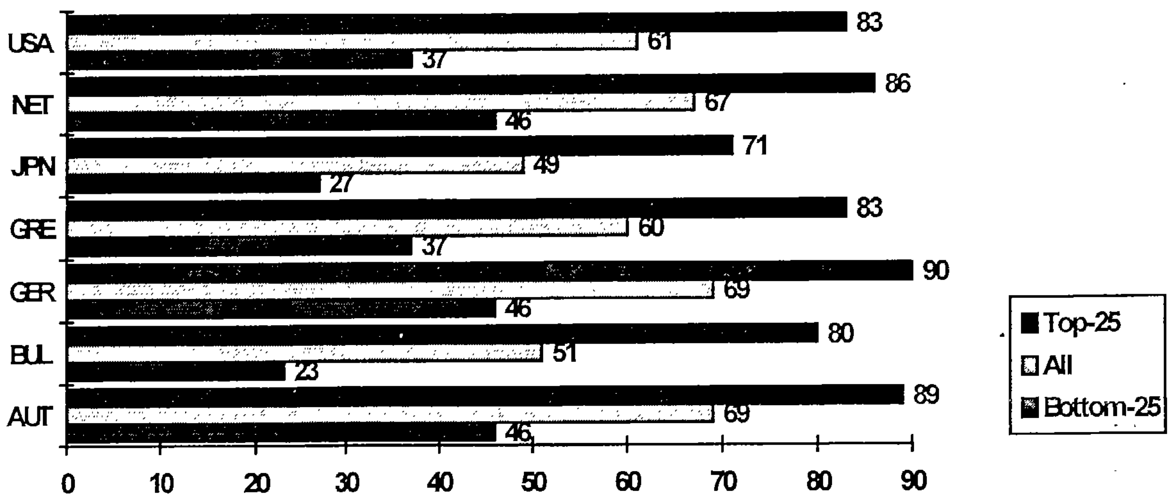
Notes: M = number of valid cases too small (< 250)
or too many missing cases (> 20 %)
The original wording of the computer use/subjects is:
A. Computer used; D.Science;
B. Computer Education; E. Mother tongue;
C. Mathematics; F. Social studies.

In order to clarify the extent of application of different types of educational software the computer teachers were asked to indicate how often they use any of them. It can be seen from Table vvv and Table Www that the *favourite* type of software is tutorial or drill and practice. Application software packages like word-processors, data bases, spreadsheets, simulation, etc. are used rarely by the Bulgarian teachers. For instance about 90% of teachers at both LSS and USS never used spreadsheets, about 90% at USS and 80% at USS never used simulation software, more than 70% at LSS and 50% at USS never used word-processors, about 90% at LSS and 75% at USS never used data bases. Educational software packages for statistics, authoring, item banks, communication, multimedia, etc. are almost unknown at schools. Most of the computer teachers use BASIC as a programming language and about 40% of the teachers at USS report that they use it every period.

The statistics provided above shows a non optimistic picture for computer application in the Bulgarian schools. There is an urgent need of a new national programme for integrating new information technologies in school.

4. STUDENTS' KNOWLEDGE ABOUT COMPUTERS

Lower Secondary Schools



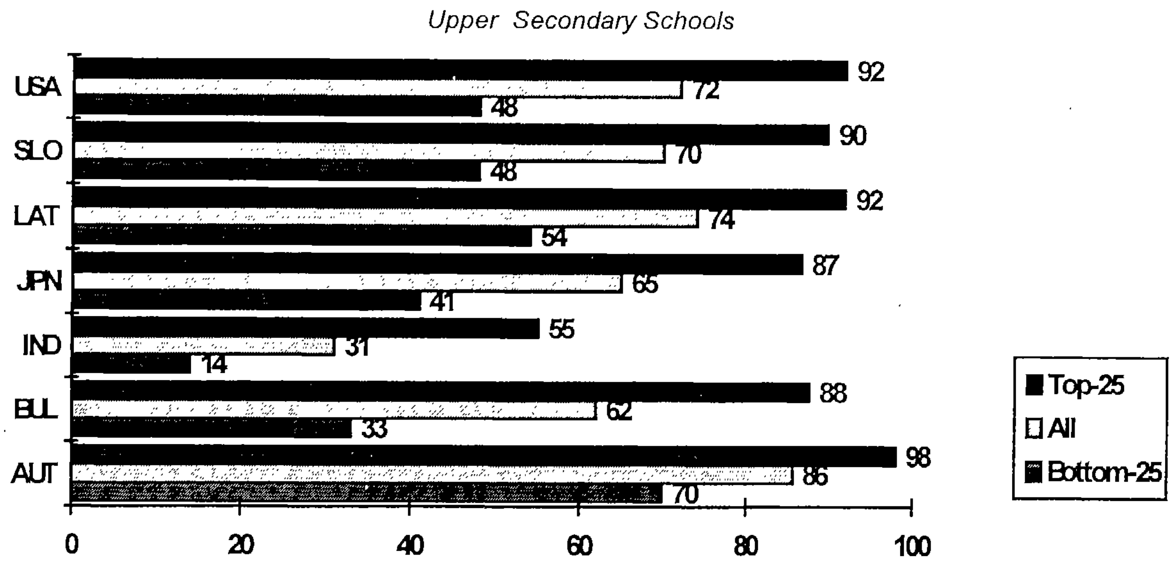


Figure 7.

The level of students knowledge and skills was measured by so called Functional Information Technology Test (FITT). The 30 item test was the same for LSS and USS. The average score of the total sample in the target grade level and for the 25% highest and lowest scoring students as well as the accuracy for estimating the score for the total target population in a country (95 % confidence) are displayed in Fig. 7. As it could be seen from the data the scores of the Bulgarian students both at LSS and USS are holding a lower than the average position. The Austrian students showed highest scores both for LSS and USS. However the test scores do not show only the effect of learning and using computers at school but rather the total experience and knowledge gained within and outside school. The relatively low achievements of the Bulgarian students are due the lack of enough additional sources of information about computers and the low percentages of the FITT topics having been studied in advance at school - 22% in LSS and 47% in USS. The highest correspondence between FITT topics and the content the students have learnt at school is in Austrian schools - 85% in LSS and 94% in USS. For Slovenia and Latvia this correspondence is respectively 87% and 82% (in USS).

The main implication from the FITT for Bulgaria is that the low scores do not mean a lack of learning abilities for Bulgarian students. For instance they are quite successful in the international programming Olympiads. Computer education in Bulgaria should be drawn towards the European standards. In addition better supply of computers, software and other teaching materials should be ensured for the Bulgarian schools as the students can not rely on access to computers outside school.

5. STAFF DEVELOPMENT

Table 3.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	22	59	81	57	9	23	21	42	60	29	15	57	32	19
B.	57	39	31	29	54	16	43	63	36	29	49	24	90	52
C.	25	3	19	4	19	11	29	21	8	3	10	22	33	26
D.	0	1	1	0	0	0	3	0	2	0	3	0	0	5
E.	42	66	13	17	7	47	29	27	74	27	7	49	20	29
F.	6	19	9	19	31	15	11	11	22	7	37	46	20	12
G.	2	1	7	9	21	20	26	2	2	2	14	0	6	40
H.	95	13	23	7	62	80	43	93	21	32	68	M	22	40

Notes: M = information not available or too many missing cases (>20%).
The explanation of the agencies is:
A. Ministry of Education;
B. Local Educational Authority;
C. Teachers of other schools;
D. Parents;

E. Universities/(teacher training) colleges;
F. Teachers associations/ other associations;
G. Business and industry;
H. Support institutions/resource centers.

Teacher training is a key problem for a successful application of computers in education. As it can be seen from Table 3 the highest support for teacher training in Bulgaria comes from universities and other teacher training institutions. For instance the teacher development programme at Sofia University has been providing courses covering the most important aspects of application of computers in education since 1984 [2].During the courses the teachers have access to powerful computers and software and gain self-confidence in experiencing new styles of teaching. Unfortunately their enthusiasm does not last very long. The informal interviews and meetings with some teachers showed that once they returned to their schools and face all the problems - technical, organisational, curriculum, human, etc. - they could not overcome the burden and only a few of them applied what they had learned. During the last few years (mainly due financial reasons) teacher training and retraining courses have been rarely organised. According to the COMPED data the Bulgarian teacher feel lack of enough knowledge about computers and their application - 58% in LSS and 66% in USS report about such problem. They also can not find adequate support and guidelines for instructional use of computers - 59% in LSS and 57% in USS. More than 40% of teachers both in LSS and USS report for lack of enough training opportunities and enough time for computer lesson preparation.

6. CONCLUSIONS

On the basis of the above said the following suggestions for improvement of computer education in Bulgaria could be maid:

- a careful analysis of Bulgarian COMPED data should be made in order to better determine the current problems and needs in the field of computer education;

- a new national strategy for integration of communication and information technologies in education should be developed by taking into the consideration the new economic and social circumstances;

- relevant educational standards in communication and information technologies both for students and teachers should be adopted;

- a new national teacher training programme should be launched for providing continuing teacher education. Some advanced training methods such as flexible and distance learning by means of new information technology should be applied as well.

- following the tendency of decentralisation a network of teacher training and resource centres where teachers can refresh their knowledge, share ideas and experience, keep in touch with new trends in the field, receive educational software and literature, rely on competent help, should be established.

- the co-operation of Bulgaria with other leading in this field countries should be extended and strengthened. For example - the International Programme "Children in the Information Age" should be re-established.

VI. TEACHER DEVELOPMENT SUPPORT IN USING INFORMATION TECHNOLOGIES IN SCHOOLS

1. TEACHER DEVELOPMENT AND INFORMATION TECHNOLOGY (IT)

It is recognised that the teacher's role is essential in the adoption of any change in education. Teachers are the key factor for the successful integration of IT in schools too. Therefore the qualification of teachers to use IT competently in their professional practice is considered here an important task. After an initial training to provide a background in IT and make them aware of the potential of IT in education, teachers need further development and continuing support in the integration of IT into teaching and the learning process.

1.1 Some Observations.

According to recent studies related to teacher education and IT and proved by our own experience, the following are important factors influencing the process of teacher development:

Teacher's motivation: Convincing examples of applying IT in education have to be presented to the teachers. The teacher's efforts to enter a new field and adopt her/his teaching style to a new technological environment have to be encouraged and stimulated. Nationally approved standards for teacher development in IT have to exist [2].

Content of training: Building a basis in IT is necessary [4]. It will help teachers gain competence and feel confident. A balance between theory and practice in their further training - activity-based training taking into account classroom reality - is needed. Teachers have to be able to decide on the content of training and choose their own paths in a flexible training program [3].

Methodology and technology of teacher education: A demonstration of the usefulness of IT is necessary. The technology has to be extensively used in the training process by the trainers themselves. Discussions, reflections and support in generating ideas of what can be done with technology in the teaching and learning process should also be included in the training. Teachers need to develop transferable skills.

Organisation of the training: Flexibility is essential: full and part-time courses, school-based training, "cascade" training [1]. Distance delivery of those could also be a useful option.

Dedicated course managers and tutors: Constant efforts are needed in the process of training and co-ordination of on-going activities.

Continuing support: Teachers need to be supported in their work after the training course. Information resources and consultants have to be accessible. The availability of teacher-supporting materials is important.

1.2 Where are we now?

There are traditions in Bulgaria in teacher-training concerning IT. Mainly higher education institutions offer teacher training programs. Most of them require a mathematics background. The experience gained so far shows some of the problems which have to be taken into consideration:

- *Content:* The training is more theoretically oriented and often not related to classroom reality. Training programs are fixed and do not allow flexibility. Teachers can not decide on the training content.

Technology: Equipment in the training labs usually differs substantially from that in schools.

Course materials: Specially developed course materials for teachers are usually not provided.

Further support: Teachers come and go - the training units are not responsible for further support of teachers after the training period.

One step towards a better match of teachers' needs could be the establishment of Resource and Training Centres, where teachers can periodically update their qualification in a more flexible way, find up-to-date information and get continuing support in the process of their work.

2. SUPPORT OF TEACHER DEVELOPMENT IN THE FRAMEWORK OF THE PROJECT "EDUCATIONAL INITIATIVE OF IBM FOR BULGARIA"

2.1 Description of the Project.

The project "Educational Initiative of IBM for Bulgaria" was initiated in 1994 by IBM-Bulgaria, the Open Society Fund-Sofia and The Bulgarian Ministry of Education and was planned for a period of 2 years. The scope of the project is supporting the integration of computers and information technologies in Bulgarian schools. 28 secondary schools participate: 1 pilot school in Sofia and 27 country schools. These schools have been chosen on a competitive base. Each of them has been equipped within the project with a computer lab: Server (PS/1 486 DX2/66) + 7 Workstations (PS/1 486 SX/25). The software initially installed is: DOS 6.2, MS Windows 3.1, MS Works 3.0, NetWare LITE, LINKWAY.

A Teacher Training Centre with exactly the same equipment has been established at the Faculty of Mathematics and Informatics, University of Sofia, with the task to provide training and support for teachers from the participating schools.

The project activities are co-ordinated by an executive body in which each of the initiators is represented. IBM provides the initial hardware and software equipment. The Open Society Fund supports financially the starting-up activities: a 3-week initial training course for one teacher per participating school; upgrade of the existing hardware at the Teacher Training Centre with additional RAM, printers and screen projection system; the establishment of a library with relevant books, periodicals and software. The Ministry of Education is responsible for the overall organisation of the project activities relating to schools.

2.2 Teacher Development Scheme.

The Teacher Training Centre is hosted by the Faculty of Mathematics and Informatics at the University of Sofia. The main purpose of the Centre is to provide courses, information services and continuing support for teachers. The courses are carried out by the Educational Computer Systems Laboratory (ECSL) which has experience in pre- and in-service training of mathematics and informatics teachers. A project co-ordinator (a member of ECSL staff) is responsible for the overall activities of the Centre.

The teacher training during the first year of the project is planned in two phases: initial and specialised.

2.2.1 Initial Phase

The initial phase consists of a 3-week full-time course, offering a basic acquaintance with the hardware and software installed in each school lab. Such a course will be offered to all school project co-ordinators (one teacher from each school participating in the project). Until now one initial course has been carried out. Here are some details about the course:

Participants' profile: 12 teachers (school project co-ordinators) with a background in Mathematics or Engineering and with varying previous experience in teaching Informatics at Secondary School level.

Duration:3 weeks;

Daily schedule: 6 hours (tutorials and guided practice) + 3 additional hours free practice (with a consultant available)

Programme:

DOS 6.2 - an overview.
Working in WINDOWS 3.1 environment
Working in a Network: NOVEL LITE NetWare
MICROSOFT WORKS 3.0 in Education:
Text processing
Spreadsheets
Database
Integration
Classroom Applications
Computers in Education: Approaches and Methods, Versions of the Curricula adopted by the Ministry of Education
Presentation of Link Way
Closing seminar and discussion

This content of the initial course was chosen by the executive body to ensure that school project co-ordinators would feel comfortable with the available hardware and software and can immediately start working with it as well as helping their colleagues to start. The integrated package

"Microsoft Works" was presented in a project-oriented way and during the course every teacher developed a small project related to some school activity.

2.2.2. Specialised Phase.

This phase will provide more individualised training for school co-ordinators according to their competence, interests and the particularities of their schools. Every teacher will be offered 3 one-week courses until the end of the school year 94/95. To match better teachers' needs and to define the appropriate paths for their further training, a special questionnaire, "Support and Further Training Need Identification Questionnaire", was developed and filled in by the teachers during the initial phase. Here follow some details:

The participants were invited to choose topics for further training among different groups of modules (open questions for suggesting additional modules were also included).

- Suggested Topics for Further Training:
- Learning Environments ("Mathematics", "Geomland")
- Subject-oriented Software (Physics, Chemistry, Biology, Languages)
- Programming Languages (Logo for Windows, Turbo Pascal, Visual Basic, Prolog)
- Theoretical Aspects of Informatics (Program Verification, Program Synthesis)
- Applications (Textprocessing, Graphics, Databases, Spreadsheets, Statistics)
- Desktop Publishing
- Hypertext and Multimedia
- Communications (e-mail based school projects, BBS, global networking)
- Other .

These "self-definitions" of further training needs are useful, but teachers will not be left to determine completely by themselves what they need. It is the training team who will make the final decision about the emphasis in the content of the training and about the style of using IT in education which will be promoted by the Centre. In this sense, creating a feeling and appreciation of using open learning environments will be stimulated. As far as application software is concerned, a project-oriented style will be followed. Teachers will be stimulated to search for cross-curricular projects.

2.2.3. Course materials

The training team has the ambition to provide the teachers with relevant materials in Bulgarian. A set of handout materials was developed by the trainers for each module of the initial course. Each set consists of a reference part (structured information about the module itself) and a methodical part (teaching notes and hints for possible classroom applications). These materials were given to the participants at the beginning of each module. Thus each participant had a handy copy of necessary and useful information to use during the course and take home at the end. This turned out to be essential also for overcoming the language barrier - all the accompanying documentation which schools get, together with the equipment, is in English.

2.2.4. Evaluation.

At the end of the initial course the participants were invited to fill in (anonymously) a *Course Evaluation Sheet*. They were invited to share their impressions, opinion and recommendations as relating to:

Course structure and organisation;

Each module in the programme, according to:

- content,
- teaching performance,
- adequacy, sufficiency and quality of the handout materials prepared by the instructor,

Other comments

This provided a useful feedback and will be taken into account for the next courses.

2.3. Further support..

2.3.1. Studying the needs.

During the initial course the level of competence and needs of the participants was studied on the basis of specially developed questionnaires. The information collected gave the Teacher Centre coordinator an impression of the individual teacher's needs and helped him form a better view of the appropriate future activities of the Centre. Here are some details about the questionnaires:

The *Participant's Profile Questionnaire* is aimed at compiling a project on the participants' database and comprises the following items:

- full address for correspondence;
- current position;
- professional background and qualification;
- track of in-service training;
- experience in teaching and using IT at school;
- areas of competence;
- areas of interest;
- English language skills.

The teachers were also asked about the RESOURCES AND FURTHER SUPPORT by the Centre they would welcome:

- Literature (topics, acceptable languages).
- Software
- Specially developed materials for teachers (to be specified)
- Specially developed materials for students (short references, worksheets, etc.)
- Expectations and suggestions relating to the Teacher Centre's future activities.
- Suggestions on the form of contacts and co-operation with the Centre.
- Other.

2.3.2. Providing Information and Communication Resources.

A small library collection was gathered and made available to the teachers. It contains recent books on Computing and Education, textbooks in Informatics, Reference Guides and Handbooks, periodicals. The next step is to establish a software library.

A telephone "hot-line" is open for the teachers to contact the Centre when problems arise in their own school settings.

Providing Internet connection for the Centre and establishing e-mail links among the participating schools is also a priority task for the near future. A Bulletin Board System could also be a solution for providing information and communication.

3. A CONCEPT FOR FUTURE TEACHER DEVELOPMENT SUPPORT

On the basis of the experience gained so far and the analysis of the filled in questionnaires, conclusions were made and a concept for further teacher development support was developed. It was recognised that Resource and Training Centres (RTC) for teachers using IT is a necessity and it should act as a focal point offering up-to-date information, courses, seminars, discussions, software demonstrations and continuing support for teachers. These should include:

3.1. Information services.

The RTC team has to permanently search for up-to-date information about research and developments in the field of IT in Education. Having an Internet connection and access to relevant publications, international conferences and expert groups meetings is essential. Special arrangements with hardware, software and publishing companies for a regular supply of relevant materials would be helpful.

Inexpensive and reliable communication links between the teachers and the RTC are required: telephone "hot-line", fax, e-mail connection, an RTC newsletter, bulletin board system.

RTC should provide library facilities for teachers. These should not only have books and periodicals, but also copies of diploma theses on relevant topics. A software library must also be maintained.

3.2. Training.

A research approach - integrating research and practice - has to be adopted in RTC [6]. A team of specialists and trainers has to be formed at RTC to discuss and decide on the content of training. A modular training scheme has to be developed [3]. Careful planning for a continuing training is necessary, taking into account the existing pre-service training programs and aimed at establishing a smooth relation between pre- and in-service training. Links and collaboration between MA students in Mathematics and Informatics and in-service teachers can be beneficial.

A *teacher-centred model* [5] has to be adopted - the training scheme must be individualised as much as possible and the support offered must take into account the concrete situation - tasks and school environment - in which the teacher works. Flexible forms of delivery of the courses have to be found - full and part-time courses, optional short modules, school-based training, distance delivery.

3.3. Continuing support.

Keeping teachers informed about new developments in the field has to be an important task of the RTC. This should include discussions between experts and practitioners to find out the most appropriate way of IT application in education as a whole and in a particular setting.

"Listening to the teachers" - the RTC must provide a forum for teachers to express their needs and findings; to exchange ideas, experience and examples of good practice between themselves. This could be done personally (seminars, discussions) or in an electronic form (e-mail, BBS), or through a newsletter.

Building a national human network of specialists and practitioners ready to devote some of their time to help solving teachers' problems would be helpful and useful. Communication in this network should be supported electronically as well.

RTC has to help teachers in the establishment of international contacts for a collaborative work in international educational projects.

Creating a stimulus for teachers and contributing to a higher social esteem (formal and informal) of teachers working with technology should also be a RTC task. Encouraging and supporting future teachers to participate in the development of teacher and/or student-oriented materials and in the development of courseware and educational software could be motivating.

If RTC proves to be successful, local branches in different geographical regions can be established. These could be build around active and future teachers.

VII. THE CONTRIBUTION OF PROSVETA PUBLISHING HOUSE TO THE TEACHING OF INFORMATICS IN THE SECONDARY SCHOOLS IN BULGARIA

There is a long-standing tradition in every Bulgarian family to respect the scholar. Most parents strive to provide as good education for their children as possible. This ambition of the Bulgarian to study was one of the reasons - even 170 years ago when the nation was still under the Ottoman yoke - for publishing a *Primer with different instructions.*

For 50 years every Bulgarian has begun to learn the alphabet from the primers published by *Prosveta* Publishing House. *Prosveta* has published and is still publishing textbooks, supplementary school and methodological books. The publishers strive to publish books with the latest scientific information.

The development of informatics has not missed the attention either of Bulgarian scientists nor of *Prosveta*. The books published on informatics confirm this statement.

We shall trace the publishing of textbooks and books separately in this paper beginning with *Cybernetics and thought* by Konstantin Kostov, which was published in 1969 (1). It is a matter for debate whether to include this book in informatics literature but we have decided to do so since in it, for the first time, thought is discussed as an object of management. Seven years after the subject

Programming was included in the curricula for the mathematical classes in some schools and mathematical schools in 1974 *Algorithms and Their Preparation for Machine Realisation* (2) by Miroslav Ivanchev was published. The book was addressed mainly to teachers of informatics, because until that time a textbook had not been published. The book included short preface on the theory of algorithms and an elementary idea of machine languages and description of FORTRAN IV was presented. The examples of algorithms were related to the already studied material in algebra, geometry and numerical methods.

In 1978 four books were published on informatics. These were among the first books addressed specifically to students in Bulgaria. The first of them was *Elementary Knowledge of Cybernetics* (3) by T. Boyanov. It was addressed to a wider circle of readers - these eager to learn could become acquainted with terms like information, its measurement, information structures, algorithms and management.

The second book was *Algorithms* (4), written by P. Barnev and P. Azalov. General information about algorithms and their presentation through block diagrams was given in the book, and a number of concrete algorithms connected with funny questions and serious problems.

The principal construction of computers was presented in the third book published in 1978 called *Mathematical Bases of Computers* (5) by Hristo Hitov. This book was addressed to students and treated historical information, elements from the Boolean algebra, and the presentation of data in computers.

The last book, published in 1978 *Information and Management* (6) written by P. Barnev, was addressed to teachers. The meaningful terms information and management are explained in it.

The coming of information systems as helpers in all spheres of life was the reason in 1981 why A. Radensky's *Information Systems* (7) was published. It explained the essence of information systems using examples, and then discusses database management systems through which they are realised.

The book *Algorithms and Algorithmic Computing* (8) by D. Skordev as one of the series for students *Alef* was published in 1981. Some basic ideas from a relatively new field of mathematics - the theory of algorithms are discussed in the book. It tries to express in a simple way these ideas to students.

For teachers, who know the classic parts of elementary mathematics and wish to know the fundamentals of programming in 1983, a second book by A. Radensky *Mathematics and Programming* (9) was published. It shows the connection between some traditional methods for solving classical mathematical problems and methods for solving problems using computers.

For students with a great interest in maths and informatics a new series of books introduced was *Mathematics and Informatics - Extracurricular Work.* Within a period of six years, six books on informatics were published in this series. The first book, published in 1985, was *FORTRAN in Examples and Problems* (10) by P. Azalov. By giving a number of examples the language FORTRAN is explained. Problems given at students' competitions were also included in the book. In 1985 the next book from the same series was published, namely *Coding of Information* (11) by St. Dodunekov and I. Denev. Its aim was to provide opportunities for the serious students to get acquainted with elements from the theory of coding. In 1986 the first *Pravets* computers (Apple-2 compatible) were produced in Bulgaria but there was no available book for these wanting to work with them. So the book *Computer for Beginners* (12) by Morgan was translated into Bulgarian. It offers a system for learning on *Apple*, and its introduction, written by T. Boyanov, differentiates between *Pravets* and *Apple*.

From 1986/1987 informatics began to be studied in all schools. Students have already studied programming at school. At that time the book *Datastructures* (14) by P. Azalov and F. Zlatarova was published. With the knowledge from that book, students and specialists could make a qualitatively new step towards improving programming and also improve their style of making programs. With the expansion of the production of computers *Pravets* children also had more free access to computers and, as usually happens, children were the first to overcome the barrier of working with them. However, there was no book available for children. Thus we published the book *I Can Program at the Age of 9* (17) by P. Stanchev, which discussed an elementary course in programming on Basic for small children.

There were schools in which children started using computers at an early age on the Logo language. The authors R. Nikolov and E. Sendova have had great experience in their work with children and they offered the book *Informatics for Beginners* in 2 parts (23), (24). The ideology of the Logo language was explained in them and ready computer programs were used in the working up of the themes.

In 1990 *Basic in Examples and Problems* (28) by Rahnev, Garov, Gavrilov was published. The very title of the book reflects precisely its contents. Using it the reader learns some methods of programming. It includes also problems given at students' competitions.

So far we have presented in succession published by Prosveta dealing with questions from informatics books which filled the vacuum existing because of the lack of textbooks. But they also served as the basis for the writing of textbooks.

Now we shall consider the textbooks publishing for the 2 stages of the secondary comprehensive schools.

In 1967 the subject "programming" was included with a resolution from the Ministry of Education in the curriculum of some mathematical classes and mathematical schools, as we already mentioned. Until that date no textbooks had been published for these students. That was not an omission on the part of the publishers as textbooks are published only if ordered by the Ministry of Education.

The curriculum for 1986/1987 provided for the second school term informatics to be studied as a separate subject. So the Ministry of Education assigned *Prosveta Publishing House* to publish two textbooks on informatics for the students in 10th and

11th grades (15), (16) and (18), (19). These two textbooks written by different teams of authors - Barnev, Azalov, Dobrev, Bisterov and Angelov, Gavrilov, Garov - with different syllabuses aimed at teachers in informatics to enable them to choose the appropriate textbook for their students. The textbook by Barnev, etc. explain basic questions from informatics illustrated by the language of Basic while in the other textbook by Angelov, etc. programming on Basic prevail. Students who studied using that syllabus could choose the second stage of education which had a different duration. For the students studying in educative industrial schools where informatics was taught, three textbooks were published by Prosveta:

In 1986 *Informatics for 11th Grade (II stage)* (13) by M. Barneva and S. Stoykov; *Operating Systems* (27) by A. Hachikyan, A. Rahnev and K. Garov; *Programming and Algorithmic Languages* (29) by P. Azalov (1990).

Education in 8th Grade began with new syllabuses in 1988. These textbooks treated elements solely from informatics. For this batch of graduates textbooks were published in mathematics written by two teams of authors. The first one, led by Sendov, wrote *Mathematics and Informatics* in 4 parts (20), the second wrote separate textbooks in algebra, geometry and optional maths. The two teams used different approaches to the writing of their textbooks. The textbooks written by Sendov, etc., republished in 1992, contained "information corners" which presented programs with the language Logo and that approach continued in the textbooks for 9th, 10th and 11th grades. The textbooks for 8th grade in algebra by other team of authors has elements from the language of Basic.

In 1989 textbooks by two teams were published for 9th grade students. One by Barnev, Azalov, Dobrev and Bisterov, *Informatics for 9th Grade* (21), treated programming by INFO (hypothetical language), and for each example in the lab, practice was given with a version in Basic.

The textbook was republished in 1992 with the title of *Informatics I* (30). The basic examples for programming also contained the programs in Basic and Pascal.

The other team, led by Sendov, wrote a textbook in informatics under the title of *Mathematics and Informatics*, part I. The language of Logo was used. The second edition of this textbook is *Informatics I - a Reference Book* (31).

Two textbooks in informatics for 10th grade students were published in 1990. They were also written for different syllabuses. *Informatics for 10th grade - a Reference Book* (25) by Barnev and Azalov does not use any concrete language for programming while the other textbook written by Sendov, etc. again uses the language of Logo (26).

The second unrevised edition was published under the title *Informatics II - a Reference Book* (32).

The authors Barnev and Azalov of *Informatics II* had new ideas for this textbook and the Ministry of Education ordered it to be rewritten as the main textbook with five appendixes separately. Thus the new textbook *Informatics II* (33) by Barnev and Azalov was published in 1993. The five appendixes *Word-processing* (34) by Azalov and Zlatarova, *Database* (35) by Azalov and Kouneva, *Spreadsheets* (37) by Azalov and Hikov, *Bureautics* (38) by Barnev, *Computer Graphics* (37) by Barnev, Banchev were published in 1994.

The last textbook written by Azalov and Zlatarova is *Informatics with Pascal - a Reference Book* (39). The Ministry of Education announced a competition for its publications. From the three applicants *Prosveta* Publishing House won the competition and the textbook was published. We have given a complete survey of the published by Prosveta books and textbooks in informatics until today. We firmly believe in our contribution to the teaching of informatics.

APPENDIX A

List of books and textbooks in informatics published by Prosveta

No.	***TITLE***	***AUTHOR/S/***	***YEAR OF PUBL.***
1.	*Cybernetics and Thought*	Konstantin Kostov	1969
2.	*Algorithms and their Preparation for Machine Realisation*	Miroslav Ivanchev	1974
3.	*Elementary Knowledge of Cybernetics*	Todor Boyanov	1978
4.	*Algorithms*	Peter Barnev, Pavel Azalov	1978
5.	*Mathematical Bases of Computers*	Hristo Hitov	1978
6.	*Information and Management*	Peter Barnev	1978
7.	*Information System*	Atanas Radensky	1981
8.	*Algorithms and Algorithmic Computing*	Dimitar Skordev	1981
9.	*Mathematics and Programming*	Atanas Radensky	1983
10.	*FORTRAN in Examples and Problems*	Pavel Azalov	1985

11.	*Coding of Information*	Stephan Dodunekov, Yordan Denev	1985
12.	*Computer for Beginners*	Morgan	1986
13.	*Informatics for 11th Grade /II stage/*	Margarita Barneva, Stoyko Stoyanov	1986
14.	*Datastructures*	Pavel Azalov, Fanny Zlatarova	1987
15.	*Informatics for 10th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
16.	*Informatics for 10th Grade*	Angelov, Gavrilov, Garov	1987
17.	*I Can Program at the Age of 9*	Peter Stanchev	1987
18.	*Informatics for 11th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
19.	*Informatics for 11th Grade*	Angelov, Gavrilov, Garov	1987
20.	*Mathematics and Informatics for 8th Grade, p. I, II, III, IV*	Sendov et al.	1988
21.	*Informatics for 9th Grade*	Barnev, Azalov, Dobrev	1989
22.	*Mathematics and Informatics for 9th Grade, p. I, II, III, IV*	Dicheva, Nikolov, Sendova	1989
23.	*Informatics for Beginners, p. I*	R. Nikolov, E. Sendova	1989
24.	*Informatics for Beginners, p. II*	R. Nikolov, E. Sendova	1989
25.	*Informatics for 10th Grade*	P. Barnev, P. Azalov	1990
26.	*Mathematics and Informatics*	Dicheva, Nikolov, Sendova	1990
27.	*Operating Systems*	Hachikyan, Rahnev, Garov	1990
28.	*Basic in Examples and Problems*	Rahnev, Gavrilov,	1990
29.	*Programming and Algorithmic Language*	Pavel Azalov	1990
30.	*Informatics I /II ed./*	Barnev, Azalov, Dobrev	1992
31.	*Informatics I*	Dicheva, Nikolov, Sendova	1992
32.	*Informatics II*	Barnev, Azalov	1992
33.	*Informatics II*	Barnev, Azalov	1993
34.	*Word-processing*	Azalov, Zlatarova	1994
35.	*Database*	Azalov, Kouneva	1994
36.	*Spreadsheets*	Azalov, Hikov	1994
37.	*Computer Graphics*	Barnev, Banchev	1994
38.	*Bureautics*	Barnev	1994
39.	*Informatics with Pascal*	Azalov, Zlatarova	1994

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NATIONAL REPORT OF BURUNDI

NEW INFORMATION TECHNOLOGIES (NIT) IN THE EDUCATIONAL SYSTEM OF BURUNDI

The use of information technologies in the system of education of Burundi cannot be considered as widespread. The situation in this field is close to critical, on the one hand, because of the lack of finance, and on the other, because of inadequate attention paid to timely application of NIT in the educational system and all advantages they can give to a user.

First steps in this field were made around 60s, when tape-recorders, compact-cassettes for languaue studies, slide-projectors, educational films etc. were first used as teaching aids. But these educational tools were not used to a full extent at secondary schools, especially in case of Church-run schools.

SCHOOL RADIO

In 1975 in the framework of the Program of the Education Bureau responsible for primary schools curricula, the Rural Schools Education Bureau (RSB) initiated so called School Radio with the aim to improve a professional level of teachers and to broadcast educational programs for school students and general public.

The programs of school radio were started at local broadcasting stations, at which all programs including educational ones were made by professional producers. At that time , they faced a lot of problems with hard- and software.

In 1979 a decision was taken to form an autonomous RSB-based "Regi-Studio" system for school needs only. The project was accoplished under UNICEF and French assistance. The programs were produced and recorded by the RSB and broadcasted over local channels of the National Radio.

School Radio provides educational programs for primary school teachers, and students through nourishing their constant interest to the process of learning by means of all sorts of radio-competitions.

Here is an example of School Radio broadcasting schedule:

day	time	program type	audience
Tuesday	3pm	preparatory programs	primary school students
Thursday	8pm	teachers' information	teachers and parents
Friday	3pm	preparatory programs	primary school students
Saturday	4pm	games & competitions	teachers, students, public

Thursday and Thursday programs are just only for school year period while the rest are broadcasted even at vocation time.

Saturday competition programs are used in primary or secondary classes as educational and instructive simulation games.

The format of a program can vary from a lecture-type to pure informative or containing elements of a competition game or a reportage. The progams can be used by teachers for enriching their teaching experience. According to them the programs help to prepare classes and to use teaching aids. Any of novel teaching tool is immediately reflected in broadcasting and incorporated into teaching process.

CURRENT PROBLEMS

- the majority of teachers are extremely busy working at two jobs and they cannot sacrifice classes to get time to listen to the radio;
- there is no proper feedback system; the broadcasting producers therefore cannot use teachers requests in later releases.
- teachers request model RSB lessons on the subjects which are considered complex. Unfortunately, radio broadcasts can reach only auditory recepters of the audience. Radio cannot show pictures, graphs and tables.

A possible solution could be found through use of audio-visual tools. TV sets must be used both at primary and secondary schools.

TV PROGRAMS

The Telecommunicaions Section of the Education Bureau and Secondary School Program has its own airtime on Television - half an hour a week beginning with February 1996. This program consists of five headings:

a). INFO

This heading covers some urgent news items from:

- EBSSP Directorate and other Ministerial Departments
- EBSSP Publications
- School Administrations which can provide interesting information on their schools

36 stories mainly about secondary school were issued under this heading. However, after December 1992 this program ceased to exist as it covered a problem of possible leadership change far too often.

b). "Come on, find an answer"

This heading deals with competition games for students. Participants are asked questions relating to general intellectual development of a child. Winners get prizes.

c). "Do you know?"

This heading covers specific EBSSP-based documentary projects.

Among numerous accomplished projects were:

•Bujumbura Port

- weather forecast
- calculations
- chimp
- snakes
- COTEBU
- deaf and dumb' programs
- hydroelectric dam

d). "Let's talk frankly"

This heading covers some problems of school life. Every month a new topic is chosen to be discussed in four sessions. The first session is normally an introductory one providing a general presentation of the problem. The second gives a chance to several participants to speak out their viewpoints on the problem. The third is run with expert participation on the issue. The fourth deals with the letters and responses received during the program time. Several programs on school failures, how to learn to learn, buildings repairs, water and hygiene, sexuality of the young, have been issued under the heading.

e). "IRABIR"

This heading has as its aim an introduction of trades which students can opt in the future.

Conditions of using School TV.

Environment in schools may differ. Out of the list of 16 schools, selected at random, all 16 have TV facilities (all in all there are 68 secondary schools, to say nothing of colleges. 80% of them have TV sets).

3 TV are out of working condition

1 recorder is out of work

4 recorders stolen

3 schools do not receive National Padio or Television at all

many (12) schools have a problem with students, namely, those who watch TV take their seats first, while the rest cannot find a seat to watch a program. In many schools the TV center is placed in a small room with windows overlooking the inner yard so that the students may watch TV programs through a window. The number of viewers may exceed 500.

INTERNATIONAL CONCORTIUM ON DISTANCE LEARNING TECHNOLOGIES IN FRENCH-SPEAKING COUNTRIES - ICDLTFSC

In 1992 a distance learning project was created by ACCT especially for Burundi.

The project is designed for transmitting French courses for non-qualified secondary school teachers, i.e. teachers who work and study at universities at the same time and those who haven't been trained to teach in French or those who haven't got a higher education in teaching.

In summer 1992, university professors who developed the distance education program and who wished to up-date it, created an AD program for further training of French teachers at secondary level.

The team of teachers of French was formed to update the program in several days. Now the trainees can learn the materials, form their own vision of the program and use methods of distant training in their work. Trainees can take home the materials, a student's guide and a questionnaire in which they can express their opinion with further return to ICDLTFSC.

All these undertakings are aimed at improving the program which was subject to criticism at the Closing Session in Bordeaux.

According to ICDLTFSC project at its advanced stage it was planned to open a new French school. Unfortunately, necessary documentation was not signed on time and the crisis that later broke out in the country made it impossible to continue experiments in this field.

However, the development of FAD concept of preparing materials goes on. Distance education is supposed to be included into the process of teaching in the nearest future.

COMPUTERS AND SOFTWARE.

We could say that the process of computerisation had little effect on the school sector (leaving aside Technical Schools and some University departments).

At the Central Administration level each separate agency (Departments, General Directorats, Offices, Ministerial services) is equipped at least with one computer and is using WP, LOTUS, EXCEL, and Dbase software.

There is a re-training center in Bujumbura for teaching office employees to use this software with respect to their functions. There are a lot of privat centers as well, that provide paid training in computer science. Many office workers refered to these services in order to learn how to use WP/Dbase, Lotus, Windows and other software.

DIFFICULTIES OF INTRODUCING NEW TECHNOLOGIES INTO TEACHING

- shortage of man-power that could widely introduce NIT into teaching process;
- lack of finance for prompt introduction of NIT into teaching process;
- problem of distant location of most rural schools from major communications and power grid which impede introduction of NIT into teaching;
- lack of due attention to NIT introduction into teaching.

PARTICIPATION IN INTERNATIONAL PROJECTS ON NIT APPLICATION

At present in Burundi there is a shortage of professional staff participating in International programmes on NIT application.

The participation in the Second International Congress UNESCO will be useful to the country. We hope to get much new and useful information on NIT application out of international cooperation. Burundi will consider international experience of, for instanct, TV-education to be able to form her own plan of applying this new leading system into National education.

PRESENTED BY
THE MINISTRY OF HIGHER AND SECONDARY EDUCATION AND ACADEMIC RESEARCH

NATIONAL REPORT OF CHAD

PREFACE

Chad, as it will be illustrated in this Report, is far behind in teaching of new information technologies. This gap is clearly observed on the levels of higher, secondary and technical education. Among the various reasons of this situation, one should point out the political instability, that has deorganized the country's education system.

The stabilizing measures have certainly been undertaken, but the absence of national policy in the informatics sphere, the lack of funds and qualified personnel still rèmain the main obstacles on the way of informatics development in Chad.

Crucial steps must be taken in the shortest possible time before the situation becoms irreversible. Probably, the channels of information transmission is the solution? Chad must find the answer shortly.

1. THE PRESENT-DAY SITUATION

THE NDGAMEN UNIVERSITY

The Faculty of Exact and Applied sciences

Computer facilities of this Faculty include:

1. Laboratory

- 2 IBM-compatible computers PC 80286;
- 1 IBM-compatible computer PC 80386;
- 1 computer IBM PC 80286;
- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh» , IICX type;
- 1 printer of Image Writer II type;
- 1 printer Epson LX-800.

2. Office of Math Department Director

- 1 computer Compaq Prolinea 486.

3. Dean's secretariat

- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh», DC 475 type;
- 1 printer of Image Writer II type.

4. Dean's office

- 1 computer «Macintosh», classical type;
- 1 printer of Laser Brother type.

Computer laboratories are intended for the second year students of Faculties « Mathematics and Physics» - 15 students, «Physics and Chemistry» - 15 students, « Natural Sciences» - 50 students and for 10 students of technical Faculties. The curriculum offers introduction courses on MS-DOS operation system and programming language Turbo Pascal. The disciplines are taught by two part-time teachers.

The project

The project of creation of informatics department has been worked out by the Technical College of the Orleans University for the Faculty of exact and applied sciences.

The project's fulfillment plan:

- year (n-2) - year (n-1): training of teaching and operating personnel;
- year n: introduction of the first year of studies (15 students, 32 weeks with 15 hours per week);
- year n+1: introduction of the second year of studies (10-12 students, 22 weeks with 15 hours per week and 10 weeks for field training at an enterprise).

Curriculum and teaching hours

Discipline	**1st year**	**2nd year**
Informatics	480	330
Mathematics	160	110
Management	160	110
English Language	80	55
Communication studies	80	55

The assessment of computer classroom construction
(in French Francs without taxation)

Items	Quantity	Sum
Tables and chairs	-	30 000,00
Micro-computers DX4100 RAM 8 Mb HDD 420 Mb Monitor 15Inc Ethernet cards Ne 2000, compatible	15	135 000,00
Server Pentium 90 MHz 16Mb HDD 2 GB Ethernet/bus cards PCI Monitor 15Inch CD-ROM discs	1	20 000,00
Inverter and anti-overload device	16	32 000,00
Laser printer HP4ML	2	15 000,00
Wiring	-	10 000,00
Total		242 000,00

The Analysis of the business circles' opinion on the necessity of informatics studying has proved the existence of demand (though limited , but real) for specialists in informatics of a senior technician qualification level. According to the Survey's conclusion, it is necessary to train highly-qualified technicians, possessing the following skills:

- operation of complicated information network system, that can be used simultaneously by several people;
- provision of an access to information and data compatibility in the system «Client-Server».

The Faculty of Law and Economics

Computer facilities of this Faculty include:

1. Laboratory
- 2 IBM-compatible computers PC 80286 (two of them are out of order);
- 1 dot printer (out of order).

2. Dean's secretariat
- 1 IBM-compatible computer PC 80286;
- 1 IBM-compatible computer PC 80486;
- 1 dot printer Epson LX-800;
- 1 dot printer Epson LQ-1070 (out of order);
- 1 printer of Laser Brother type (out of order).

Training is available from the first to the third year to 300 students of the «Economics» specialization. The discipline is taught by two teachers. The curriculum consists of:

1st year: operation system MS-DOS, WordPerfect and Lotus;

2nd year: introduction into programming , based on Turbo Pascal language;

3rd year: introduction into algorithmics, Dbase III+.

The secretariat of the Faculty of Law and Economics uses information tools daily. But the «Personnel control» function is not computerized in most of the faculties of the University and this causes mistakes and time expenses.

The Faculty of Philology and Humanities

In comparison with the others, the Faculty of Philology and Humanities is the best equipped one and it has the following computers for scientific research at its disposal:

1. Linguistic Department
- 1 computer «Macintosh» LC 630;
- 1 computer «Macintosh» LC 475;
- 1 printer StylWriter II;
- 1 printer Laser Writer 320.

2. Philological Department
- 1 computer «Macintosh» LC 320.

3. Geographic Department
- 1 computer «Macintosh» (multimedia);
- 1 printer StylWriter II.

4. Geographic Department
- 1 IBM -compatible PC 80486;
- 1 dot printer Epson LQ 1070.

5. Dean's secretariat
- 1 IBM -compatible PC;
- 1 dot printer Epson LX 800.

With the exception of the Office Informatics Course for post-graduates (16 students), this faculty doesn't offer any teaching courses of informatics.

Medical Faculty

Medical faculty doesn't practice the studying of informatics course, and all the equipment (one IBM-compatible computer PC and a printer Epson LQ 1170) is used for administrative purposes.

National Institution of Humanities

The National Institution of Humanities is equipped with one IBM-compatible computer PC and a printer Epson LX 800, used for administrative purposes. Though put in the curriculum, informatics and statistics haven't been studied in this institution because of the absence of laboratory, equipped with the corresponding hard- and software.

Central University Library

The Central University Library and its four divisions (Library of Exact and Applied Sciences, Humanitarian and Philological Library, Library of Law and Economics, Medical Library) has one IBM-compatible computer PC and a printer for control of their funds. In 1990, supporting the informatization process, the French partners granted the University 18 micro-computers, 12 printers, a large amount of expendable material. But the lack of funds has actually ruined the program and, though part of the personnel has learnt the software for word processing, it cannot be of practical use because of the lack of equipment.

University Administration

The University Administration possesses:

1. Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LaserJet 4M;
2. Deputy Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LX 800;
3. Chief Secretary 's secretariat - 1 IBM-compatible computer PC and 1 printer Laser Brother;
4. Personnel service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070;
5. Bachelor training service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070
6. Central service of school training - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070.

Computer is daily used by all the University Administration services. The best equipped sector is the Bachelor training service, the worst equipped - the Central service of school training.

CENTER OF INFORMATION PROCESSING

According to the PRIMTAF project, Canada presented 19 micro-computers, 8 printers, software and expendable materials to the University of Chad in 1995. A part of this equipment (12 IBM - compatible computers PC, linked in the network; one printer LaserJet 4MP; one printer DeskJet 560c; two printers Epson LQ 1070) was transferred to the Computer center, aimed at training as upgrading or re-training of people, working in governmental, mixed and private sectors.

Software of the Center of Information Processing and the Ndgamen University:

- Text processing: Word 6.0, WordPerfect 5.1, WordPerfect 6.0;
- Table editor : Excel 5.0, Lotus 1,2,3;
- Databases: Dbase III+, Dbase 5.0, FoxPro 2.6, Clipper;
- Control: Ciel (accounting), Saari Major (business control), Saari Major (accounting), Saari Major (wages).
- Documentation flow control: Texto;
- Project management: Project Bridjet Modeler, Project Workbench, Microsoft Project;
- Integral functions: Works 3.0;
- Graphics: MapInfo 3.02, PowerPoint;
- Statistics: SPSS;
- Polls: Survey Pro;
- Programming languages: Turbo Pascal, Turbo C, Basic.

NATIONAL CENTER OF SCIENTIFIC RESEARCHES SUPPORT (NCSRS)

At the National Center of Scientific Researches Support every service has its own modern micro-computer. Recently, a new computer network has been installed in the Publishing Department. The Manager of this Department has taken a 3 months' training period in France.

As the consequence of the visit of one of the Center's representatives in Dakar in May 1995, NCSRS has managed to arrange for the installation of an INTERNET provider at its premises. Unfortunately, the Chad's network is not linked with the international network, though this problem is being under discussion.

On October 27, 1995 the American delegation, headed by the United Nations Development Program adviser made evaluation of the situation in Chad. They declared about a possibility of granting necessary equipment and linking to international network, but the problem still remains unresolved. By now, only several international organizations (including the UN Development Program) are linked with this network.

NATIONAL INSTITUTION OF PUBLIC WORKS

Curriculum of the Institution pays proper attention to informatics. It has the following equipment:

- 1 IBM-compatible computer PC 80286 at Secretariat;
- 3 IBM-compatible computers PC in the Departments, dealing with basic training;
- 3 IBM-compatible computers PC 80486 in the system of professional upgrading and re-training .

Possessed software: Word 5, Winword, Autocad, Page Maker.

Project: National Institution of Public Works expects financing for the new computer-information center, which will be equipped with:

- 6 IBM- compatible computers PC Pentium;
- 1 drawing table of A3 type;
- 2 laser printers;
- 1 color laser printer ;
- CD-ROM Drivers.

CENTRAL SERVICES OF EDUCATION SYSTEM

The majority of the Departments of the Ministry of Education have informatics tools at their disposal for managing administrative problems. Some operation services, listed below, are equipped better then the others.

1. Statistics Department

Facilities - 4 IBM-compatible computers PC

Software - Word 6.0, WordPerfect 5.1, Excel 5.1, Lotus 1,2,3, Dbase IV.

2.Evaluation and Control Department (evaluates and controls the qualification level of teachers and the extent of students' knowledge).

Facilities - 3 IBM-compatible computers PC, 3 laser printer, 2 portable computers.

Software - Word 6.0, Excel 5.1.

HIGH INSTITUTION OF PEDAGOGICAL SCIENCES

Today , the students of the High Institution of Pedagogical Sciences don't study informatics. The limited micro-informatics course is organized in the framework of the «Teachers Training» program and the «Educational Masters Training program.

Equipment:

- for current administrative problems settling - 8 micro-computers, 1 portable computer, 1 printer.
- for teaching process - 2 micro-computers;
- for school printing facilities - 1 micro-computer

Software : Word 6.0, WordPerfect 5.1, WordPerfect 6.0, Excel 5.1, Lotus 1,2,3, Dbase IV.

Project: furnishing of a computer class with the equipment for teachers training.

TECHNICAL COMMERCIAL LYCEE

Informatics is not studied in the Technical

Commercial Lycee.

Equipment: 2 computers IBM PC XT (for the management)

Software: WordPerfect 5.1, Lotus 1,2,3, Dbase.

Project: to purchase 20 new computers under the program «Education - Occupational training - Employment» .

TECHNICAL INDUSTRIAL LYCEE

Informatics is not included in the curriculum. Micro-computers, used by the Administration, broke down many months ago.

FELIX EBOUE LYCEE

The Association of Students' Parents was planning to buy two micro-computers in the school year 1995/96.

* * *

The acquaintance with the role of informatics in large organizations of the Capital gives no hope that the situation in provincial lycees and colleges may be better. With state education system failing to provide informatics studies, there are private schools that include informatics courses (mostly for settling administrative problems) in their curricula. The largest of them are the Center of Occupational Training and Upgrading at the Ndgamen Chamber of Commerce and the High Management Institution.

2. STANDARDIZATION POLICY

There is no standardization policy for new information technologies in Chad. However, in the framework of the program «Education - Occupational training - Employment», the priority is given to the studies oriented to market needs and employment. As informatics is thought to be a necessary field of knowledge, one should expect the standardization policy to be worked out in a short time.

3. DIFFICULTIES

Obviously, Chad is falling behind in studying new information technologies. There can be a number of underlying reasons:

- political instability disrrupting the whole education system;
- low level of National Revenue compelling the government to settle only the most vital problems. In the sphere of education the government can afford to finance the minimum program, based on the cheapest technologies;
- insufficient skills of teachers. The majority of them haven't received proper knowledge and are unable to estimate the advantages of new technologies and promote their studying.
- difficulties with the uninterrupted electricity supply which is, by the way , the most expensive in the world. Numerous unexpected disconnections cause the loss of time and data and break computers down;
- absence of well-equipped technical services. Computer's breakdown is known to be a catastrophe.

These factors themselves don't explain the gap. The weak political will at the national level should be added to the list. Otherwise, it is impossible to understand the absence of informatics courses in curricula of the most prestigious colleges of the country.

4. SUGGESTIONS

In order to narrow the growing gap, Chad has to establish the National Body , accumulating human, material and financial resources, for elaboration of programs, fitting the political strategy of the country.

After the Congress closing it is necessary:

to arrange a national seminar on the problems of new technologies role in education system and in occupational training and their significance as of Chad's development factor;

to establish a national body promoting new technologies studying and their introduction into companies' and government bodies' activity.

All the measures, that should be taken, can be divided into the main groups:

Step 1

- analysis of the present situation;
- elaboration of a general plan;
- evaluation of needs;
- making out an operation graph.

Step2

- teachers training;
- working out teaching programs;
- promoting informatics studies in the University;
- executing experimental programs

Step 3

-inclusion of new information technologies studies in secondary technical and occupational education

Step 4

- inclusion of new information technologies studies in secondary education system.

* * *

Naturally, studying new information technologies can't be successful without changes in the professional sphere. But this process requires favorable environment for application of informatics in all spheres of life. This purpose can be achieved with the help of seminars and upgrading and re-training programs.

NATIONAL COMMISSION OF CHAD FOR UNESCO

NATIONAL REPORT OF CHILE

1. INTRODUCTION

The given report presents the major results of the Enlaces Project second year official implementation (Enlaces Interconnection). La Frontera University is responsible for the project development for the 4-year period since March 1993 in Araucania area and in lesser degree in other regions. The Enlaces project in the capital district is being coordinated by the Pope Catholic University of Chile.

Main objective of the Enlaces Project is to organise a net of educational centers for studying contents, costs, positive and negative sides of initiatives in the field of Educational Informatics. The Project includes the evaluation methods for its results and is aimed at defining the part of computer technologies and telecommunications for municipal schools, especially, in state funded, which do not possess oflarge budget.

By December 1994 there were 81 centers and 19 establishments in the network. Major part of them are situated in the 9th District including Angol, Vilcun, Lautaro, Temuco, Pitrufcen, Viliarica, Freire and Gorbea. The project base was yet enlarged due to agreements with Concepcion University and Los Lagos University in Osorno. These educational establishments and subnets in Santiago (Pope Catholic University), in Viliarica (the same) and in Angol (La Frontera University) enable setting of the basis for future decentralized growth. There are already three rural schools involved, two of them operating with mobile phones and one directly with radio.

The Net covers schools as a result of projects' tenders and it depends upon the equipment available and switch-in possibilities. Municipal and subsidized schools constituent the majority on the net. They recieve hardware equipment from the Ministry of Education: 3 computers, 1 printer, 1 modem and 1 CD-ROM and software (educational programs, La Plaza); have the possibility to teach their staff and recieve Enlaces support. Other funded schools can join the net as a result of projects' tenders while Enlaces provide software, teaching and net support. Private schools can obtain partially software and partially net support.

La Plaza program inside Enlaces teaches the use of computer both for learning programs and for communications (local, metropolitan, wide-area and international ones), for participation in educational projects, for finding and sending information in the net.

Right now, the experience gained shows that computer technologies should be introduced at schools paying special attention to the work with teachers and to the special features of every school, its situation, priorities, basic activities at the moment of technology installation. The succes of the project is basically achieved due to the job done by teaching staff and school principals of the schools involved in the net. The strategy of support, learning, continuous help, staff meeting, document procedures were designed for teachers. And that made technology implementation easier for many schools and enable the use of computer in administrative management.

2. BASIC POSITIONS

The Enlaces Project is a part of the MECE program with the Ministry of Education. It is an experimental one and its objectives are to evaluate the role, costs, negative and positive sides of computer use and telecommunications at schools. There are three major factors to dominate it:

- Chile Education System
- *Learning Technologies* Implementation experience in Chile and in the world
- Achievements and Tendencies in Information Technologies and Telecommunication development.

The analysis of these factors and the experience gained during the project development determined the definition of principles on which the Project should be based:

Informatics is a means, an instrument easy to use and to serve to teachers, other educators and students. That is to say that learning computer use should not be for the sake of learning only and should not become the restricted area "for experts only".

People have the leading part in education: students, teachers, administrators and not machines. Even the most powerful and perfect computer is yet an instrument of support for the educational projects where people are involved. That's why we are armed at organizing a computer laboratory in every school where both students and teachers could work over different subjects and different projects, instead of providing every student with a computer.

Educational objectives of a school should define the use of a computer in it. As well as, the social and cultural grounds and geographic location should do. There are no common prescriptions for every school but there is a possibility of knowledge and experience exchange which can be modified and suit a special case.

New technologies and telecommunication bring new roles for hardware and software:

Pedagogic: support instrument and didactic material for teachers and students; motivation instrument to develop linguistic, communication, mental and art abilities and skills.

Social and Professional: personal contacts and experience exchange between teachers and students; widening life vision of students.

Administrative Support: important element in modernization and acceleration of a school administration process; education administration support.

The presence of a computer at school cannot serve as a guarrantee of learning effect. Internationally the hopes of the 80s for the learning effect of technologies failed to come true. Now we can use the positive and negative experience of the past and witness the gradual process beginning with the adaptation of technology, taking it in, followed by the creative impulse to use it. The process is very slow - all teachers are being involved in it gradually - so it needs long-term support. It is difficult to use this reliable principle in developing countries because they concentrate on equipping their schools.

The mentioned principles show the frame of the Enlaces project development. We will go on with the positive moments of information and communication technologies for Chilean schools:

Equal opportunities and decentralization: schools can join the Schools Community regardless of location. For example, any teacher in the net has an access to the same information as others and participate in interschool projects on equal grounds regardless of where he lives: in Temuco, Las Condes, Freire or Boyeco.

Professional Growth: teachers can exchange experience, material, succes and advice if united by the net. They can also take part in group sessions and discussions over different subjects issues, eg. Spanish, Mathematics, teaching kids with learning difficulties, History, etc.

Management development: teachers and school principals can raise their job efficiency and make it easier through the use of computer technologies to keep diaries, notebooks, data bases, to prepare materials for exams and tests, students lists and for book-keeping.

Educational process modernization: teachers and students can use new learning software as didactic material. New learning programs' quality and quantity is improving every day. To use it we should change the pedagogic process structure, ways of delivery and aquiring knowledge, to stimulate abilities and develop gifts and skills of students.

Students demonstrate strong a wish to work with computers: teachers can use computer to stimulate education and to stimulate creativity.

The named positive moments have good influence over quality of education in school system. But we can expect informatics implementation to bring results in a social sphere. For example:

Having got access to the technology at school young people will bring changes to production field and a service sphere developing those technologies. To use technologies properly, to manipulate information one should have a high degree of knowledge and skills in the field which are necessary in today's world. Those skills are to be developed during school period. Eg., searching, underlinig important things, sythesis and information providing.

Due to the fact that young people will be having access to the world information nets for the whole of their school life regardless of the geographical location, their vision of the world is sure to widen. It teaches them to contact other people of different cultures, races, languages and interests. These skills are important in the world where international contacts have become necessary and usual.

3. PRIMARY OBJECTIVES AND TODAY'S SITUATION

1. INTRODUCTION

Futher we give information on the project objectives realization by January 1995.

PRIMARY OBJECTIVE 1: *To organise educational net* covering 100 schools and 10 establishments during the period of 1993-1997. 70 % of the net is located in Araucania, 20 % are in Santiago and 10 % are in other regions. The network will be based on computers, they be connected by means of telephone or radio. The software will provide net support for schools. The net will be open for other schools and establishments to join if they have necessary equipment and want to participate with their projects.

Today's situation: The set 100 schools are to be on the net by March 1995, and by the end of the year the number will be 300 schools. Now there are 81 schools 19 establishments on, including those who joined with their own equipment. The Enlaces net is a part of Internet that's why teachers and students have possibilities to contact schools, universities, libraries, discussion sites and similar projects around the world.

PRIMARY OBJECTIVE 2: To organise at La Frontera University and Pope Catholic University Educational Informatics Centres (EIC) with the right staff, equipment and funds to support school net. Centres should control traffic in the net, to design and implement Learning Strategies for users and continuos education, to support school provided projects, to create and evaluate software, to provide schools involved in projects with technical and pedagogic support.

Today's situation: Now EIC at La Frontera University is organised. It occupies 600 sq.m. The team of teachers of various subjects, psychologists, telecommunication engeneers, software writers, computer designers, journalists and administration experts work over the Enlaces Project. Also it includes the computer centre at Pope Catholic University at its Programming Department in Santiago and in Viliarica. Later the University of Concepcion (8^{th} District) and University of Los Lagos (10^{th} District) joined the net.

PRIMARY OBJECTIVE 3: To convert three schools into experimental ones and on their basis to implement experimental job with new technologies and teaching and learning methods.

Today's situation: One school in Temuco is founded.

2. MAJOR

ACHIEVEMENTS

This project started in 1991 in several Santiago schools and was primarily experimental. Its objective was to evaluate the existing technologies to research the input capabilities of telephone lines for computer links, to settle a professional level necessary for computer use and basic multimedia, and also to look into ways of computer implementation at schools. In 1991 the project covered 3 schools in Santiago and Pope Catholic University. In 1992 in Santiago 8 new nodes appeared and they got stable connection with foreign schools.

That experience confirmed the importance of designing new implementation strategies and use of technologies at schools. It also proved that school educators of all levels should participate in that process. The experiment showed that children took in new conversational possibilities enthuasiatically, as well as the use of learning programs and that children should be taught minimum users skills to use computer efficiently.

1993 saw the net growth up to 33 nodes: 17 in Santiago and 14 in Temuco. The contacts with foreign schools grew. Main job was to create methods of joint use of technologies for teachers in different schools through various interschool projects and to modify and to widen software. And in general, it was the task to evaluate main areas for computer use at school.

The network grew up to 100 nodes: 81 schools and 19 establishments. Many of them had their own equipment.

Here is the joint table of the schools in the Districts, showing the origin of the equipment:

District	*Equipment provided by Ministry of Education*	*Own Equipment*	*Total number of schools*	*%*
Capital	13	7	20	24,7
6^{TH} (*)	0	5	5	6,2
8^{TH}	4	0	4	4,9
9^{TH}	46	6	52	64,2
TOTAL	63	18	81	100
%	77,8 %	22,2 %	100 %	

* The 6^{th} District net came to life with the help of the San Vincente Municipal Council in Tagua Tagua community. The Council equipped all schools of which 5 have joined the Enlaces net. Enlaces provided them with communication software, taught staff and students minimum computer use and switch them in. This example can be followed by other communities in other regions of the country. We expect such forces to bring other schools to Enlaces.

Establishments in the net are schools, faculties and departments of various Universities (La Frontera University, Pope Catholic in Santiago and Viliarica, Concepcion with the centre in Los Anjeles, Los Lagos University, ORT Chile, Acsis, etc.).

3. EXAMPLES FOR USE OF LA PLAZA (THE SQUARE) PROGRAM

The La Plaza program was designed to possibly ease the use of computer for teachers and students. It is a simple one and combine several items named Post Office, Newsstand, Museum, Culture CentreThe Square - access to the system.

We choose the image of a Square because every student and every teacher knows it immediately in any part of the country. This place doesn't evoke bad assosiations, it is an attractive and familiar one serving as a meeting point for community members. Also there are different services here: banks, shops, City Hall, school, entertainments.

3.1. Post Office

The Post Office at the Square is a e-mail office one can have simple access to, teachers and students can easily send and recieve messages. Its aim is to build up informal atmosphere for first contacts and then to create a workgroup in Culture Centre sliding to personal contacts between teachers and students.

Children use the Post once a week: to write letters in different subjects, eg. looking for friends, quizzes exchange, their pets, interests, dreams, etc.

Teachers use the post in experimental regime because they have understood that learning telecommunications, looking for people of the same views in the net would demand patience and consume time. This is a universal phenomenon. In developed countries the use of nets has grown significantly though it took them several years to get accostomed to them and to study their use. The same picture is true for school teachers.

3.2. Newsstand

Newsstand is a window into the world of electronic information but it changes as time goes, as any paper or magazine does. It contains electronic newspaper section (environment, sports, for teachers only, etc.) which is being edited by teachers and students themselves.

In Newsstand there are short stories of educational contents with sound, animation, texts stimulating desire to read or write something. The number of the stories grow and every school has access to them.

The most popular sections of the electronic newspaper

Position	Name	Number of news in 1994
1	Thoughts	823
2	Interesting Facts	611
3	Sports	553
4	Schools	402
5	For Teachers Only	388
6	Ads	395
7	Environment	326
8	Information about the country	232
9	Information about the world	189

All those sections are of experimental character. In the future schools will be able to subscribe to them through computer as their number grow. In this case sections can be written by "agencies" (Museum, City Hall, Environmental Protection Ministry, News Agency, Library, etc.).

3.3. Museum is an information centre where the learning programs data is stored. Generally, it's the easiest data base oriented for a teacher who needs didactic materials. One can travel from Museum to Information, to the experience exchange section and new programs demonstration. CD-Roms are being used since 1994. Here's a licenced programs' list:

- Graulier's Multimedia Encyclopedia
- Animals (San Diego Zoo CD)
- The Language of Lyrics (music)
- A Tortoise and a Hare
- Carmen San Diego
- Decisions - Environment
- Juanito and His Magic Beans
- Earthenware in Chile
- XXth Century
- The Earth
- Lessons in Mathematics: Functions

In addition to those they work over programs that are difficult or impossible to buy on the market:

- Chilean Artists
- Architect's Workshop
- Peoples of the Earth
- Human Body
- "La Plaza" Program Manual
- NESCO: Healthy Teeth (delegated to the Dentistry Department of La Frontera University).

Here is the list of other programs sent to schools:

Claris Works: text editor, calculator, data base, graphic and drawing editors included

Kid Pix: drawing programm for kids

Hypercard: multimedia production

The most used-by programs for the last month of 1994:

1. Kid Pix
2. Claris Works
3. Human Body
4. Chilean Artists
5. Peoples of the Earth

3.4. Culture Centre

Culture Centre is a meeting point for those who realise joint projects of teachers and students from different schools. It also helps teachers to find colleagues of similar interests so they can exchange experiences, opinions, materials and documents (Eg. physical training instructors, professors of English, Literature Workshops, foreign connections, etc.).

Culture Centre and its working sectors
Here is the list of the most popular sectors
and topics with Culture Centre

Number	Topic or Program	Number of Messages
	"ABC Teaches"	370
	"Mathematicing"	325
	Hallo, Chile	319
	Games and Sports	293
	Ecology	293
	Caught in the Net	252
	Square and I	236
	SOS	184
	We grow happilly	176
0	Kid Pix	136
1	Claris Works	89
2	Dinamicas	83
3	Necso	70

4. EXPERTS TRAINING, RESULTS EVALUATION, MONITORING

1. EXPERTS TRAINING

In 1993 Experts in schools connected recieved the following training: three introductory lessons (one week period) for groups of 12-15 teachers from the same school (totalling 195) were giving the skills necessary to work with "La Plaza".

The Learning Strategy for teachers in 1994 seriously differed from the mentioned one because schools were given most autonomous rights for that matter. The number of skills to obtain grew also: Teacher were able to study both Enlaces basic program and Claris Works consisting of the editor, data base, drawing program, etc. To optimize its use teachers learned the use of archieves and the way a hard disk works.

As the number of the involved schools grew so does the necessity to let them solve training issues themselves since the geography of the schools widened and was distancing from the Project Centre at La Frontera University. The experts were expecting that growth... there became three times as much schools involved... and they developed a multimedia program with various topics and training workshops. One has access to that program "The Learning Square" from the Square section "Museum".

Together with the already published textbooks and manuals this program was a trial basis for a telelearning method which is expected to be as efficient as usual learning methods. We should mention that teachers could us it as they believe it necessary, at every school.

The next step to bring new members to the net was its administrative decentralisation. It is expected that as the number of members will grow, assistance to most far situated and worst equipped schools is getting more and more complicated. To escape this supposed problem and to test the more reliable and more flexible system of the net widening it was agreed that: The Chilean Pope Catholic University in Villarica would take control over Subcomponent 1 of the net (where they serve 6 schools); La Frontera University in Malieco would take Subcomponent 2 (5 schools in Angol and 1 in Collipulli. The same agreement was signed with the Concepcion University in Los Anjeles to work with 4 schools.

There is the following work plan for the teachers of the schools in the said subnets which joined the project in the third semester (village schools near Temuco: Lautaro, Freire and others). The 1st stage consisted of:

Learning how La Plaza works, including basic elements of equipment functions. At this stage teachers were to study in groups of 3-5 persons (from 4 to 6 weeks) at least once a week until they would be able to deal with the "Learning Square" tasks properly. The subnet coordinators evaluate the results of learning for each teacher individually. He (she) is tested according to the 30-point "La Plaza" user list.

The 2d stage consisted of Learning how to use an operational system, archieves and a hard disk. Again at this stage of 4 to 6 weeks teachers were to work in groups with an interactive self learning system and textbooks to match. Effiency evaluation was practice-based and was carried out when a teacher felt himself (herself) ready.

The 3d and the last stage consisted of Learning how to use Claris Works and Kid Pix programs. The learning program was "Claris Works Help" with a textbook included. In some cases "Additional Manual on Claris Works" was used. The efficiency evaluation was carried by practice-based methods when the teachers felt themselves experienced enough.

Total number of the teachers involved
(see Table)

Sub-Net	Stage 1	Stage 2	Stage 3	Total number
• Santiago	86	43	33	162
• Angol	138	67	55	260
• Viliarica	103	54	50	207
• Temuco and communities	115	18	10	143
• Los Anjeles	57	7	7	71
Totaling	499	189	155	843

Deminishing number of participants by the end of the stages can be explained by the fact that the First Stage was not completed in time. The learning period in many schools took twice as much time as was supposed either because of the lack of lateral control or because of the difficulties at the spot. Having learnt the use of La Plaza most teacher didn't believe it necessary to master the knowledge about other operational programs. There was yet another stopper: the working plan was not covering all teachers who needed computer in everyday use.

Workshops

This year mastered one more learning field: workshops for detailed study of instruments and specific technologies. Example number one: "Use and management of Claris Works and Kid Pix programs". This program was proposed by Viliarica subnet coordinators during winter holiday. 37 teachers studied it.

13 seminars course made serious impact into learning. Those seminars were presented For the First National Congress on Informatics and Educational Nets ENRED 95 which took place on 6, 7, 8 of October. The total number of participants in the seminars were 437 teachers. Seminars were followed by lectures by foreign and Chilean experts. All the delegates from the schools in the net had possibilities to meet each other and share experience. There were 550 delegates.

Many Informatics Programs' Coordinators saw the success of the seminars and offered their own developments for schools. That raised the Congress' efficiency very much. We noted the learning developments popularity so we set to produce Educational Workshops in 1995 aimed at: a) answering schools' demand and developing supply; b) founding experimental secondary colleges with coordinated teaching beginning March 1995.

In addition it was decided to organise school journalistic societies for school teachers at Temuco and to organise seminars from one to two days depending upon the needs of teachers from the schools in the net.

2. EVALUATION

The job done in these two years let us evaluate the project efficiency in the field of school education.

For this matter an evaluation system was developed which cover wide range of marks. Though we didn't hope that it could be efficient in every field we began wide-aspect evaluation. We draw a primary picture of these aspects in the schools in the net and then we tested each school thouroughly comparing them to the primary picture.

We included in the evaluation such factors like territory, population, school level. Here are aspects we have evaluated up now.

1993 Primary pictures in 12 schools in Temuco and 6 schools in Santiago

1. Testing 1800 children in these schools participating in the project according to the following characteristics:

Creative activity (speed, flexibility and originality in product making). Development of learning levels. Level of comprehension when reading. Group interactivity (towards the task and with other pupils). Self evaluation according to learning tasks. Controls were set on intellectual levels and serious learning deviations.

2. Testing 207 teachers according to the following characteristics:

Mentor's role appreciation by teachers Learning objectives appreciation, appreciation of Learning process and school climate.

Levels of success, autonomy, fixed behavior, selfevaluation and efficiency.

Teaching styles types: professional, initiative, paternalistic and selfmaking.

3. Testing 1200 parents and guardians of the children involved in the project according to the following characteristics: diligence, statisfaction with school, evaluation and activeness.

1994 Comparison to the Primary picture 1 and number growth.

Primary picture 1 was drawn in 6 schools in Viliarica, 5 school of Angol, 3 of Los Anjeles (8th District), 7 of Santiago (one specialized school and one school for children with Dawn Syndrome) and in one school in Temuco (rural one). The testing positions were the same. The respondents included:

- 3000 students
- 450 teachers
- 2000 parents

To compare it with the Primary Picture we tested the same people we had tested in 1993. The information is being processed. We already have primary results for characteristics, like reading comprehension where we can expect changes in the direction of thought. But we are looking for the results from the schools that joined the project later to make sure changes take place because of Enlaces.

3. REVIEWS

Polls were being held regularly in schools to have quick and exact answers to questions about the use of technology.

In 1994 teachers from schools in the net in Temuco were polled. Here are its results. The left diagram shows the use of computers and software in learning process: 1% bad, 48 % good, 51 % very good. The right diagram shows improvement in contact with students: 19 % more or less, 76 % significantly, 5 % not much.

Page 14. In the upper left corner:

The use of communication instruments in the educational process: 14 % more or less, 3 % not much, 83 % much.

In the upper right corner:

How much can it damage learning process if the net will be switched off:

12 % not very much, 3 % not much, 71 % very much.

In the middle to the left: computer

The monitoring gave the full picture of how often Museum, Square, Culture Centre, Newsstand are visited.

Here is the graphic showing the traffic monitoring. Decisions over the net software, time to visit schools due to the schedule, etc., are taken on its basis.

Weekly schedule of a secondary school in Temuco.

5. PLANS

1. NET DEVELOPMENT BY THE SCHOOLS WITH OWN EQUIPMENT

We regularly develop choice strategy, development, motivation, implementation of software that can be copied for schools, especially for those involved in the Enlaces project. At the same time new achievements in telecommunication technologies and new programs developments are used to widen the net bandwidth.

One most important moment in the net growth is to integrate schools or establishments with their own equipment. The simplified version of La Plaza is designed (colorless, soundless and no video) for that, but one can join the net and exchange ideas, news, experience (as text files).

2. Switching of other establishments to the net.

Establishments (schools, universities, Technical Training Centres, private persons, etc.) who wish to join the net (with money, equipment, place, lines) should remember the following:

a) Software and hardware

In 1995 Enlaces have "La Plaza" program with communication capabilities and multimedia learning materials. One should possess an Apple Macintosh 8/180 computer with a 14" colour display or PC with Windows since March 1995 to use these programs.

The Enlaces Project has software for DOS Environment. 17 enables net access and let you send text files only. This version services older PCs AC, XT with monochrome displays without hard disk and minimum memory.

We can add that an establishment can use other Internet-compatible software (Eudora, MacWeb, etc.).

2. NET MEMBERS

Possibilities and Obligations

To join the Enlaces net an establishment should:

Send a request for membership. The net reserves are limited so they will consider the request judging by a school's capabilitiy to switch in to the Internet, its readiness to take some obligations and its real abilities to support Enlaces. At the talks the Enlaces management and the school principle/owner should sign agrement describing the project contents, which a school would like to realise due to Enlaces, the ways it would be carried out, human and material resources for it.

Switch-in. It would be better for school to be located in the Enlaces contact zone: that is since 1995 all the phone-connected places in the 9th District, some Capital District communities, Los Anjeles, Concepcion, Osorno. Place out the contact zone can join Enlaces though the closest Internet node (one should turn for help to the University close to his place). In 1995 we expect to widen the Enlaces' cover zone after the support centres are on.

The equipment that the establishment own (modem, computer, software) should be compatible with the one of the Enlaces net (Internet standard switch software, own programs or "La Plaza").

An establishment should be able to pay expences and costs including those of Internet.

We advise all potential members to get in touch with our coordinators before purchasing equipment. You can keep connection with us in Internet, our address: enlaces - ufro@ enlaces. ufro.cl

MINISTRY OF EDUCATION

LA FRONTERA UNIVERSITY

NATIONAL REPORT OF CHINA

EDUCATION TECHNOLOGIES IN CHINA

INTRODUCTION

China has a territory of 9.6 million km, a population of 1.1 billion and 30 provinces/autonomous regions and 517 cities. In recent years she has achieved great growth in her national economy. The Chinese government has all along paid attention to the promotion of cultural and educational undertakings and raised the slogan of bringing prosperity to the nation through science and technology. "The National Program of Educational Reform and Development" was published in 1993, designing a blueprint for a system of education with Chinese socialist characteristics. In this document the development and utilization of educational technology are stressed.

From the perspective of social progress throughout history, it is evident that education is the mainstay of a nation, and that education is the very foundation of economic growth. The relatively low level of education in China has seriously hampered the advance of China's modernization. How to make the best use of the limited resources of education and the latest educational technology to train highly qualified personnel as soonest and as numerically the largest as we can — this is the major problem confronting education in China.

THE EXISTING EDUCATIONAL SYSTEM IN CHINA
is indicated in Tables 1 - 4, as follows:

Table 1.

Basic Education

	Number of Schools	Number of Students
Elementary Schools	700,000	124,210,000
Ordinary Junior Middle Schools	68,415	40,822,000
Professional Junior Middle Schools	1,582	562,400
Special Schools for disabled children	1,123	168,600

Table 2.

Professional/Technical Education

	Number of Schools	Number of Students
General Technical Middle School	3,964	2,820,300
Professional High School	8,403	3,063,500
Technical Middle School	4,447	1,716,700

Table 3.

General Higher Education

	Number of Schools	Number of Students
Ordinary Higher Education	1,065	2,535,500 BS/BA 88,800 MS/MA 17,600 Ph.D

Table 4.

Adult Education

	Number of Schools	Number of Students
Adult Higher Education	1,183	1,862,900
Adult Training Middle School	4,783	2,067,600

This educational structure is basically adapted to the demand for personnel at different levels to secure social advance in China. However, in respect of the quality of personnel, there still exists a considerable gap between our education and the first-rate education in the world. Numerically speaking, the personnel we can train, as shown in the above Tables, fall far short of the amount needed for our social advance.

The development of science and technology, especially that of information technology, has created the possibility of improving the conditions of education in China. The present paper will introduce, mainly in two aspects, the current situation of educational information technology in China and its prospective developments.

THE STRUCTURE OF EDUCATIONAL TECHNOLOGY IN CHINA

(including its subdivisions) is as follows:

(1) The audio-visual education centers in higher education institutions and professions/industries, which help spread educational technology among the respective institutions or professions.

(2) The local audio-visual centers (AVCs), headed by the National Audio-Visual Center of China (NAVCC) which help spread educational technology among the primary and secondary schools throughout the country.

(3) The local radio-television universities, headed by the Central Radio-Television University, which undertake, chiefly through the nationwide TV networks, formal-schooling education and education without academic credentials of various kinds throughout the country.

(4) The agricultural radio-television schools set up by the Ministry of Agriculture, which undertake education in rural areas in agricultural techniques in the form of technical secondary schools with academic credentials.

(5) The network of educational TV stations, headed by the China Education Television (CETV), which render television-broadcast service for the above-mentioned various forms of education.

(6) The China Education and Research Network (CERNET), which provides the means of academic exchange, both domestic and international, in the service of teaching and research at key universities in China.

Education with Audio-Visual Aids

The Chinese government has paid great attention to the utilization of modern means of instruction in primary and secondary schools as well as in regular HEIs. In order to popularize the use of audio-visual aids in primary and secondary schools, the National Audio-Visual Center of China and many local audio-visual centers (AVCs) have been established. According to available data, among the resources processed by these facilities are 2 billion frames of projector slides, 8 million hours of sound recordings, 8 million hours of video materials, in addition to a number of educational films (or film strips), and a collection of compact discs (including VCD and CD-ROM) and a collection of software used for CAI. Through the cooperation between the NAVCC and AVCs at various levels and the audio-visual education centers and AV classrooms of various educational institutions, remarkable progress has been made in applying modem media to classroom education provided in schools of all kinds. Moreover, progress has been achieved through relevant instructional design renewal of educational concepts and reforms for the enhancement of the efficacy of teaching, the optimization of teaching process, and other efforts to realize the goal of modernizing school education.

Education Television

As China is a developing country with a vast territory and a large population, in the education sector, besides doing a good job of running regular educational institutions at various levels with their programs delivered essentially by face-to-face tuition, efforts have been made to develop distance education through the utilization of modem means of instruction so as to effectively expand the scale of educational provision and create opportunities for more people to receive lifelong education.

As early as 1960, when black-and-white television sets just began to enter the homes of China's common people, radio and television universities (RTVUs) were established in such metropolitan cities as Beijing and Shanghai. With the advent of a new era of reform and opening up in China and concomitant with the formation of microwave television networks established in various regions of China, the Central Radio and Television University (CRTVU) was established in China in early 1979. In 1980, the Agricultural Radio and Television Institute (ARTVI) oriented to audiences and viewers in the countryside was established. With the commission of a satellite-transmitted educational TV channel, China Television Teachers College (CTVTC) was established in 1986 conducting service training of primary and secondary school teachers. China Liaoyuan Radio and Television School (CLRTVS) was established in 1990 providing programs of rural practical techniques oriented to the needs of rural developments. Thus, a multi-dimensional and highly diversified new framework of distance education has gradually taken shape in China over the years.

At present, the complex system of China's RTVU's is composed of the CRTVU (comprising also CTVTC and CLRTVS), 44 provincial-level RTVUs, 696 local branches of RTVUs, and over 1,600 county (or urban district-level working stations of RTVUs.

On the other hand, the Chinese government has invested in developing a network of satellite-transmitted educational TV programs. This network comprises China Education Television (CETV), which has at its disposal three satellite TV channels and a decimeter TV channel serving the needs of the Beijing area, 10 provincial-level educational TV stations and covering 1,000 relay stations, and over 10,000 satellite ground receivers. Besides, the cable television services in more than 200 cities have taken part in replaying the programs of CETV. Through the integration of these two networks, a wide-ranging network of distance education covering both urban and rural areas has taken shape in China.

By 1994 a cumulative total of 1,778,000 students had graduated from 359 subdegree (short-cycle higher education) level programs (specialties) offered by the RTVUs throughout the country in diverse fields of science, engineering, agriculture and medicine; the humanities, economics, political science and law; and fine arts, physical education, and teacher education, accounting for 14.74% of the total output of graduates of all regular and adult HEIs of the nation in the same period. Besides, 3000,000 have successfully completed specialized secondary school programs provided by the RTVUs.

1,006,000 have graduated from the programs offered by ARTVI. The development of distance education in China has contributed a great deal to the formation of a new educational framework in China, to the renewal of educational concepts, to the improvement of teaching methods, to the expansion of educational provision, and to the improvement of educational structure, and to the modernization of education.

Computer Networks

China's economy has been growing very fast in recent years and China is becoming more and more open to the outside world. At the same time, the construction of the global information infrastructure has become a world trend. The Chinese government is promoting the construction of the China Information Infrastructure (CII), with the Internet connection forming one of the major concerns.

In December 1993, the China Education and Research Network (CERNET) project started to be planned. It is the first nation-wide education and research computer network in China. The CERNET project is funded by the Chinese government and directly managed by the Chinese State Education Commission. CERNET will connect all the universities and institutes in China in the near future and will connect high schools, middle schools, primary schools and other education and research entities by the end of this century. CERNET will link to the global Internet and will become a major part of the Chinese Internet community.

The main objective of the CERNET project is to establish a nation-wide education and research network infrastructure to support education and research in and among universities, institutes and schools in China using the up-to-date telecommunication and computer techniques. Its specific aims are as follows:

(1) Establish a nationwide backbone which connects eight regional networks and connect them to the global Internet.

(2) Set up a national network center.

(3) Set up ten regional network nodes.

(4) Adopt TCP/IP as the network protocol and establish network management systems.

(5) Provide Internet applications and develop China's information resources and applications.

CERNET has a three-layer hierarchy (the nation-wide backbone, regional networks and campus networks). The CERNET national backbone uses Digital Data Network (leased line) offered by China's Ministry of Post and Telecommunication (MPT). It forms a multiple ring topology and it has an international link connected to the Internet in the United States. Links to Hong Kong and Germany will be installed in the near future.

CERNET finished its first phase of implementation in December 1995. Currently, there are more than 100 universities connected to CERNET from all provinces and regions except Tibet. The regional distribution of these universities and the corresponding IP blocks (CIDR) are shown in Table 5. It is clear that the Internet development in coast areas is much faster than remote areas in China, the former having

enjoyed much faster economic growth. This indicates the correlation between Internet development and economical development.

Table 5.

CERNET Current Connectivity

Region	# of Univ.	# of conn.	IP Block
• Beijing	191	10	202.112/15, 101.204/14, 162.105/16, 166.111/16
Shanghai	153	10	202.120/15
Nanjing	156	23	202.119/16, 202.194/15, 202.38.64/19
Xi'an	100	12	202.117/16, 202.200/15
Guangzhou	74	17	202.116/16, 202.192/15, 202.38.192/18
Wuhan	156	16	202.114/16, 202.196/15
Chengdu	113	9	202.115/16, 202.202/15
Shenyang	147	11	202.118/16, 202.198/15

CERNET is a nation-wide education and research network in China. CERNET has very rich information resources about China both in English and in Chinese. The starting point of CERNET information is www.edu.cn.

The CERNET information resources fall into 6 categories.

(1) University information. In general, it contains university history, departments, courses and related information.

(2) Information concerning technical/specialized topics. For example, China's stamp collection, ancient Chinese poems, China's water resources, mines and treasure, Chinese law database, universities equipment database. Such information is provided by experts in the specific fields concerned.

(3) Information concerning international sport events. For example, the 43th World Ping-Pong Championship, the 95 Asia College Student Championship, 3rd City Championship and so on.

(4) Hot topics for the general public. For example. Silk Road tourist, Cantonese food recipe and Chinese folk arts.

(5) Libraries with html interface. For example Tsinghua University Library and Peking University Library.

(6) Electronic magazines. China's Scholars Abroad. Mirror sites.

(7) Mirror sites.

Although CERNET has so far only finished its first phase of construction, it is the most important constituent of the information infrastructure in the top universities in China. CERNET makes it possible for our professors, graduate students and undergraduate students keep track of the research developments all over the world and communicate with cooperators/friends at home and abroad. CERNET also enables the outside world to know the education system and the education reforms in China. In addition, the digital library and remote education projects are being carried out based on CERNET, which is playing a more and more important role in China's education and research.

CONCLUSION

At present, China is one of the countries, which undergo the world's fastest development of their national economy. Economic development makes very high demands on education, and at the same time affords the necessary conditions for the improvement of educational technology. With the advance in the construction of the global information infrastructure, we are confronted with a tremendous opportunity and challenge to move towards new educational models in an information-oriented society through making full use of the existing facilities for audio-visual education, such as the educational TV stations, the China Education and Research Network etc. The policy we are ready to adopt is to bring into play the role of the educational TV stations throughout the country and that of the China Education and Research Network and actively to carry on research and development in integrating these two means in order to satisfy the demands of education at different levels.

NATIONAL REPORT OF CONGO

NEW INFORMATION TECHNOLOGIES IN EDUCATION SYSTEM

1. PREFACE

A National report, written in the form that was prescribed to the developing countries, can't illustrate sufficiently enough the required points as the scope of application of new technologies in the country and especially in the education system is quite narrow.

But the number of computers, used in government offices and education facilities of Congo, amounts to 5000 units. This makes us think that the fulfillment of the minimal program of informatization, which implies building up of the National Information Computer System, will lead us to the acquaintance with new technologies. The International Program of Communication Development constantly points to the drawbacks of this sphere. Actually, the only factor that slows down the development of this preferable sector is the lack of investments, estimated as 1% of Gross Domestic Product. Supporting the necessity of the rapid development of this sphere , the developing countries should look for other ways of settling the problem, then those offered for the developed states.

It is necessary to make special steps in this direction by counting on regional and international cooperation. Unfortunately , the execution of the bilateral cooperation programs are still accompanied by shortcomings, that form disproportion among the African countries, especially to the south of the Sahara. As to Congo, the following problems deserve particular attention:

- the present state of telecommunication networks (the development of networks with high carrying capacity and usage of optical cables);
- system and parametric studying of teleinformation networks;
- the terms of creatinig teleinformation networks for linking to the Internet system (working out of protocols, interfaces, etc);
- setting up an Internet server;
- training of a sufficient number of qualified personnel;
- popularization of new information technologies (participation in distant education programs);
- setting up a commission exercising an overall control of the situation .

2. THE STATE OF THE PROBLEM

Information science has shaken the world during last decade. Its rapid and constant development has reached up the level of applied programs in all spheres of life. The integration of informatics and telecommunication in the 70-s was called teleinformatics and moved the information sector toward new area of communication. Telematics, born by teleinformatics, is the discipline that will be used in equipping telephone stations that have to manage high density information flows, transmittrd in digital signals.

At the National Administration of Post and Communication and other information organizations (radio and television of Congo) theoretical introduction of telematics and new communications started rather late, in the 80-s. The year of 1990 was the beginning of their practical use in communication and information services: the Center of Temporal Communication (Centre de communication temporelle) was put into operation at the National Administration of Post and Communication in Brazzaville. The point is that the problem of popularization of informatics in Africa, and in Congo , in particular, was raised in 1980. That is why there are no quantitative assessments of the informatics and new information technologies spreading in education system.

Preliminary arrangements in the frameworks of the Investigation of the process of setting up and utilization of teleinformatics and new information technologies in Africa were made unsystematically. They revealed considerable disproportion between countries in the discussed sphere , characteristic for the whole Southern region of Africa, especially for the countries to the south of the Sahara.

With the Program «The Decade of Transport and Communication in Africa» having been unrealized, each country carried out independently its minimum programs of the telematics and new information products spreading.

Congo participates in the ATF/CEFTI program. We have applied our first experience to the «Transit» project, financed by the Business Forum of French-speaking Countries. As a result, a special Internet server was assembled in the Forum's head-office in Paris. The system is furnished with the following minimum of equipment:

- 1 micro-computer IBM 486 DX2
- 1 modem (9000 Kbps)
- 1 printer HP 550.

Thus, there was set a «SITATEX BZV 8X.STX/28» station, providing a possibility of dialog with the whole group of correspondents. Its linking will be temporarily carried out through the network of the International Society of Space Communications. The established station can serve the teaching personnel of the M.Nguabi University as a mean of setting up relationship with their colleagues. It will also promote the application of new information technologies in higher education system.

3. THE PRESENT STATE OF THE BACKBONE NETWORK

Congo possesses a standard ground IVA station, situated in Brazzaville surroundings and directed to the Atlantic Ocean. There is also a more updated ground digital station, assembled in 40 km from the city Point-Noir. These two units provide an access to international networks. Still functioning on the base of the analogue technology, the Universal Service Network is unable to provide rapid information transmission. At present, the project of setting up a digital information transmission network has been presented and is likely to be soon placed in operation. Today, only private networks are able to handle massive flows of information. The International Society of Space Communications' network, being the base for the E-mail project «Transit», is one of them.

Other private information networks can be utilized (e.g. the Radiotelephone Network (CYRTEL).

Congo shows the average dynamics of telephone and private information networks development: from 1990 the increase makes up 60 % for Congo and 100% - for Africa. In order to catch up with the pace of the «communication and information revolution», radical measures should be taken. In particular, it is important to install an information network, based on the telephone and television channels of the National Administration of Post and Communication.

Functioning of about 100 computers and other equipment in the Commutation Centers provides assurance that the development will grow at a rapid pace after setting up the national teleinformation network. This work can be originated from the project «Technical space» that is being fulfilled by the group of experts, concluding communication engineers, teachers and scientists. This project is realized after placing the «SYTATEX» station into operation in Brazzaville.

In fact, the «Technical space» project, initiated by the National Center of Documentation, Scientific and Technical Information, presupposes pooling together all the existing local networks through the dial-up telecommunication network. First of all, it involves networks of research centers (M. Nguabi University) and International organizations (World Health Organization, UN Development program, AGRI-Congo, AGIP and others).

Our country has made use of the resources of the General Informatics Program, offered by UNESCO. Though our representatives took part in several international conferences, the country didn't receive computer equipment for its education system as we hadn't work out a proper project. That is why Congo submitted the «Technical space» project to the French-Speaking Countries' Experts Committee on the Problems of Telecommunications and Information Technologies. Thus, we are entering the «Transit» project, financed by the Business Forum of French-Speaking Countries, which has given the «SYTATEX» E-mail station into our disposal.

Besides this station , there is a server of the International French-Speaking Countries' Data Bank. Its technical facilities include: a micro-computer «DELL», a laser printer «Jet SL», software of «CDS/ISIS» type. The capacity of the system is 2000 information positions, that equals to the capacity of all the national libraries. By the way, our country acts as a distributor of the «CDS/ISIS» software, belonging to the Documentation Center of the Regional African Office of the World Health Organization.

The largest private companies of the country operate tabout twenty telecommunication systems of «L.A.N.» and «W.A.N.» types.

The installation of the «SYFED» server, integrating the Electronic French-Speaking Network for research and education systems seems to be feasible. The possibilities of these projects and networks will expand with the introduction of a new network, elaborated by the American Firm «ATT» and called «Africa OME: Optical African Network». As a result , the applied technology will provide African countries with a free access to the services and information of international data banks. Their technical facilities amount to about 5 mln computers, linked to Internet. The «Young Africa» magazine (# 1801, July 1995) graded this event as a «technological breakthrough».

Informatisation of school management, carried out with the help of UNESCO, and the planned informatization of the University will lay the base for the composing of a local network of the education system in Congo.

4. RECOMMENDATIONS

The main objectives of this Congress can be formulated as follows:

- establishment of the Permanent Observing Committee for the Program of elaboration and carrying out of educational policies and application of new information technologies - NIT. (Congo suggests a non-governmental status for this organization);
- popularization of NIT as the preferable instrument of progress and supporting NIT development;
- studying the problems of effective introduction of NIT in the developing countries;
- determining ratios of NIT development;
- supporting the working out of national plans of the NIT development in the education system;
- harmonization of services and equipment tariffs;
- providing professional training and human resources development;
- using of statistics;
- carrying out research and information exchange;
- participation in different International organizations, related to NIT.

5. CONCLUSION

It is impossible to talk about the progress of NIT in the developing countries without analyzing the situation in some of them. The survey is likely to be oriented to the desire of finding both the most successful and the most undeveloped fields. And this process should be accompanied by passing of technologies .

During the next stage, the analysis could consider all aspects of the problem (development level, real needs from the point of view of newly creatd services, control over NIT development, etc.). Such approach will make it possible to elaborate measures, conserving and perfecting the achieved results, to propose new rational solutions within a short period of time. And all these steps prove the above mentioned thesis that the developing countries have to look for an alternative way , than the developed states.

Thus, the Congress should be more pragmatic and should offer new forms of cooperation.

APPENDIX

The Research Program of the process of telematics and new information products introduction and application in Africa.

1. Telematics definition and its contents
2. New information products - toys or necessities: an automobile radiophone, teleconferences (including audio - and teleconferences), telecopying, teletext, videotext, teleanswers, automated dialing systems, storage devices, etc.
3. It is a necessity to apply telematics and new information products to the African countries with their development level and needs?
4. Who can be today's and tomorrow's users of telematics and new information products (government bodies, companies, rural communities,

education, medicine, agriculture, etc.)?

5. What product , based on telematics can be suggested?

6. Political, economic, social and cultural consequences of the presence or absence of telematics in Africa.

7. If the large projects carried out under the Program «The Decade of Transport and Telecommunications in Africa» can be continued without the fulfillment of minimum program of telematics and new information products development?

- If «yes», what will be the consequences?

- If «no», what will be probable and desirable advantages

8. What kind of information popularization policy should be carried out in Africa for promoting the development of telematics and new information products, adopted to Africa.

9. Conclusion.

PRESENTED BY

THE GENERAL DIRECTORATE OF TECHNICAL EDUCATION AND OCCUPATIONAL TRAINING
BRAZZAVILLE

THE NATIONAL REPORT OF CROATIA

INFORMATION TECHNOLOGY IN EDUCATION

ABSTRACT

Croats are an old nation who had their state centuries ago and then have lost it. Recently they regained it and realised their future depends, among other things, on their ability to adopt and implement latest information technologies in all aspects of their lives.

In less than five years one of the best academic and research information infrastructures has been deployed covering the whole community and culminating in the brand new 155 Mbps ATM core backbone.

Croatian future plans concentrate on spreading the infrastructure and technology into elementary and secondary education as well as other aspects of *alternative, additional and continuous education.*

Introduction of country's leading individuals as well as decision-makers to IT, its applications and its consequences is considered to be one of the priorities. Educational process and system is considered to be the crucial importance in achieving those goals and to have the decisive role in creating the nation's capability to take an active role in the future world.

In achieving those goals a number of problems is expected: financial, social and psychological.

This paper suggests that our ability to transform education and use it to transform the society will determine our ability to survive at all.

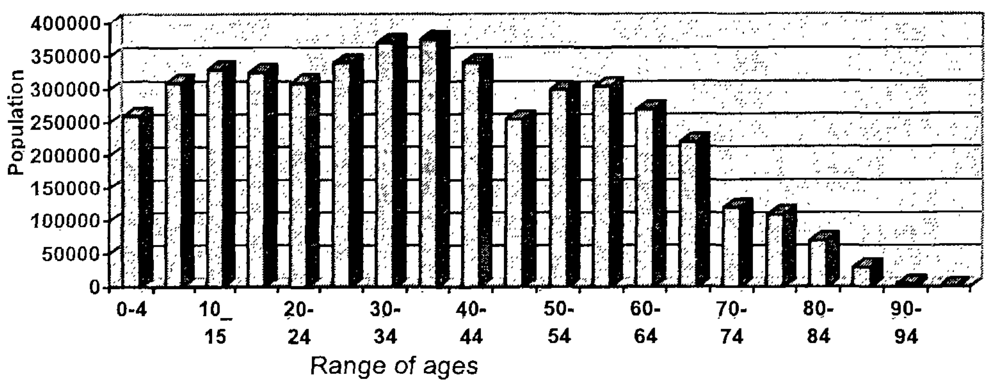
1. CROATIA IN GENERAL

Croatia is a Mediterranean state in central Europe. It covers 57,000 square km of land, framed with 2,000 km of land borders and 6,000 km of coastline along the Adriatic sea. A special geographical beauty present 1,185 islands.

Croats inhabited Dalmatia the southmost part of contemporary Croatia along the Adriatic sea, about 630 A.C. The first Croatian state was established in 892 A.D. and its independence lasted for three centuries. Afterwards, Croats have been a constituent nation in various states until 1990 when Croatia declared its independence. United Nations recognised Croatia as a sovereign state in 1992.

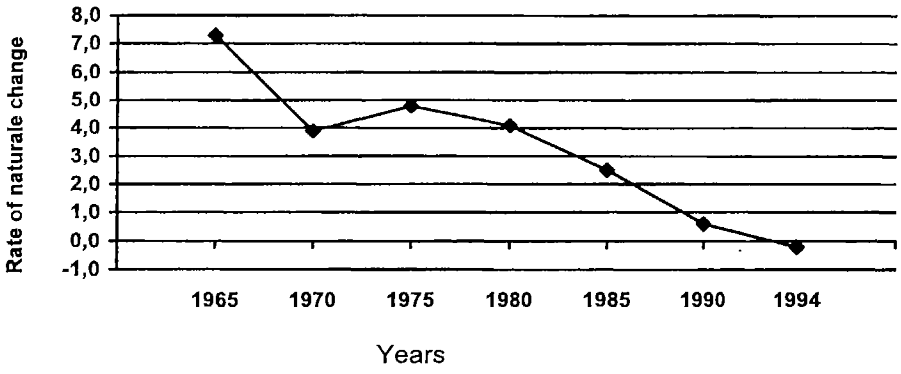
Today's population of Croatia counts 4.8 million, 67.5% of which are in active age, between 15 and 64 years.

Population according to five-years age groups



The war in ex-Yugoslavia from 1991 till Dayton agreement in 1995, inflicted significant social changes reflecting in decrease of GNP from 24.4 billion USD in 1990 to 11.86 billion USD in 1993. Population growth was continuously decreasing since 1975 and reached its minimum at -0.2% in 1994.

Rate of natural change in population



2. EDUCATIONAL SYSTEM IN CROATIA

The oldest written document in Croatian language is a monument "Bascanska ploca" from 1100, in glagolic script. First university was founded in 1669. According to census in 1991 illiteracy in Croatia is at 3%.

Croatian educational system is compatible with those in most European states which enables easy transfer of students at every level. This is often exploited during secondary or higher education. Degrees from most Croatian faculties are recognised in the world.

The educational system has four levels:

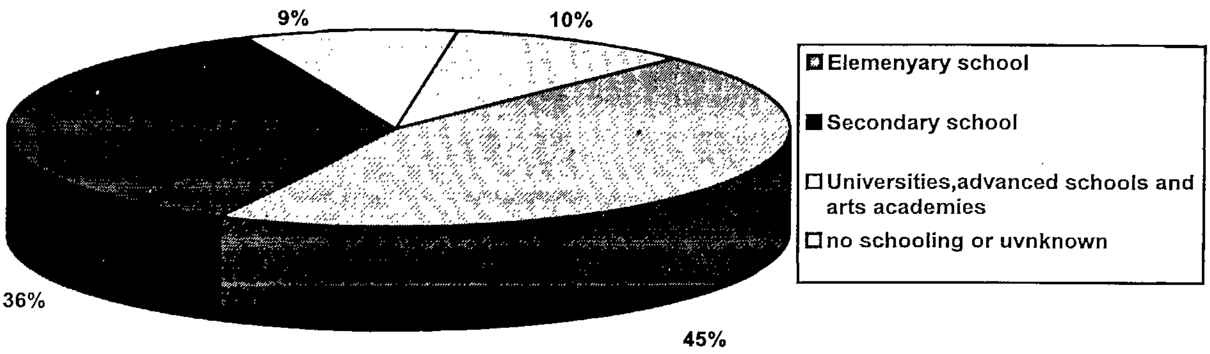
- kindergarten for ages one to seven
- primary education in duration of eight years
- secondary education in duration three to four years
- higher education in duration of three to six years

Number of education institutes, attendees and teachers in school year 1994/95

	Institutions	Attendees	Teachers
Kindergartens	846	74,274	5,081
Primary schools	1,936	438,461	24,091
Secondary schools	478	200,358	15,449
Vocational and technical schools	3	2660	79
Universities	61	77525	5814

The new law on education allows privately owned educational institutions at all levels. However, the majority is still owned by the government and the education is free to all citizens of Croatia. Students do pay for textbooks, food and lodging although a part of those expenses is subsided from the state budget.

Population aged 15 and more years by second degree



2.1. PRIMARY AND SECONDARY EDUCATION

The primary and secondary education in Croatia are free to all citizens of Croatia. Primary education is mandatory for all kids over seven years old.

In addition to regular forms of primary and secondary education there are: education of children with learning disabilities, education of adults and primary musical and dance education.

Special education for children with learning and other disabilities is conducted in elementary and secondary schools for 80,000 students using individual instruction and special techniques.

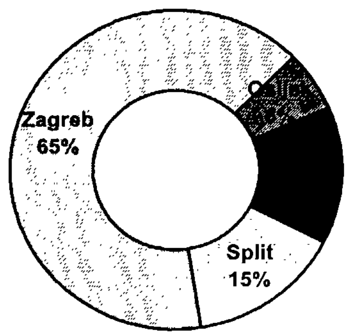
Elementary and secondary education for adults is conducted according to special curriculum and program of instruction, and can be pursued by attending classes or passing examinations. The costs of such education are borne by students themselves or their employers or the Department of Employment.

Ethnical and national unions and minorities have special elementary and secondary schools or classes.

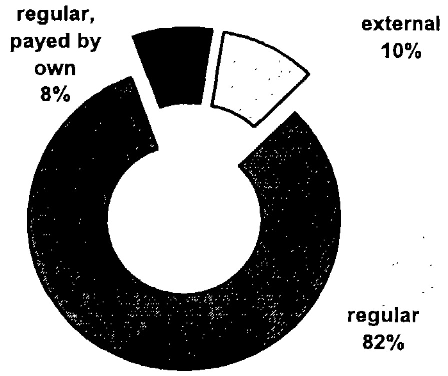
2.2. HIGHER EDUCATION

The Croatian academic community consists of four universities: Rijeka, Osijek, Split and Zagreb. 6,000 teachers educate 80, 000 students..

Number of students by universities

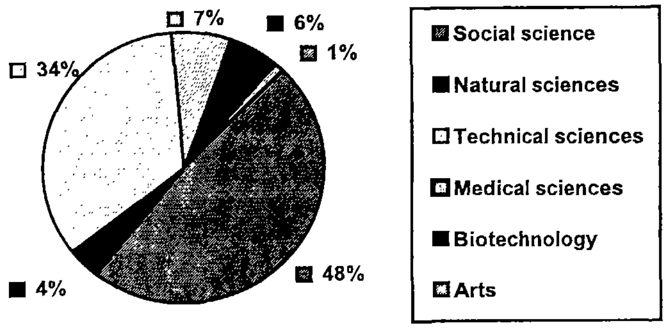


Number of students by type of schooling



Number of vocational and technical schools and universities and students by science fields

	Institutions	Students
Natural sciences	2	3,240
Technical sciences	26	27,620
Medical sciences	4	5,760
Biotechnology	5	5,046
Social science	25	37,759
Arts	3	760



2.3. CONTINUOUS EDUCATION

Currently there is very low demand for continuous education. Statistics show that 48% of participants in a survey in 1975 with about five years of working experience attended some kind of additional education. In 1987 this number has fallen to only 11%. This negative trend is due to labour laws and regulations imposed from ex-Yugoslav regime in the seventies which obstructed and discouraged workers to stream for better education. Today, this number has only slightly grow to 13.7%, mainly due to the war situation present in the country since its declaration of independence.

This situation is unacceptable since trends in employment and market of working force as well as trends in economy in general expect workers to keep up to date with changes in their profession and enable themselves to work in interdisciplinary areas.

Additional problem is the question of literature. Croatian market is rather small so publications are relatively expensive. The same is true for imported international literature due to high transportation costs and relatively low average incomes of citizens.

3. THE ROLE OF MINISTRY OF SCIENCE AND TECHNOLOGY

Ministry of Science and Technology is organised in five departments. One of them is Department for Information Technology. It's duties are:

- co-ordination of development and application of IT in all areas of public activities
- development of information system for academic and research community
- development and maintenance of IS for the Ministry

Definition and enforcement of Law on Information Activities and other regulatory documents the Ministry should facilitate and co-ordinate deployment and usage of IT in all areas of public interest or whenever equipment, SW or services are being purchased with money from state budget. Application of standards is necessary in order to ensure compatibility of people, data and equipment.

The primary method for stimulation of deployment of IT are pilot projects which target real-life problems in real environment and give case studies for similar problems. This helps non-IT people to get the feeling of the benefits, but also requirements of the application of IT. Pilot projects are usually performed by academic and public research institutes though other candidates are not excluded.

National information systems in various areas of human activity are increasingly gaining in importance for everyday's life. Their compatibility, connectibility and data interchargeability are therefore of great importance. In addition, a small country like Croatia has to take care on the usage of its professionals in key areas. This all means that not only hardware, software, applications and data but also people need to be compatible and exchangeable between different national information systems.

Thus, Ministry has adopted the policy which requires all new systems to be built on open operating systems platforms originating from UNIX, mandatory use of TCP/IP protocols and international EDI standards.

Enforcement of this policy should prevent unnecessary development of propietary systems requiring specialists of limited use and resulting in closed worlds.

The main goal of the whole effort is to improve the quality of life of every citizen.

The introduction of IT in academic and research community is undergoing. Activities are focused on providing necessary tools and infrastructure which are of common importance. This includes, but is not limited to: PC's, network nodes (UNIX workstations), modems, office software, programming languages, database systems, scientific databases and referential information. In order to facilitate the usage of advanced ITs, a variety of pilot projects are being initiated. Their role is twofold: to demonstrate the usage of IT in some activity or process and to introduce an academic group to team work and project management.

"Scientific Information System" also belongs to the domain of Ministry. Its aim is to provide an information infrastructure for preservation and dissemination of all types of information acquired or produced in scientific research in Croatia. The development and deployment of system is being centred around six thematic centres covering specialised scientific areas and fields. It is intended not only for better co-operation among scientists but to facilitate co-operation of science and business, as well.

4. CURRENT STATUS OF INFORMATION TECHNOLOGY

4.1. The Internet in Croatia

The main information infrastructure of the modern society is computer-communication network. Today, it is quite clear that it should be some kind of "information super-highway" based on TCP/IP technology.

Only five years ago it was not so obvious but it was then when Ministry of Science and Technology of Republic of Croatia decided that one of key elements of Croatia's strength in future (both social and economical) will be it's ability to use and develop modern computer-communication infrastructure.

Therefore, in the middle of war, in autumn 1991 the idea of Croatian Academic and Research Network was conceived and in less than a year a national infrastructure based on Internet technology covering all four universities has been created and put in operation.

Today, less than five years after, CARNet reached each and every faculty and institute and upgraded it's core backbone to the latest 155 Mbps ATM technology.

A special care has been taken not to profile the network from information consumers point of view, but rather to stimulate users to provide information from the very beginning. It has been achieved by equipping each institution with at least one network node based on UNIX workstation and running networked information services on it.

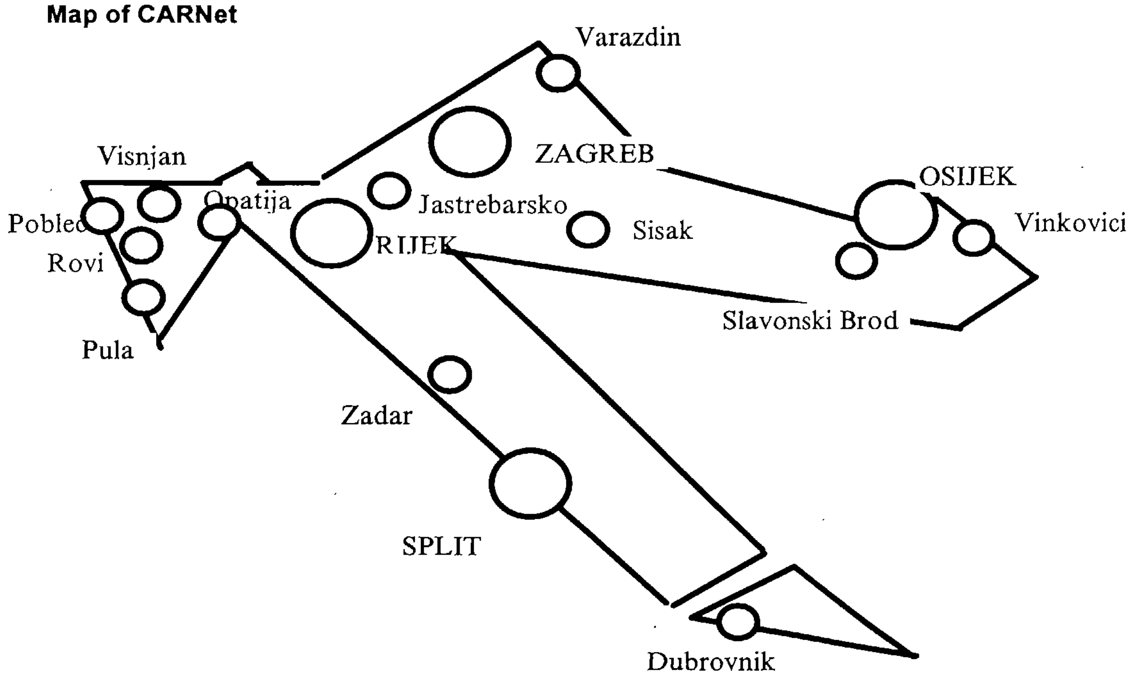
Thus users were able from the beginning to supply their own information or digests to the network.

This infrastructure was available to all segments of Croatian society enabling contact with latest information technology to institutions, companies, groups and individuals.

The project did not confine itself to acquisition of equipment and software only. Education of users and developers, pilot and user support projects are equally important.

Numerous pilot projects help to demonstrate usage and importance of IT in various fields of human activities. The most important projects are: the office of the President, government, Croatian Radio and Television, travel agencies and various medical pilots aimed at laymen, students and professionals.

Map of CARNet



Services provided and examples given helped rise broader attention and thus initiate creation of IT market. It enabled Croatian Post and Telecommunications to start it's own Internet service and thus open doors to commercial activities.

Although CARNet allows access to technology and services to all citizens free of charge, it's aim is not to substitute or compete with commercial or not-for-profit organisations. Still, CARNet provides services to more than 6,000 users on it's public host and negotiates deployment of Internet access point in public libraries in attempt to accelerate the spread of IT usage among "ordinary" citizens.

International project "GLOBE" is being used as a launching vehicle for penetration of IT into elementary and secondary schools.

4.2. COMPUTERS IN CLASSROOM AND WORKPLACE

The global trend in development of IT is towards personalisation and closest possible approach to individual user. As a consequence it means that users are no longer prepared to travel to IT access point. They expect it on their desktop.

It means that every student and teacher should have a personal computer on their desktop with appropriate connection to global Internet. However, it is impossible to achieve for a country like Croatia, not only because of the huge number of units which should be deployed. The second problem is ever shorter living cycle of IT equipment. Five years old PC is practically unusable.

Therefore, the number of educational workplaces equipped with IT is too low. In average, about 1,000 PCs enter classrooms of elementary and secondary schools every year. The same is true for universities and research institutes. The required number would be about three times higher.

However, much better situation is in global connectivity. Academic community is completely "connected", and process for elementary and secondary schools is about to start.

5. PROBLEMS ENCOUNTERED SO FAR

Although great efforts have been made to supply sufficient number of PCs and other required IT equipment to classrooms and workplaces in the academic, research and educational community the absolute number is still too low. Additional problem is in the fact that the equipment is not homogenised in the sense of age and technological level which complicates maintenance and uniformity of applications.

However, this is not the greatest problem. Existing equipment should be used to it's maximum, which is not the case. The major problem is the lack of educational contents (products) utilising new IT. In addition there are very few contents to be used out of regular educational process.

To achieve this is two primary factors: a number of producers and a critical mass of skilled and motivated teachers. And this is where the major problem lies.

The chronical lack of money in state-funded education prevents creation of educational software market and competing producers. This situation is worsened with the fact that interest for additional and continuous education is decreasing for the past twenty years. State policy of ex-Yugoslav regime only discouraged individuals motivated for auto-education.

The lack of domestic educational material has been substituted with the quality products from the world market. Small Croatian market makes translations expensive and lack of state policy makes imports equally expensive.

All mentioned is accompanied by the general fear of new technologies in middle and old generations of citizens, professional and educators, as well as in huge administrative structures.

Children and users are much faster and are on the forefront adopting and using new Its and they leave far behind their teachers and administrations. The result is the chronical lack of acceptable use policies and rules of behaviour in virtual world.

Fast penetration of IT in everyday's life brings common social problems into this new world of electrons and photons. However, the means and organisations that should prevent or fight them do not follow that speed.

Therefore, aggressiveness, selfishness, ruthlessness and misuse are sometime more visible and annoying in electronical than in material world. Instead of repressive and law enforcement methods, education would be much more fruitful in making Cyberspace a better place for living.

6. FUTURE IMPLEMENTATION OF IT IN EDUCATION

The long term strategy in the field of nation-wide introduction and implementation of IT should take care to provide sufficient information, presentation, reading materials and hands-on experience to political and economical leaders and decision-makers in general.

Specialised presentations and courses will be organised for the members of the government, parlament, political parties and state-owned companies.

Case studies and real life examples of those who faced similar problems world-wide are most convincing methods for getting attention and trust in IT.

This activity has to be organised on a wide front, simultaneously attacking all fields of human and social activities: public administration, public health, education, tourism, commerce, army and others. Likewise, this process has to include individuals in the highest positions in hierarchy but this mustn't be the only focus, IS and IM executives and professionals need to be included as well.

For future generations it is crucial to ensure that today's generations of new teachers leave their schools with knowledge, confidence and enthusiasm about IT. However, it is important to avoid situation in which teachers community would be divided in two camps: those who can and those who can't. Therefore, courses, training and textbooks need to be prepared for older generation of teachers. In the whole activity, a special care should be taken for the needs of non-technical teachers.

Literature and best international educational software need to be translated and localised for use in national educational process. This is the easiest way to quickly start the process. It should be immediately followed with government initiatives in production of domestic educational material.

This century has seen hundreds of thousands Croats leaving the homeland and starting new life elsewhere in the world. They have been driven by economical and political forces and majority remain outside of Croatia. Today, it is believed that as many as 3 million people world-wide consider themselves to be of Croatian origin. This is a great tragedy of Croatian people, but it is also a great treasure for the small nation.

Cultural and economical ties between diaspora and homeland need to be intensified. IT can help in a great deal by providing textbooks in Croatian language, display of Croatian national and cultural heritage, establishing databases of economical interest. It can help diaspora influence events within the homeland, but also get a homeland a better picture of needs and potential of diaspora.

Croats have been successful in selling their potentials world-wide. IT might help them to do the same, but this time, without selling their physical being, i.e. emigrating.

7. PROBLEMS EXPECTED

The problems we discuss here are problems of educational process. The main subject in it is the teacher. It is the basic element from which success or failure will result. Therefore, the main problems to be expected in Croatia are in establishment of positive selection of new teachers, motivation and enthusiasm. Social status and material conditions are key elements in achieving those goals.

Croatian educational system is relatively large and thus introduction of IT infrastructure poses a financial and organisational problem. It is expected that financial sources will be weak for several more years and that several generations of equipment deployed need to be accepted as normal operational environment. Awareness should be kept in mind of the consequences of this state to the applications and educational programs.

A multitude of laws and other legal documents need to be defined and enforced in order to create a stable environment for development, application and use of IT in all types of activities.

Educational system has huge role in educating users not only in the use of IT but also in proper use and behaviour as well as rising the awareness of new relations such as copyright and license issues.

It is equally important to stress information acquisition as information providing in educational process. A great deal can be achieved by taking information from premiere sources. However, true results are achieved only through active co-operation which assumes intensive sharing of own information, i.e. information providing.

Great dynamics in IT market and economy in general requires that technical aspects of IT be separated from the content, legally, financially and administratively. The trend should be toward decentralisation, demonopolisation and deregulation.

Without government intervention it is hard to expect faster creation of educational software market and producers. A kind of "New DEAL" is required in order to start things rolling.

Privacy and security issues are in the centre of interest of Cyberspace citizens and those who consider to apply for citizenship. In order to compensate these problems and seek viable solution it is necessary to separate technical and social aspects of the problem and thoroughly re-examine and redefine the fundamental values of our society.

Education has the major role in this process.

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NATIONAL REPORT OF CUBA

REPORT ON THE MODERN STATE OF NEW INFORMATION TECHNOLOGIES IN THE EDUCATIONAL SYSTEM OF CUBA

The state educational system in Cuba consists of the following subsystems:

- *Pre-school education*
- *General polytechnical and labor education*
- *Special education*
- *Technical and professional education*
- *Adult education*
- *Higher education*

In the academic year 1986/87 a wide-range introduction of the State Program of Educational informatics into the national educational system began. Since then, this program has become the priority direction in education.

Introducing informatics into education is done on three levels:

1. State educational system.

2. System of industry-branch and territorial institutions for raising qualification, which comprises refresher courses for persons employed in industry or service.

3. System of Popular Distribution, which includes computer and electronic youth clubs, pioneer palaces, and mass media. Various educational and entertaining actions with unlimited access are organized within this system.

The initial objectives of the Ministry of Education were:

1. To familiarize pupils with computer equipment and to cause their interest in studying the computer.

2. To develop pupils' skills of interactive work with the computer and peripheral devices.

3. To teach pupils basic concepts and methods of work with information, so as they could solve simple problems (especially in other subjects) and apply their knowledge in various situations.

The program was introduced on the following levels:

- in all higher education centers, where informatics was taught as separate subject in all departments and was included in the graduates' diploma;

- in higher pedagogical colleges (there are 14 of them) and in the centers preparing teachers. Informatics was included in the teaching plan (the contents of the course differs depending on the specialization). A new specialization called "Informatics teacher" was introduced;

- in baccalaureate schools, where the course of informatics is taught 3 years and includes 200 hours of lectures;

- in high school, where pupils could choose informatics as optional subject according to the program "Sphere of interests". Informatics was taught two hours per week. Various methods were used in schools in order to familiarize pupils with computer equipment and show them the role of computers in the society;

- in 157 primary schools by way of an experiment intended to study possible methods and forms of introduction computers on this level to develop rudiments of computer using culture (in the LOGO language) in the framework of courses of mathematics and native language;

- in 45 specialized schools for children with psychological deviations;

- in the centers of technical and professional education a one-year course of informatics was introduced for all professions (the contents of the course depends on the profession).

To perform all that, it was necessary to fulfill the program of investment and teachers training.

22,000 computers, both 8 and 16-bit, were purchased.

In the institutions included in the program, laboratories with 11 working places on the average were organized. The number of laboratories depends on the number of pupils, so as to have one computer for 2-4 pupils during the lesson.

At the first stage, 3,500 practicing teachers and graduates of pedagogical colleges, as well as scientists with diploma, were promptly reshaped into teachers of informatics. At the second stage, training teachers of informatics in pedagogical colleges began.

A teaching plan for training teachers of informatics was developed, didactic concepts for each type of education were worked out, textbooks and activity books for each level of education were published.

Measures for development and evaluation of educational software were taken; this is necessary for the further development of the program of educational informatics.

Moreover, finances and computer equipment for education management were allocated. This measures were applied to the central educational agencies, provincial educational committees, and pedagogical colleges, with the purpose of processing information about the level of pupils' knowledge and about the pedagogical staff, planning incomes, processing statistical information, information on the number of children attending school, etc.

We can draw the following conclusions from the ten year experience of fulfilling this program:

1. Of all the components of the Program of Educational informatics, preparation of the personnel is the most important for success.

2. Concerning general objectives, contents, and didactic concepts, one could point out that:

- preparing pupils to problem solving with the aid of computer should be the principal part of the program;
- while teaching basic informatics, one should include it in the contents of the school program in order to form culture and skills of using computer;
- taking into account what we said above, one should make teaching via problem solution, which is the main didactic method in teaching informatics.

Introduction of information technologies into education implies paying special attention to the following problems:

- demand for information technologies;
- study of skills and needs of users of iinformation technologies;
- social, psychological, and cultural problems that influence upon usage of information technologies;
- psychology, sociology, and ethics of users and groups of users;
- methods and techniques of transmitting information technologies from the manufacturer to the user;
- qualification of teachers that use information technologies;
- orientation at information service in education;
- the necessity of working with non-standard methods and service;
- harmonious inclusion of information technologies into teaching plans and programs.

PROSPECTS AT EACH OF THE STAGES OF EDUCATION

In the primary school, the number of computer-training centers will be increased. The main purpose is the same: to familiarize a child with the computer world and to use informatics as an aid in studying various subjects.

In the special education, work with children with psychic anomalies will be continued; informatics will be introduced into programs of other courses in order to support the treatment the children receive.

In the basic high school, informatics will be introduced as a separate subject. The objective of developing basic computer education with the use of computer programs or software packages remains the principal one. These programs are intended to develop basic skills of interactive work on personal computers, of using computers for solving problems in other subjects and for other needs.

On the baccalaureate level, informatics remains a separate subject still. The main objective is to supplement basic knowledge of informatics with specialized software packages and elements of programming. The result of this should be development of skills of computer-aided problem solving.

In the technical and professional education the main objective is teaching applied informatics, dependent on the specialty, and the development of skills for solving problems that arise in industry or service. All this should be accomplished by teaching programming languages and skills of using software systems.

In the preparation of informatics teachers, the main stress will be made upon their technical and didactic training, which will allow to raise the level of teaching.

In other pedagogical professions, the teaching of informatics will depend on the character of the profession and the subject.

In colleges, systematic training of practicing teachers will be organized basing on postgraduate student courses.

It is also planned to create a network for the

National Educational System; this network will be used for distant education, accessing databases, processing information pertaining to management of education, exchange of software, technical, and scientific documentation.

Concerning the obstacles to introduction of the new technologies, we came to the following conclusion:

The main obstacle is of economic character. The present financial restrictions did not allow to systematically invest into new technologies for education and specialized technical documentation.

The Cuban program of educational informatics is not supported by any international program.

DEVELOPMENT OF INFORMATICS IN CUBAN UNIVERSITIES UNDER THE AUSPICES OF THE MINISTRY OF HIGHER EDUCATION

INTRODUCTION

The computerization program for higher education was approved by the Cuban Government in 1984, with the purpose of developing and applying the strategy of introduction computer equipment on this level of education.

At the first stage the program was financed centrally by the state. A major step was made then in the direction of outlining development prospects of national culture in informatics, and needs of various educational services in computerization were determined.

The ministries and organizations having the greatest need in computerization of the educational process were included in the program.

Due to the economical crisis in the country, in the first months of 1991 a decision was made to decentralize the program; it was suggested that the universities change over to self-financing. In particular, it was decided by the Ministry of Higher Education that under these circumstances each university should take the responsibility for fulfilling this program as far as its currency income permits.

The aim of this document is to give an account of the most important points in the history of the computerization program for the Cuban university system, of its present state and prospects, and of the priorities outlined by the Ministry of Higher Education.

1. EVALUATING THE RESULTS OF INTRODUCING THE COMPUTERIZATION PROGRAM

During the ten years that have passed since the moment the computerization program was outlined, significant progress was made. Further on we name the branches in which the success is apparent.

A. Professional education

The computerization program allowed one to include computer literacy in plans and programs of all disciplines, both computer oriented and those where informatics is needed as teaching means and/or tool.

Speaking of preparation of experts in informatics or modern information technologies, one should say that, as a result of intensive work, 13,000 specialists were prepared, including 2,111 experts in electronic equipment and microchips, 3,142 experts in automated control systems, 3,920 experts in telecommunication, 1,500 experts in programming and 1,400 experts in engineering informatics (numerical methods).

For each specialization, a plan of using computers was developed that provided for optimization of the educational process by creating real situations to be analyzed during the classes or increasing quality and exactness of solving various problems. This plan was called General plan for computerization of professional education and became the main document according to which introduction of computer literacy into teaching programs was done.

Each program determined exactly the needs of future specialists in computerization and teaching plans in informatics. We have serious achievements in introduction of computers into the process of training veterinarians, chemical and mechanical engineers.

Introduction of computers allowed to add new methods to those used by professionals in their work, thus allowing to solve the problems that are very hard to solve using old methods.

It should be noted also that one of the achievements of this program is changes in the public opinion about the necessity of introduction the computer as essential tool for solution of many problems. Although these changes in mentality cannot be called universal, they should contribute to a breakthrough which will allow the specialists to use their professional potential more efficiently.

The computerization program contains the concept of final user, according to which the classical schemes of mastering one programming language for each separate occasion were discarded.

The flexibility of the computerization program allowed one to adjust software and equipment to needs of each particular branch of knowledge and guaranteed the steady development of technologies.

The obvious success of the program in developing methods of application of computers to professional training allowed us to conclude five years ago that we were in the avantguard of the third world and able to compete with some of the developed countries.

The present crisis and the stringent economical blockade imposed on us by the United States are the reasons for the ceasing of funding the computerization program, which had negative effect on the performance of the equipment and made it 83% obsolete. All this told very negatively on the quality of training specialists. For example, the operating environment Windows, which became standard as early as five years ago, can be installed only on 27% of our computers.

B. Training professors, scientists, and post-graduate students

Training professors and researchers is one of the principal factors in attaining the prospects of the computerization program. To that end, for each discipline, the scope of knowledge and skills in informatics required for a professor of it was established. It is clear that efficiency of introduction elements of programming and modern technologies in general depends on to what extent the professor himself has mastered the computer and uses it in his work. This is why the shortage of equipment has a very negative effect upon the level of training of our professors.

Concerning post-graduate training of professors, considerable success was made in this field, because we managed to satisfy the needs in various branches of education, consulting, and service of computer equipment.

We managed to have about 130 refresher classes in informatics for users and personnel, even though shortage of the necessary equipment had its negative effect on this kind of activity, too. A great number of students participated in these classes; the equipment installed in non-university organizations was used as well. In the framework of this activity, 5 teacher-training programs were accomplished (for training teachers of informatics in general, teachers of informatics for engineers and architects, teachers of educational informatics, teachers of programming and of applied programming) and one program for training specialists in computer-aided design and typesetting. 50 persons attended these classes.

There are also a few professions which, not being of a purely computer character, require some knowledge of software and computer architecture. On the other hand, of 169 professions existing in the country, 125 (74%) include computer literacy as one of the disciplines in their syllabi.

An important role in training teachers, scientists, and graduate students was played by the Regional Center of Computer Training for Teachers of Architecture and Engineering (CREPIAI), which is a branch of the Jose Antonio Echeveria Polytechical Institute and by the Center of Informatics for Managers, which is a branch of the Habana University. Both of these centers were created under the auspices of UNESCO.

C. Research

An extensive use of computers is observed in this field; it is thanks to the computers that most of the success in the sphere of higher education was achieved. This statement may be supported by the fact that at the contest of projects submitted to the Ministry of Education for financing, most of the projects submitted imply the use of computer as indispensable ingredient. Of course, levels of the projects vary since the command of computer is not the same in all the groups.

Some scientific teams regard informatics as subject of their research, others are related directly to development of software. Among the teams working with applied programming, those working upon applications of informatics to education stand out. In 8 of 15 universities belonging to the Ministry of Higher Education there are research teams that actively work in the field of educational informatics, that investigate and develop software, programming languages, multimedia, etc. It is a proof of their fruitful work that 50% of works submitted to the Congress "Informatics in Education", which took place in Habana in March 1996 in the framework of the Convention "Informatics in Education", were from our universities.

One of the methods of stimulating interest in informatics among scientists and students is the Students' Computer Contests for the students of the last five years. The number of participants of this competition is steadily growing.

D. Management and using scientific and technical information with the aid of computers

The network of the Center of Scientific and Technical Information of the Ministry of Higher Education was created in 1972; since then and until 1984 the organization of this network had been improved. The finances assigned to this network were used for the purchase of equipment and information and for automating management of university libraries. Since 1984 to 1989 the final phase of creation of the network began, that is 19 centers of information (or main libraries of 15 universities of the Ministry of Higher Education) were founded.

During this second stage, the main investments were made into the purchase of information, computers, copiers, laser printers, CD ROMs, scanners, modems, and other materials required for strengthening the network. After 1989, one continued investing in the network, for information was purchased and the performance of the network was enhanced.

At present, about 3 million copies of books, periodicals, and other documents are stored in the universities. This is why such services as photocopying, computer-aided bibliographical and context search were organized, and databases were created. At the moment we have 300 databases that store more than a million records. Only in 1994/95, the support service allowed to add 77 thousand original articles to these databases (9 articles per one professor or researcher on the average). The network exchange among 3,000 organizations, in which 39 university scientific journals are published, has achieved a great scope. Several thousands of copies of the journals, to the total cost of more than 100 US dollars, take part in this exchange.

As an important event in the history of the network, one should point out the creation of the "National Server of Scientific and Technical Information" with the REDUNIV node. This server is situated in the Center of Scientific and Technical Information of the Ministry of Higher Education (the ICT/MES center), from where the program of development of the network is directed and coordinated. REDUNIV provides e-mail, spreadsheets, referative, bibliographic, mixed and control databases that were purchased or developed in the network. All services are supported by the database control system CDS/ISIS, which is known as MICROSIS and has been distributed by UNESCO.

On the other hand, the ICT/MES center distributes the MICROSIS system in all the country, to which end 90 courses and seminars have been organized starting with 1995; about 1500 persons from 22 organizations attended these courses.

One should point out that REDUNIV node gives our universities the access to the Cuban Academy of Sciences network via X.25 protocol, which gives access to other national services and to the international email via UUCP.

In spite of all these achievements, the access to scientific and technical information with the aid of modern technologies is extremely difficult due to problems with equipment and to the poor quality of national telephone lines.

E. Management of the universities

Speaking of computerization of administrative functions in the universities, a new tendency should be pointed out: the automated systems are coming closer to the final user, thus breaking the older schemes of functioning of computer centers. The systems developed by the Ministry of Higher Education and by the universities themselves allowed to improve the working discipline and to secure more efficient administration of the universities.

The grave situation with equipment had its negative effect both on this field of activity and on the capabilities of the personnel specialized in installation and service of the network in the universities. During the last 5 years, we managed to maintain the level of automation of management in our university centers; in those with the greater potential, their own programs were developed or the base programs were improved.

2. THE FUTURE OF THE PROGRAM OF COMPUTERIZATION OF THE HIGHER EDUCATION IN CUBA

In November 1995, the National Commission in Computerization of the Ministry of Higher Education in Cuba was founded. Experts from all the universities are members of this commission. They decide the directions in which one should develop the computerization program and what parts of the program, which had been created 10 years ago, should be updated.

The measures taken indicate that the Cuban revolutionary Government sees the strategic importance of the computerization program for the future development of our country and gives it a financial support even in the present grave economical situation.

It is certain that one should prepare such a computerization program that will allow our universities to make a breakthrough, that will be realistic enough not to be so dependent on the financial difficulties caused by the present severe crisis. If the program is to perform badly, this will certainly have its effect on the quality of training of the future specialists, and the drawbacks of the programs, with which we will have to fight, will become clear.

One of the fundamental priorities of the computerization program is creating the culture of work in the computer nets and of using the sources of scientific, engineering, administrative, and economical information. This orientation guarantees that our specialists will be ready to work in the national networks and, in the nearest future, in the Internet. This strategy will allow us not to be overwhelmed by the avalanche of new technologies, whose development causes extensive exchange of information between the developed and developing countries. We will be also sure that our students, professors, and scientists are ready to use these resources adequately, by creating the true image of our country and the Revolution in the Internet. To achieve this end it is necessary to create computer networks that join the maximal number of universities and to teach the professors and computer experts so as they could include the new knowledge and concepts into the syllabi of all the disciplines.

The distribution of resources in the higher education will be based upon dividing the existing professions into three groups; for each of these groups, it will be indicated to what extent usage of computers and new information technologies is a priority for each of the disciplines in these groups. It is obvious that the first group will consist of the professions for which informatics is one of the main disciplines, as well as those dependent on the modern computer equipment.

The computerization program should make a special stress upon training specialists and professors, as well as graduate students. It is the graduate students who are responsible for the revision of all computerization programs from the standpoint of the new technologies and for the introduction of the revised programs. Using computers in research will become the second priority, taking into account the extent to which it influences quality and efficiency of research.

The administration of the Ministry of Higher Education knows very well to what extent computer technologies, telecommunications, scientific information, and modern information technologies are intertwined in the modern world. Creating a technological and methodological base for the development of knowledge and skills pertaining to the usage of this technology, introducing its elements into the basic syllabi of each profession, and attaining the new level of information culture in our country are both the main objective of the new Computerization Program for Higher Education and our most ardent wish.

HABANA,

THE REPUBLIC OF CUBA

MINISTRY OF EDUCATION
MINISTRY OF HIGH EDUCATION

NATIONAL REPORT OF FINLAND

EDUCATION AND INFORMATICS IN FINLAND

THE EDUCATION SYSTEM OF FINLAND

The most essential goal of the Finnish educational policy is to provide the entire population with a high level of education. The education system is built to offer people opportunities to proceed in different types and channels of education according to their own abilities and needs, regardless of their place of residence, economic situation, sex or mother tongue. Instruction is mainly given in Finnish or Swedish. In Lapland it is also possible to study in Sami language.

PRESCHOOL EDUCATION

Preschool education, which is not compulsory in Finland, is arranged for 6-year-old children in a day care centre or in a preschool group attached to a comprehensive school. Annually, more than half of the age group participates in preschool education, some 2 % of whom is given preschool education in comprehensive schools.

COMPULSORY EDUCATION-COMPREHENSIVE SCHOOL

In Finland the compulsory school age begins at seven and continues for ten years unless the person has completed the syllabus of the comprehensive school earlier. In general, it takes nine years to complete the comprehensive school. It is the duty of the local authorities to provide comprehensive school education or other corresponding studies for children of compulsory school age resident in their areas. The majority of children attend to comprehensive school studies arranged by municipalities. However, it is possible to study also elsewhere, for example, in private schools, in hospital schools or at home. Some 62000 children start their comprehensive school education annually.

SENIOR SECONDARY SCHOOL

Senior secondary schools provide general education and continue the basic general education provided by comprehensive schools. Nearly 60 % of the comprehensive school-leavers opt for upper secondary school. The upper secondary school terminates in a national school leaving examination, the matriculation examination, which in 1994 was taken by some 30 000 students. The completion of upper secondary education and matriculation examination give general eligibility for university studies and vocational education intended for matriculated students. Under certain conditions universities may also admit students who have not passed the matriculation examination.

VOCATIONAL EDUCATION

Basic vocational training (2-3 years) is given in multi disciplinary or specialized vocational schools. Higher vocational education (3-5 years) is usually given at specialized colleges which can be entered either after comprehensive school or (usually) after completed secondary level studies, Apprenticeship is provided as an alternative route to these qualifications. Polytechnics is in Finland a new Fachhochschule-type institution of higher vocational education whose 3-4 year programmes lead to an academic degree.

UNIVERSITIES

The basic university degree (candidate, master's degree) consists of three stages and takes 5-6 years to complete.

The Finnish universities consists of 20 institutions, of which 10 are multi-faculty universities, 6 specialised universities, and 4 art academies. The universities are located in 11 cities. The number of university students is 135,000. The total number of staff is 23,500, of which 7,500 are teachers.

ADULT EDUCATION

Finnish adult education can be grouped into basic general education, basic vocational education and liberal education. Adults are also offered the same kind basic education - vocational, general and higher education- as is provided for the young.

THE STARTING POINT IN FINLAND IN USING NIT IN EDUCATION

Finland has a good base for development as an information society, which benefits from modem information technology. The network of educational establishments is dense and there is an extensive supply of training opportunities after comprehensive school. About 60 percent of each age group go on to upper secondary school. Over 90 percent of each age group, after completing comprehensive school or upper secondary school, go on to attend a vocational training institution, polytechnic or university. The supply of adult education has increased rapidly since the 1980s.

Information is readily available to people throughout Finland. The nationwide public library system has been designed according to a networked model based on cooperation and division of responsibilities. Every Finnish municipality maintains a public library. In total, these public libraries have over 2,000 service units providing services, which are available to all citizens. About 80 percent of public libraries have computerized library systems, and this percentage continues to increase. Currently, libraries use over ten different computer systems.

There are some 800 scientific libraries in Finland and university libraries represent a central part of this network. Unlike the situation in many other countries, scientific libraries in Finland are public services and open to everyone. The joint data network of university libraries is the backbone of the computer systems in scientific libraries. The uniform structure of this system makes it unique in the world.

In some sectors, the information technology and telecommunications industry in Finland is a world leader, and the development targets set by the EU have already been reached. The quality of Finnish information technology has been recognized in OECD reports, among others. The level of information technology employed in society and business life is relatively high, this is also true in some sectors of education and training.

Major improvements in information technology and telecommunications have also taken place in the science and research sectors, especially during the last five years.

Scientific computing and symbolic data processing have both solid traditions and established positions in Finland. Internationally, computational science and research are at the leading edge, and the results obtained are transferred to companies for use in their product development. Finnish research leads the world in some sectors of the data processing field.

Progress in very exacting areas such as supercomputer projects and information network development has been made possible by effective national cooperation and division of responsibilities between the universities.

The number of Internet connections per capita in Finland Us one of the highest in the world.

INFORMATION TECHNOLOGY STRATEGY FOR EDUCATION

Education and research are crucial factors for the development of Finland as an information society. For the citizens of such a society to prosper, they must possess a good general education, a wide variety of capabilities to act and solve problems, and the professional competences and skills required by the continuous changes inherent in a working life based on networks.

The Finnish Ministry of Education has published in 1995 a document on the strategies for developing education and research in accordance with the demands of the Information Society. The strategies and attendant measures cover the ground up till the year 2000. The implementation of certain steps was begun in the current year. The main areas of development are the following:

FROM ONE-OFF TRAINING TO LIFELONG LEARNING

Networking methods and the changing requirements for professional competence demand that the education system is both flexible and adaptable. Educational authorities and organizations must promote networking of the education system and create open learning environments to support the development from "once-and-for-all" training towards lifelong learning. Individual study opportunities must be improved at all levels of education, and study methods, teaching material, as well as the required information services need to be developed.

To ensure that the adoption of new teaching methods and the use of information technology is effective, their development and application must become a part of the everyday activity of universities and educational establishments.

The use of open and flexible learning methods and teaching materials should be increased in adult education establishments, civic and workers' institutes, as well as in open university education. Students should be shown how to benefit from the use of information technology as a learning tool.

The ability of libraries and information services to serve the public in acquiring information should be improved. The libraries should be developed as nodes in the open information network, and their role in providing user support for information networks and electronic information products should be strengthened.

BASIC INFORMATION SOCIETY SKILLS FOR ALL

The task of comprehensive school is to give every girl and boy the multi-faceted basic skills and competences required to find and manage information and to communicate. These are basic requirements in the information society and are essential for further education. All levels of the education system should support the continuous updating of these skills.

The comprehensive school must ensure that every pupil learns how to acquire information independently from different sources, how to manage and process information and how to use information in an analytical and critical manner.

The task of the comprehensive school is to provide every pupil with basic skills in using information technology. Girls in particular need to be encouraged to use information technology.

The use of information technology as a learning tool in initial general and vocational education should be increased as specified in the new national criteria for curricula. Information technology should not be taught as a separate subject, it should be a factor that is integrated into the teaching of other subjects.

The municipalities need to ensure that the schools have the equipment and network facilities necessary for teaching the basic information technology skills. Continuing education should be increased to guarantee that teachers and necessary support staff possess an adequate level of competence.

Adults must have the opportunity to learn the basic skills of obtaining and managing information, communicating and understanding information technology. They must have the opportunity to improve these skills continuously.

VOCATIONAL SKILLS IN THE INFORMATION SOCIETY

Vocational education should provide such skills for living in the information society that correspond to the requirements of a networked working life, one which is continuously changing and becoming increasingly international.

Educational authorities and organizations should together ensure that the initial and continuing education that supports the information industry is sufficient, at the right level, and of the required quality. A national goal should be that professional competence in the different sectors of the information industry in Finland is counted among the best in the world.

The know-how of professionals in the information industries need to be extended to meet the diverse needs of changing job requirements. The introduction of information technology causes particular needs for change throughout initial and continuing education in the fields of library and information services.

FOCUS ON THE TEACHERS

In implementing the principle of lifelong learning, teachers' professional skills are absolutely essential. Teachers need not only to know how to manage and communicate information in their own field, they must also be able to teach methods of obtaining and using information to enable learners to work independently. Teachers should have the ability to use the media necessary for open and flexible learning and be able to modify and develop material in ways which make it suitable for them to use. The prerequisites and content of basic and supplementary teacher training must be developed to respond to these requirements.

DEVELOPMENT OF INFORMATION PRODUCTS AND SERVICES

The availability and competitiveness of high-quality Finnish information products serving education and research must be guaranteed.

Using the new methods which technology makes available, information resources need to be made available for both national and international use. To ensure that Finnish information services function smoothly as a part of a global electronic library, the technological capacity and know-how required to achieve this need to be developed.

The production, distribution and utilization of information products published in digital form must be increased in a variety of sectors, especially in education and training, research and public administration, and in the libraries, information services and archives which serve these sectors. Support is needed for Finland's emerging multimedia production facilities and related businesses through commissioned work and subcontract work.

RESEARCH IN THE INFORMATION SOCIETY

Developments in information technology impact all fields of research, from basic to applied. Nowadays, in almost all cases, information technology is an essential part of the research process. The prerequisites of scientific computing, such as adequate high-performance computing capacity, workstation facilities and high-speed network connections are crucial factors in competitive research.

Finnish universities and scientific research aim to be at the international forefront in applying information technology. Participation in the information technology programmes of the European Union should be active. Finnish education and research should be among the first to attain the goals set by the RTJ for applying information technology and telecommunications.

Developments toward the information society, the application of information technology and increased networking have far-reaching economic, social and cultural impact that requires further research. The focus of pedagogical research should be on the fields of media and learning, and on the interaction between humans and machines.

EDUCATION AND RESEARCH NETWORKS

The national information infrastructure, the Finnish Information Highway, should be assembled as a multi-layer, seamless system. The information network for education, training and research will be a part of a global open network.

The Internet and emerging standards for broadband networks and services should provide the foundation for the education and research information network in Finland.

Schools and educational establishments must be integrated with their local environment. Links between schools and educational establishments at different levels and operating in different fields must be increased, and links with community and business life improved. The information networks should be structured so that they support these developments. The most effective technical way of achieving this is based on regional networking and cooperation.

Information network services are to be made available to all schools and libraries. An adequate level of service should be guaranteed to all educational establishments. Both scientific and public libraries must be guaranteed not only adequate facilities, but also the telecommunications links and expertise required to utilize these effectively. Special attention should be paid to the development of public library information network services and to the development of libraries as nodes in the open information network.

LIMITING FACTORS

In the 1980s, substantial hardware investments were made in schools providing general education and in vocational institutes. At the same time, continuing education for teachers was organized on a large scale. In recent years, as a whole, the school system has not kept pace with the rest of society in terms of information technology, even though a number of advanced regional communication network projects are in progress and several development projects in open and distance teaching and multimedia materials are under way.

The use of information technology in education and training has also been held back by a lack of applications. Finland is a small market and language area, and hence production of electronic information products has got off to a slow start. This is clearly seen in the production of educational software. The weak economic situation has also reduced demand for such software.

Currently, the level of information technology equipment available differs from school to school, and some of it i.s obsolete. The situation is worst in primary education. Even where adequate equipment exists, it is often not fully utilized. Teachers have differing abilities in using information technology. The level of utilization of telecommunication services and information networks is still low in Finnish schools, mainly due to the slow development in equipment resources. Cooperation between educational institutions in using teaching resources has been rare. All these factors have slowed down the development of an organizational culture that utilizes information technology.

DEVELOPMENT PROJECTS

Based on the above-mentioned strategy of the Ministry of Education a development programme was launched at the beginning of 1996 with an aim to improve the schools' computer hardware and permanently link individual educational institutions up with Internet. The programme will be concluded by the year 2000.

The name of the programme is Suomi tietoyhteiskunnaksi - koulutus tiedon valtatielle (Help make Finland an information society - help put the school on the road to better knowledge). The programme includes projects for developing classroom practices turning to the best account the new information technology and developing new Finnish multimedia programmes and study materials for use on the net. Over the next three years the government intends to support the local school owners and mandators with roughly FIM 100 million in order that the latter will be able to purchase PCs to the schools and enlarge their information networks. The programme has been enthusiastically and universally applauded. About 80 percent of the schools and their owners have expressed a wish to be part of the programme already in its first year.

INFORMATION TECNOLOGY IN NATIONAL CURRICULA

Curricula at all levels of education in Finland, from preprimary education to university postgraduate programmes, have just been renewed.

Decision-making concerning the organization and content of general and vocational education has been transferred to those who maintain the schools: the municipalities and federations of municipalities. At national level, general criteria for curricula provide the framework for steering education.

New national criteria for curricula for comprehensive schools and upper secondary schools were approved in January 1994. The national criteria for curricula for upper secondary vocational education were approved at the beginning of 1995. The criteria for curricula for higher level and institute level were approved in February 1996. At present, national criteria are under preparation for the vocational diploma and special vocational diploma in adult education, as provided for in the law concerning vocational diplomas.

Requirements of technical basic education, including information technology skills, are incorporated in the curriculum criteria for basic general education. The principles for how these skills should be taught vary from one curriculum to another.

COMPREHENSIVE SCHOOLS AND UPPER SECONDARY SCHOOLS

In the national criteria for curricula for comprehensive schools, pupils are expected to learn how to utilize information technology applications. The study goal is that the pupil, irrespective of previous experience, learns how to use computers and the most common software applications and is also able to make a realistic assessment of the possibilities of utilizing information technology in different subjects.

In the criteria for curricula for comprehensive schools, information technology has not been allocated a separate number of lessons; it is regarded as an integrated theme. Study goals for information technology have been set, but since it is an integrated theme, teaching takes place either in conjunction with other subjects or, in the upper levels of comprehensive schools, as an optional subject, depending on the local curriculum.

In the curriculum for upper secondary schools, information technology is not specified as a subject, course, or separate integrated theme, and no specific goals are set for the skills to be acquired. However, upper secondary school studies include optional, applied courses which can be taken either at the student's own school or at another educational establishment. These optional courses may include studies in information technology. In both comprehensive school and upper secondary school, information technology is used as a tool when studying other subjects.

VOCATIONAL EDUCATION

According to the curriculum criteria for vocational education, information technology must be taken into account from a variety of points of view in all studies, both as a subject in its own right and as a tool for learning other subjects. In general studies, from which a student may choose courses worth between one and four credits (study weeks), information technology is an optional subject available to all students. Information technology is also an optional subject in adult vocational education.

General studies are intended only for those students who enter vocational education from comprehensive school. No general studies are separately defined for students entering from upper secondary schools. The goals of the general studies are included in the national criteria for curricula in every field and degree. This means that the emphasis on the teaching of information technology varies according to the field and the degree. The general goal is to teach the students to use the hardware, software and information resources available in their own field and for them to gain an understanding of the basic functions of computers.

At institute and higher vocational level, students may choose from one to five credits in information technology studies. The aim is that the students become knowledgeable in how to use information technology to retrieve, produce and process knowledge in their future occupations. They should learn to access and use domestic and foreign networks and be aware of the versatility of IT and the new multimedia and how to make the most of them. They should further be able to act naturally and responsibly as users and producers of information technology.

The national core curricula provide a good basis for making use of the new information technology. How IT is taught and made use of, however, is ultimately in the hands of the individual school. It has been found that the curricula especially of small lower stage comprehensive schools show very little IT. Also at the upper stage of comprehensive school and in upper secondary school the use of information and communication technology has been scarce except for the optional courses in IT. The development programme introduced by the Ministry of Education has, however, helped change general attitudes and many schools are currently revising their curricula in regard to their information and communication technology content. The use of Internet in teaching is an interest common to most schools.

UNIVERSITIES

The universities in Finland are autonomous and they are responsible for developing their own curricula. Recently initiated evaluations of university activities have clearly encouraged the universities to pursue this work. The evaluations have been the basis for the development of degrees and degree programmes. A new two-level basic degree system has already been adopted in six academic fields. During 1995, the intention is to have new degree statutes in force in six or seven additional disciplines. Once this has been achieved, 90 percent of new students will be studying in accordance with the new two-level system. The reform of diplomas concerns both structure and content. The goals are to make study more effective and to improve the quality of research work.

In the performance agreements made between the universities and the Ministry of Education, it has already been decided that universities carry out regular evaluations of their teaching and that students take part in these evaluations.

NEW WAYS OF LEARNING AND TEACHING USING NIT

Modern concepts of learning emphasize the students' responsibility for their own learning and their active role in seeking and using information. The role of the teacher changes from being a distributor of book learning into being a tutor guiding the students. The school environment becomes a centre for learning and activity. In libraries and information services, telecommunication and digital information products are increasingly found alongside traditional services as information sources of equal value.

The development of information technology has facilitated new types of teaching arrangements and a more flexible division of responsibilities between universities and educational establishments. Education units can agree on joint distance teaching, which is able to reach students throughout the country.

This makes possible an increase in educational opportunities while reducing costs resulting from the duplication of teaching. Locally, the focus can be on tutoring support for students and on reinforcement of the learning process. For working people, the possibility of studying without time and place constraints is important.

The furthest on the way in Finland is the development of open and flexible study practices in adult vocational education and training. In this sector work for the turning into the best account of new equipment has been steadily done already for years. Development work has been effected in project networks, each comprising thirty educational institutions. Areas of stress have been the development of action models for open learning milieus and the development of study materials for distance teaching. The work goes on. Next in line is the development of distance operated upper secondary schools for adults and the opportunities of mature students to pass examinations using data nets. These projects will be launched in 1996. In addition to the data networks, the use of radio and television in adult education will increase.

Information technology is widely used in Finnish university education. Different kinds of computers are available to both teachers and students, and special computer rooms with terminals, microcomputers or workstations are provided for educational use. However, more information technology is needed, but the lack of financial resources for additional investments and for employing new personnel in maintenance and support is the most important obstacle in trying to meet this demand.

Within the framework of the national strategy for education, training and research in the information society, special projects have been agreed in annual negotiations between the universities and the Ministry of Education. These projects include training courses in information technology, as well as developing hardware and software and campus networks of the universities.

PARTICIPATION IN INTERNATIONAL PROGRAMMES

In Finland, several small-scale experiments on networked training arrangements have already been carried out or are currently under way. Several of these projects have been executed within the framework of the EU telematics programme. The large-scale introduction of new learning methods demands that the development and application of these method's and the technology required to support them become part of the day-to-day activity of universities and educational establishments.

Finland's membership in the European Union has enhanced the interest of the schools to participate in international projects. So for instance the LEONARDO programme has approved five Finnish coordinated projects developing the use of multimedia and IT in education.

COMPUTERS AND SOFTWARE

SCHOOL AND INSTITUTES

Hardware

Exact figures on the number of PCs in Finnish schools are lacking. The number has been estimated by the authorities to be on average the following:

	PCs /school	PCs/number of students
Lower stage comprehens. schools	4	28
Upper stage comprehens. schools	22	14
Upper secondary schools	21	11
Vocational institutions (Including Polytechnics)	60	3-10

Software

All schools with computer hardware also carry the necessary central software. Further, some computer assisted teaching programmes are in use, but not to the extent as could be wished for. There are very few programmes to be had in Finnish and the few there are have not yet reached all the schools.

The most use of computer aided software has been made at vocational institutions who also have the best hardware. The education authorities have supported the production of domestic software for use in schools for more than ten years now, but only recently, with the advent of multimedia software and CD-ROM, have these programs spread also to the non-vocational general education institutions. At the moment there are 10 CD-ROM disks available in Finnish, some further ten being prepared with the support of the education authorities. Due to a very small market, the publishers are not very keen on producing teaching materials in the new media.

Schools are only learning to produce WWW material for the Web.

UNIVERSITIES

Hardware

Information technology at the universities includes different kinds of computers: from individual microcomputers to supercomputers, peripheral devices, and local area networks. Many students also use their own personal computers for their studies. Multi-user servers can be used either via classroom terminals, microcomputers or workstations, or from home by using a modem and telecommunication connections. Microcomputers and workstations can also be used separately, with software either installed in the hard disk or loaded from network servers. The total number of microcomputers and workstations available to students at the universities is about 4,500. This means one device for every 30 students, on an average, but the ratio varies from 1/100 to 1/15. Efforts are taken to reach one device for every ten students by the end of this decade. Teaching staff as well as research and administration staff have normally microcomputers or workstations in personal use. Portable computers are also widely used.

Software

The most common operating system in multi-user servers and workstations is Unix. Microcomputers run mainly MS-DOS and Windows, but also Macintoshes exist with their own operating system. Computers which are used in instruction are provided with the necessary software. Teas or even hundreds of different programs are being used at universities for various purposes. Microcomputers are also equipped with necessary telecommunication accessories and programs for using other computers and network services.

Networking

At the universities, practically all computers are connected to the local area network of the university (Ethernet), which are linked via Finnish University and Research Network (FUNET) to international Internet. Internet connection offers a wide range of services to its users: electronic mail, news groups, remote login, file transfer, World Wide Web, and so on.

The FUNET network was upgraded to ATM (asynchronous transfer mode) technology in 1995. Current connections between universities are nowadays 10 - 34 Mbit/s. International connections from FUNET to Nordic network NORDUnet has also been upgraded to 34 Mbit/s recently. Since need for network services is constantly increasing, the FUNHT network needs to be developed further so that the transmission speed would increase. Also international links to Nordic countries, to other Europe and to the United States, must also be upgraded in coming years. Universities will also upgrade their local area networks and take the ATM technology more efficiently in use.

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NATIONAL REPORT OF FRANCE

EDUCATIONAL MULTIMEDIA IN FRANCE

INTRODUCTION

At the beginning of 70s different forms of information technologies were introduced in the educational system of France. During the period of the last 25 years all lyceum and colleges were equipped with computers as the result of some programmes implementation in the field of national education ("1000 micros", "100000 micros", "Informatics for everyone"). Near 5% of teachers took informatics pedagogics courses, which lasted for at least 3 months. Short-term courses of informatics basis training have been overall offered. After the adoption of the regulations, related to the information technologies application in education, software became a didactic means.

In is interesting to remark, that the objectives of informatics application in education, defined at the beginning of the 70s, has considerably changed since that time. The resume of the changes is the following:

- to provide the opportunity of information technologies application in different disciplines;
- mastering the concepts, used as the professional means of education;
- studying informatics methods.

The application of interactive multimedia for educational purposes is always very sensitive to every shift in the system of vocational training. In doesn't even matter, it is an agricultural, vocational or higher education. In any case the development of educational software involves the following perspectives:

- the modernisation of pedagogical practice (education individualisation; education differentiation depending on one's interests and abilities), which allows to increase the efficiency of education;
- the diversification of educational forms as the result of the diversification of the demands for education; it is considered in the national policy of territories accomplishment (the diversification of the modes of access to education; the development of different educational centres in the rural and urban regions for the partial solution of the problems of the isolation of those, who are willing to study, and of the deficiency of the students in some educational institutions);
- re-qualification of active employees and those, demanding a job, in every field of economy.

Depending on users' demands, the general purposes of informatics utilisation are divided into the following groups:

- the realisation of the citizens as soon as possible the necessity to appropriate to the modern technical culture, in particular to master information technologies;
- the admission of computer and multimedia advantages as didactic tools for youth and adults teaching;
- information technologies recognition by public institutions, in particular by the Ministry of the National Education and by the establishments of the system of agricultural education, less by the institutions of vocational education, which don't have defined specialisation in this field, and for the regional departments, which recently became responsible for some fields of education;
- information technologies application in everyday practice of vocational training and education, which is still occasional, though the responsible bodies are formed and there is a certain experience in the field of vocational, agricultural and higher education;
- the low level of families equipment, though many of them are very much interested in information technologies. There are two groups of interested consumers: parents, anxious about the progress of their children - pupils, who consider, that computer is the aid to improve their results at school; adults experience the demand for the means of self-learning in every field of knowledge and in particular in the field of living languages.

1. THE INDUSTRY OF EDUCATIONAL MULTIMEDIA

There are three large sectors in the consumers' market of pedagogical products:

- the market of articles of general consumption;
- the market of professional products, that is the market of intermediary products;
- informal market of exchange the pedagogical documents of establishments and organisations.

These markets are closely interlaced with each other in the field of finances and industry. However the structures, developing educational software, represent a highly heterogeneous group, that consists of the following:

A. ISOLATED AUTHORS

They don't have any commercial structure, helping them to sell their production. Usually, they are teachers, since recently this group was supplemented with freelancers workers, who work on contract base with an educational institution or a publishing house.

B. BOOK PUBLISHING HOUSES

Publishing houses form departments and affiliates, dealing with software. Usually these are big publishing houses, specialising in the field of school literature, such as *Hatier* and *Nathan*. The public establishment the National Centre of Pedagogical Documentation (NCPD), one of the aims of which is to publish pedagogical materials, has a department of software *development (Unité des logiciels Educatifs)*. The system of agricultural education has a specialised establishment - the National Centre of Research and Resources in the field of Advanced Technologies (NCRRAT). The Centre has developed more than 10 CD-ROM programmes.

C. INFORMATICS COMPANIES

This group consists of the publishing houses, specialised in professional software with the departments of educational software development. Among them there are Microsoft (Microsoft Home affiliate) and Claris and servicing and information engineering companies, such as SYSECA and CISI. Most of their clients are the establishments, that are in need of special professional training of their personnel, or they are non-specialised producers, such as book publishing houses without any specialised department for software development.

D. AUDIO-VIDEO PRODUCERS

The TV channels *La Cinquième, TF1, France Télévision* and *Canal+* are intending to start the production of multimedia.

E. SPECIALISED PUBLISHING HOUSES

They have appeared quite recently and their experience in publishing is rather poor. These publishing houses are specialised in new information products (Informatique, Vidéodisque, Télématique, etc.). They are rather small, but able to produce industrial production for a wide range of consumers, as well as services for individual clients. Among them there are *Génésie, Jériko, Chrysis*.

F. SPECIALISED EQUIPMENT COMPANIES

It concerns producers of the equipment, used in the field of education, which applies information and communication technologies. These companies often have to produce "pedagogical production" as a supplement for the main equipment they manufacture. For example, the *Jeulin* and *Micrelec* companies, specialised in laboratory school equipment had to develop a series of data collecting software, compatible with the equipment, produced by them.

G. TRAINING CENTRES

It's quite often, that the centres, offering educational services in a form of courses (lectures) and tours of duty, need to apply new educational technologies for the widening of the range of their students and for the diversification of teaching means. They try to sell their developments through the agency of publishing houses. It is worth to mention, that some centres are specialised in distance education (the National Centre of Distance Education (NCDE), *le Centre National des Arts et Metiers (CNAM)*, the Association of Adults' Vocational Education (AAVE). Owing to this fact they become the leaders in the field of educational software development.

There also a lot of ideas, concerning information technologies implementation in the field of higher education. Some of higher educational institutions have already established quasi-professional structures, able to concretise them (or promote their commercialisation). However, among the serious obstacles in the implementation of innovations are the individualisation of directorship, the absence of financial support, non-regulated stakes in the benefits of the authors or establishments, developing "pedagogical production".

The list of the before mentioned producers of educational software should be supplemented with the departments of big private and state companies (insurance company *l'Union des assurances de Paris (UAP)*, the companies *Vendôme Formation, Electricité de France (EDF), Société Nationale des Chemin de Fer (SNCF), France Télécom*, etc.), developing software for their own needs.

H. CENTRES OF MUTUAL EDUCATION FINANCING, FUNDS AND ASSOCIATIONS

These are non-lucrative organisations, which main aim is the resources' parcelling among the demanding establishments. Some of these organisations are mainly busy with finances gathering and their distribution among the members of the Councils of education development. Others are working with projects in the field of software development, involving the members of these organisations aimed at the reduction of the corresponding costs. The example of these organisations is the Rhone-Alpes Region Association of the Educational Multimedia Development.

Sometimes other associations are developing software for concrete targets, mentioned in their constitutive documents. The *Association Française pour la Lecture* (for reading promoting) has developed a number of products ELMO; the association *Enseignement public et informatique* has developed the product HYPERTEXTE; the fund *Avenir-Jeunesse-Entreprise* - CHOIX, etc.

I. RESEARCH LABORATORIES

Their production is the result of investigations in the field of educational multimedia. Among these laboratories there are *Laboratoire de Structure Discrete et de didactique* in Grenoble, the *Centre de recherche en Infirmatique* in Nancy, the laboratory *Représentation et Traitement de l'information Chimique* in Nice, etc. Their products are subsequently diffused though publishing houses. It happened so with the product Le géometre, developed by LSD and diffused by the publishing house Nathan/Edusoft.

J. MUSEUMS

Under the promotion of the National Union of Museums, many museums of France (*Le LouvreCité des sciences et de l'industrie (La Villette), le musee d'Orsay , le Centre Georges Pompidou, etc*) follow their own policy of the development multimedia, working in on-line and off-line regimes.

Lastly, we should note, that the sector of educational software producers is now in the process of radical transformation: intensive merging (*France Télécom* has purchased some small enterprises, *Chrysis de Logedic*; it has attached *Jeriko* and *Infogrammes*); concentration among industrial groups (*Liris* with the *Cité* group; *Havas Edition Electrique* joint *ODA* and *Arborescence*, *Hachette Multimedia, etc*); capital inflow, some activities stoppage, etc.

2. THE INFRASTRUCTURE OF NETS AND SERVICES

Regarding net's services, it's worth to mention, that, though the situation is rapidly changing, at present:

- the services of the interactive regime in the field of education are still not structured in France;

- the communication nets introduction in the system of educational services offering brings about radical changes in pedagogical means (from book and video cassette to interactive multimedia).

There are two basic types of nets: information nets and audio-video nets.

INFORMATION NETS

- The TELETEL net is widely applied in the field of various services and very little - in the field of education. This net is well adapted to interactive queries processing (information on transport time-tables; reserving spaces in airplanes, rooms in hotels, etc.) and much worse adapted for education purposes (there is no opportunity of documents transference, poor graphic interface, slow transmission). Mostly, in the system of education it is used for control.

- RNIS generalisation throughout the territory of the country still didn't change the situation, because the *Kiosque Micro*, which is really able to solve many problems, has opened quite recently. Though now, we are witnessing, how quick visual lectures became popular on the second stage of education, in higher school and vocational education on enterprises.

- The realisation of the RENATER net (French affiliate of Internet) gave higher school a potential opportunity to use such a fantastic means of education, as multimedia.

Some private nets on the base of Internet (Infonie, France on line, MHM), advertised the services in the field of education, emphasising pupils' training at home.

AUDIO-VIDEO NETS

There fore ways of their application:

- application in TV programmes of general channels, in particular of France 3;

- the global application in the framework of recently organised educational channel La Cinquiéme, broadcasted in the Fifth National Radio wave Net, before French - German programme ARTE;

- thematic application in some satellite or cable channels, for example the Planete channel, specialised in documentary information, or the Histoire channel, which is expected to be organised in the near future by *Institut national de l'Audiovisuel* and *SEPT/ARTE*;

- application for the special audience in particular cable nets, which have educational channel or a bank of query programmes, such as EDUCABLE, offered by CNDR, or the channel of the France 3 net, intended for Lorraine schools.

In the future these forms of application will be more often supplemented with information products editions.

3. USING EDUCATIONAL MULTIMEDIA

3.1. USING AT HOME

Only 7% (24 million) of all French families have compatible PC computers at home and only 2-3% of them have the other equipment (approx. 1 700 000 pieces in all these families).

However, the volume of CD-ROMs sale increases day after day: since September, 1993 till September, 1994 there were sold about 700 000 of products; according to some calculations in 1995 the volume of sale will come to 1,6 million. The part of educational products is evaluated in 13%. According to the data of *Electre Multimédia* the main of them are the products for schoolchildren and encyclopaedias.

3.2. USING IN THE SYSTEM OF INITIAL EDUCATION

3.2.1. Primary education

The number of available multimedia equipment is still limited. The educational system has at its disposal 450 working places for the total number of 1100 pupils.

Usually computers are situated in classrooms and pupils are able to accomplish individual tasks. However such tasks are rather rare nowadays. Only the first steps are made in studding the programme LOGO, computer-aided training (EAO), including learning foreign languages.

Some publishers are already offering schools EAO multimedia, but we still don't know it is right.

There are no multimedia products as articles of general consumption for personal computers, financially available for schools. The appearance on the market of some products free for schools, such as "The magic theatre" *(d'Edusoft)* or *Gazelle* software, will partially solve the problem of schools' equipment with multimedia products. Apple production (Kid Pix, Apple Média Tools, Kid Works, etc.) offers wide opportunity for adaptation and creation, easily used by the children of the very early age and by their teachers.

We believe, that the successful Internet using, in particular in the school net on Vercor's Plateau, will get development.

3.2.2. Secondary education

The laws, regarding the decentralisation of the national control system, have considerably changed the allocation of responsibilities, concerning financing of equipment purchasing, between central and regional administration. Regional administration became in charge of some responsibilities, formerly concerning central administration, regarding equipment purchasing for secondary educational institutions. At the same time, the parallel trends of credits' decentralisation and strengthening the position of educational institutions led to the necessity to differ lyceums and colleges, which is closely connected with financial resources and the offering type of education. Rapid and sensible changes took place in this field: schools began to purchase computer equipment without any intermediaries. It has accelerated the realisation of the projects of cables' laying on and lyceums and colleges connection with general net.

At present 350 thousand of microcomputers were installed in 12 thousand of French public and private secondary schools of the system of general, technical and vocational education. Besides computers they were equipped with peripherals (printers, scanners, CD-ROMs, physical interfaces, etc.). The number of CD-ROMs, installed in lyceums and colleges comes to 12 thousand.

Most likely, that the new information space, which will be created in the near future, will be characterised by the three main tendencies:

- existing computer resources integration into a net and their connecting to big communication nets or data transmission nets. About 400 schools have already began to connect their computer resources to the net and during the next months this process should be developed. There is an experience of these nets connection to Internet through RENATER;
- the acquisition of multimedia devices, leading to television and informatics integration;
- the appearance of portable machines (in particular, in preparing classes of higher school), may radically change our attitude towards computer pedagogics, turning microcomputer into super-calculator.

Software for secondary education consists of two types of products:

- professional software, specially developed for the application on enterprises: operational systems and programming languages, general tools of bureautics, specialised tools.
- pedagogical software, specially developed for educational institutions. Most of them are developed by private publishing houses and information companies.

Our state has financed from the budget (80 million francs) purchasing software for secondary educational institutions. The Ministry of education introduced an original system of procedures, related to the acquisition of a right to use a software (mixed licences). These procedures make possible to reduce expenditures for the products, which were evaluated by expert commissions as the products of pedagogical interest (annually schools purchase something about 60 thousand of such products).

Computer education may be acquired not only in specially equipped halls, but in school computer classrooms also. Moreover, more and more computers are installed nowadays in artistic classrooms, lecture halls, laboratories, lounges for teachers and students.

3.2.3. Higher education

There are quite different places for computers in the establishments of higher education. But usually they are placed:

- in the special halls for informatics training or for the technical support of different disciplines teaching (calculations, statistics, econometrics, etc.); these halls are first of all used for compulsory education (practical training, working under teacher's direction). When there are no lessons, the halls are at the disposal of the students, who can study individually with the help of text programmes;
- specially equipped halls for self-learning of particular disciplines; they are usual for technical and medical universities; the students, who reserved working places, get at their disposal different educational products, permitting to acquire the necessary technical skills, to test yourself, to train and to evaluate your own knowledge of basic disciplines;
- specially equipped halls for learning modern languages; these halls either similar to the previous ones (microcomputers, connected to the net or autonomous), or they function like "language laboratories", in case they have the necessary equipment.

Moreover, university libraries are also equipped with the devices, permitting to work with multimedia. Mostly, they are necessary for reading encyclopaedias, dictionaries and data bases on CD-ROMs. If a higher educational institution doesn't have a hall for self-learning, library usually purchases a programme package "electronic documents".

Multimedia application for education in higher school has some difficulties. Bit by bit the resistance to innovations abates, as well as the fear of new technologies; the problem of the necessary means of infrastructure (materials and cadres) is partially solved. Nevertheless, the main problem still exists - environment individualism: teachers consider, that their role is in the creation of individualised education, and they long to its unaided formation, without any regard of the pedagogic materials of the other authors.

Supposing, the named difficulties are overcame. It brings about the new problem: the acquisition of multimedia products is too expensive. It is extremely dangerous under the conditions of the absence of any policy, regarding licensing on sites. Dispositions, concerning the promotion of these products production, partly solve the problem, but the vote for these purposes is still insufficient in comparison with the total amount of educational vote. We'd like to notice, that the solution of the problem through the products purchasing by the students on their own faces the absence of the corresponding teachers' directions, the lack of the necessary equipment at home and too expensive costs, though equipment producers and regional administration assume measures, aimed at costs reduction).

Higher educational institutions are longing to link their local nets with the RENATER net, to provide their students with the opportunity to use as much multimedia, data bases and other products as possible. Since recently, some educational institutions adopted the course of the elaboration of the products, interesting for a wide range of consumers or designed for nets.

3.2.4. Agricultural education

Educational institutions of agricultural system of education are fist of all focused on the elaboration and distribution of professional educational software. The application of pedagogical software is new for us and yet we don't have reliable and comprehensive information about the experience in this field and available equipment. However, besides the aforementioned NCRRAT, we have at our disposal:

- 60 local centres of computer resources, which are under the authority of the Ministry of Agriculture, are equipped for individual and distance learning;
- 600 biggest agricultural educational institutions were implemented with basic computer equipment: the minimum computer class equipment is 21 computers, among which 1 is for multimedia.

3.3. USING IN THE SYSTEM OF VOCATIONAL TRAINING

There is no systematised information about educational software using in the system of vocational training of France. However, there is a certain experience in this field and competent structures have already been formed.

3.3.1. Educational institutions (except the institutions of agricultural profile)

The Ministry of Labour launched the initiative, providing for all comers the opportunity to acquire individual training in basic disciplines. In the framework of this initiative the educational network of the departments of individual training is functioning. It comprises 450 departments, which make use in their teaching activity of educational software. According to the available data, in some regions (in particular, the Bourgogne region, 1995) only 80% of the network departments use educational software, but on a different scale (the number of PC differs from 1 to 12, while the number of applied software differs from 1 to 40).

The AAVE Centres (340 locations), the Centres of pupils training (more than 800 centres, where pupils are trained by rotation on enterprises and in the centres) and the establishments of adults' vocational training in educational institutions, guided by the Ministry of Education are supposed to be well equipped with computers. The ways of their application are various: multimedia tools for acquiring professional and technical skills, learning the basic disciplines and the improvement of the general level of culture.

Public and private establishments, offering modern languages teaching, are widely using information technologies (about 20% of the total amount of the educational programmes in use) in the form of multimedia means: students either use them independently, or they are involved in the training process. Monographic studies (ORAVER - 1995, and the new edition, now its preparation is under way) show, that software may be intensively used for education, but yet it's rather difficult to estimate its application quantitatively.

The general plan of educational software application in private educational structures depends on the decisions of the enterprise, financing them, because it entails the necessity to change the organisation of training and pedagogical approaches. It's supplemented by some other factors, related exclusively to the sphere of vocational education: competition (it dictates the conditions of the maximum profit of investments); the status of the private educational institution; the diversity of employment forms (from the full employment by sine contract to temporaries).

3.3.2. Enterprises

Nowadays educational software became on the means, used by enterprises for their employees training (teaching special professional technical skills, languages, bureautics; general professional education)

Such special technical occupations, which are extremely necessary under the conditions of the modern technical progress (railway traffic safety in the company *SNCF*, aviation technologies of Airbus airplanes in the company *Aérospatiale*), annually attract a considerable number of matriculates (about

1000 students annually). Training in these occupations correspond the strategic objective and worth the development of the specialised software. The structures of vocational education in banks (e.g. the *Scalbert-Dupont* bank) and financial sectors use the products, represented on market.

The application of the products, that are represented on the market, for the professional languages training and bureautics studding began quite recently and now it has the tendency to develop. Sometimes, for example, in case of the *BULL* company, when vocational training is offered about 7000 students, it may be generally of almost completely based on software.

The use of educational software for general education rapidly develops and is introduced in many disciplines. There are the examples of software using for training fast reading in the company *Alcatel-CIT*, the bases of communication and general culture in the insurance company *Assurances Générales de France*, elementary mathematics in the *Renault* company, etc.

Software application has got prevalence in the system of education control (e.g. the bank *Crédit agricole* in the Central region of the country).

3.3.3. Professional departments and the organisation of mutual financing vocational training

Almost all these establishments are not involved right in the programmes of educational software production and application. Nowadays the situation changes, in particular it concerns development of information systems on the existing products and the conditions of their use.

3.4. THE INSTITUTIONS OF DISTANCE TRAINING

There are about 550 000 persons, who take the courses of distance training, offered in catalogues by 250 private enterprises and public and para-public structures. These data was collected without regard of the services of distance training, offered by companies for their personnel, because this education is not for all comers. Information and communication technologies application is expressed only telephone communication services and video texts. Other practising computer and communicational services are rare. So, there is an example, illustrating the situation in general: The National Centre of Distance Training of Agricultural Profile, having 5500 students, doesn't use any pedagogical multimedia.

Educational software is also used in case of on-the-job training, but the scale of it differs. Judging by the number of organisations and consumers it's still rather poor. However, some educational institutions largely use it: the regional centres of the *National Institute of Compatible technologies, Centre Université Economie d'Education Permanente* in Lille.

There are two measures, which are necessary to change this situation: families equipment with microcomputers, because now their level is lower, than in the neighbour countries; the development of corresponding educational structures in the system of vocational and agricultural training, as well as in universities.

4. THE POLICY OF PROMOTING EDUCATIONAL MULTIMEDIA

4.1. THE POLICY IN THE FIELD OF EDUCATION AN VOCATIONAL TRAINING

4.1.1. School education

The France Ministry of Education developed some experimental programmes in the field of new technologies implementation in education. These programmes comprise all disciplines. The experiments objectives and content are presented in reports, distributed overall.

The last report concerned information mainlines and services and revelled the following urgent objectives:

- the liquidation of educational institutions isolation from the world, through communication, remote access to computer resources;
- co-operation development (between teachers' groups, students, on a national and world scales);
- sharing the resources and competence inside educational sector, teachers' and students' tele-training (the organisation of data banks of class works; technical and pedagogical support of consumers and educational institution; continuous teachers' training; lyceum training with the aid of video lectures).

In collaboration with higher educational institutions and some other partners, the Ministry of Education launched a global project. Technically, it is based on RENATER infrastructure, locally connected with the most perfect and economic systems, in particular with RNIS and cable video communication nets.

Twelve higher educational institutions and 400 establishments are involved in the project and at present are developing services on the base of *RENATER* and *Numéris*.

At the same time, there is a search for partners in other organisations, in particular in the sphere of culture and science, for the elaboration of the products, adapted for learners' demands. Presently, the list of the involved organisations is supplemented by the National Centres of Space Research in the filed of environment protection and observations of dirt condition, the *Georges Pompidou Centre* in the sphere of culture, with *Institut National de la Sante Et de la recherche Medicale* and the National Institute of Pedagogical Research in Biology.

4.1.2. Higher education

The policy of the Ministry of Education in this field is active, but constantly it faces the aforementioned resistance of teachers. As far as higher school institutions are autonomous, they can be influenced only through stimulation or financial support of existing nets. The contract financing policy and the new policy of the working out the regional development schemes for higher education incited higher educational institutions to use the new teaching methods, based on multimedia.

The resources of the RENATER net, which is under the control of central and regional administration, are available for every university. However, educational institutions are to finance the connection to the net and to provide data exchange in the ambit of their university. The Ministry provides financial support (unfortunately insufficient) of collective activities, such as the development of distance training or self-learning on sites, and to involve in this activities the structures in charge of the popularisation of perspective experience. It also supports financially those multimedia distributors, who sell at a discount. The Ministry makes efforts to create a real market, French and multilingual, of hi-tech products. The Ministry of Foreign Affairs and Co-operation follows the policy of the creation a French-speaking market.

Considerable efforts are made to influence teachers' attitude towards this situation (the distribution of brochures, guides, multimedia, etc). It began to create the information system on existing computer resources on the base of RENATER.

4.1.3. Vocational training

The policy, promoting the elaboration of educational multimedia in the frames of the system of vocational training, is under the control of central and territory administration (mostly regional). Target contracts for several years determine the volume of co-operation on this level.

The Ministry of Labour pursues the promoting policy in the field of multimedia through the three types of measures:

- drawing the inventory of the products, entering the market, from technical and pedagogical points of view;
- the financial support of some products distribution among educational institutions (it's expected, that due to the state support the cost of these products amounts only two thirds of the initial price for 4500 educational institutions);
- the promotion of the pilot projects devoted to the organisation of teaching/learning process with the aid of multimedia.

Approximately 150 centres, possessing computer resources, are responsible for providing educational institutions with information and for the evaluation of educational programmes. These centres are financed by the Ministries of Labour, Education, and Agriculture, by territory administration and, in particular, by regional Councils, as well as by public and private organisations. Though the centres activity is unwarrantablly narrowed (to the problems of reduction the level of illiteracy and qualification improvement), today the range of the problems of their concern widens.

4.1.4. Agricultural education

The ministry of Agriculture, Fishery and Alimentation:

- financially stimulate multimedia resource creation (2 million francs annually, distributed under the control of NCRRAT);
- works out the policy of resource centres development, which includes the promotion of nets' creation, personnel tours of duty (2-3 million FF annually).

4.1.5. Regional policy

Regional administrations, usually having long-term contracts with the central administration, are taking the following measures:

- direct aid to the production of educational software;
- financing the infrastructures of the Information Resource Centres and telecommunication nets for open and distance education;
- technical and financial support of the projects, related to these infrastructures, which objective is pedagogical resources development;
- the programmes of teachers' training, including the section of new technologies;
- promotion of reorganising the regional educational market, using, if necessary, the relevant projects of educational software development;
- the organisation of the Resource Centres for teachers and providing information about educational software.

The policy, conducted by different regions, differs in content and scale. As common for the national programmes, financing in the field of educational software can not be a separate item and usually it included in financing items of other operations.

Usually the realisation of the part of the national programme in the field of vocational training, concerning communication technologies and educational software, fathers by territory administration on agencies - the organisations with autonomous juridical status.

4.2. THE STRATEGIES OF SCIENTIFIC RESEARCH AND DEVELOPMENT

France is an active participant of the European Union scientific - research programme in the field of information technologies implementation in education and vocational training. IT seems, that regarding France role in the European Union, it is able to undertake more obligations, concerning this programme. Its international co-operation is yet correspondingly limited and mostly covers only Francophone countries (Canada, in particular).

4.3. INDUSTRIAL STRATEGY

Almost all French industrial companies, except *France Télécom*, which has recently become very active, are almost passive on multimedia market and don't launch any large attacks, like those, campaigned on the other coast of the Atlantic ocean. The role of the state in this field is still determinant.

Education software development demands considerable investments, which are rather risky, when the Francophone market is relatively restrained. State administration influences this market either through the direct aid in multimedia development, or through the procedures of the further license acquisition with the help of mixed licences.

Le National Cinema Centre put into effect a specific form of aid to multimedia edition. A part of advance is returned to the producing enterprises, providing them with necessary funds for multimedia development. The Ministry of Culture and Industry is responsible for these advances financing.

In order to realise the aforementioned recently adopted programme of promoting the development of information mainlines, there was organised a bidding, in which 138 project took part. In 1995 the total sum of 50 projects support will amount 53 million francs (in 1996 it'll be 100 million francs). Bidding arrangement once more illustrated the demand for qualitative programmes, aimed at multimedia development. The mechanism of lending the aforementioned returning advances is supposed to be supplemented with the fund of interactive products edition promotion (in 1995 its financing amounted 30 million FF).

NATIONAL REPORT OF GABON

APPLICATION OF NEW INFORMATION TECHNOLOGIES: PROBLEMS AND RESULTS

This Report is a branch one, rather then national, from the viewpoint, that the sections related to education were prepared by subdivisions of many organisations, and in particular of the Ministry of the National Education, Youth and Sports and Women Affairs, which is in charge of the of occupational training, etc.

According to the formal features the Report should include the sections, related to the activity of two subdivisions - Women Affairs and Youth and Sports. However, these structures are new in the Ministry, and therefore will be out of our consideration.

Thus, the spheres of the direct (public establishments) and indirect (organisations with the status of social service) influence of our Ministry covers the following types of educational activity:

Pre-school training (26 classes in kindergartens), initial education (1122 establishments), teacher training (2 centres, the first one is state, the second - private, Catholic);

Secondary general education (98 establishments) and secondary technical and vocational education (12 establishments);

Higher pedagogical education under the aegis of two organisations: the Ministry of the National Education is the superior for one of the Centres of teachers training for technical lyceums and colleges; The Ministry of Higher Education is the superior for one of the Centres of teachers training for lyceums and colleges of general education;

The preparing courses under higher educational institutions (2 classes: higher mathematics, special mathematics).

In the educational system, directly of indirectly influenced by the Ministry of the National Education, the process of new information technologies implementation (such as micro-computers, computer application in experiments) is often checked and runs selectively. Still, there are sectors, that haven't been even touched.

Other information technologies (Internet, data banks, computer networks with local servers, developed interactive graphical systems) are too expensive, and today the problem of their purchasing is not of priority.

However, some latest innovations of the office informational technique (telecopier) and in the field of communication (cellular telephones) are quickly developed.

Thus, the given analysis of the situation with the informational environment in the system of education, revealed the following orientations for work:

1. Pedagogics-oriented equipment.

2. Equipment for teaching and control in school system.

3. Control-oriented equipment.

4. The development of automated control systems in central services; policy of standardisation.

The three following consistent patterns are revealed in the process of informational technologies implementation in education institutions:

1)The creation of informational computer space (special halls with air-conditioning);

2) Purchasing of new or second hand equipment in case the teaching process is run by groups, consisting of 2-3 persons - the project initiators.

3)Purchasing new and used equipment, regarding systems' compatibility.

The illustrated part of the Report comprises only the data, acquired in the result of our investigation, which has involved:

- 11 exemplary educational institutions of initial and secondary education in Libreville and Port-Gentil. These were the first organisations, which started to implement informational technologies in their activity.

- 7 technical Directorates of our Ministry.

1. PEDAGOGICS-ORIENTED EQUIPMENT

Table 1

1.1. The structure of information computer environment

ORIGIN and date	Technical directions and establishments	Type of equipment and their number	used software and languages
France 1987: used equipment	1.1.1. I.P.N. (C.I.P) C.I.P already doesn't operate (1990)	(6)MO5, integrated into a network, (1) GOUPIL (3)IBM PCXT (2)AMSTRAD PCW 9512 (2)printers IBM	BASIC, WORKS, WORD
France 1987: used equipment STATE-GABON 1995 and 1996 1995	1.1.2.L.T.N.O.B a)Sector STT: hall closed since 1990 b)industry. sector c)administration	(2) IBM PCXT & PC286 (2) SHARP with cassettes (2) AMSTRAD PCW 9512 (2) IBM PC & (2) printers Telecopier	BASIC, WORKS, WORD No software (by order)
economical operators 1988 STATE-GABON 1994 and 1995	1.1.3. National Commercial School of Port-Gentil	(3) AMSTRAD PCW951, (2)IBM PCXT & 1 printer (broken) IBM APTIVA486: (3) SX25, (2) SX50, (1) SX66; Printer LEXMARK: (1) 2391/PLUS, (1) 4072, (1) 4076 1 FAX Brother 370	BASIC, WORKS, WORD, LOGOCRIPT EXEL2,5, LAP LINK ORDICOPTA, ACCESS POWERPOINT, WORD6

I.2. Activities and results

For the teachers of *Technique and the services technology* (1987-1990): during the period of 15 days after their work they studied intensively methods of modular and structural programming in BASIC and WORKS. Here informatics is considered as the discipline, related to Services.

Exclusively for the seniors of general educational schools and of the National commercial School: informatics was taught as a subject with the following examination.

2. EQUIPMENT FOR TEACHING AND CONTROL IN SCHOOL SYSTEM.

Table 2

2.1. The structure of information computer environment

ORIGIN and date	Technical directions and establishments	Type of equipment and their number	used software and languages
France 1988: used equipment 1992 1993	2.2.1. The Immaculate Conception Institute	(1) BULL.MICRAL40, (1) IBM PS/1, (12) MO5, integrated into a network (worn out) Printer:(1) OKEY, (1) BROTHER M 1918; (2) OLIVETTI 486/5X PC & Printer; (1) COMPACT 486 & Printer EPSON	BASIC, WORD, EXCEL The programme of control after students
OWN FUNDS AND AID (1987-90) OWN FUNDS (1991-95)	2.2.2. RAPONDA walker college	(14) MO5, MO6, integrated into a network; (1) GOUPIL, (1) IBM 88 (1) AMSTRAD, (12) LEO PC386; (2) LEO PC486; (3) printers Hewlett Packard	BASIC, LBO/PCE, PROLOG, WORD DBASE III, Software on physics and chemistry

Table 2 (continue)

France 1991 and 1992 State-Gabon, 1995	2.2.3. LEON MBA NATIONAL LYCEUM	**COMPUTER HALL**: (5) KENITEC 386 & (6) 486 & printers EPSON **Department of information** (1) UNISYS 486, (2) KENITEC 486 & (2) printers **Director's Bureau and Secretariat:** (1) MAC & (1) printer UNISYS Supplement: (1) BULL, (1) printer	TURBOPASCAL, DBASE IV Software for students Controlling software
AID 1993, 1995 OWN FUNDS	2.2.4. TECHNICAL LYCEUM OF PORT-GENTIL	(5) IBM XT286, (1) APTNA 386 Printers: (3) EPSON 1500 & (1) EPSON 800, (1) AMSTRAD 1 FAX BROTHER 370	LOGOCRIPT 2 WORKS, FRIGO DEP, EXCELL 4, AUTO SKETCH
France 1989-91 1992 1992 1993-1995	2.2.5. Conventional public schools (France-Gabon)	(8) MO5, integrated into a network; (6) IBM 8530 (5)OLIVETTI:286;(19)486SX; KENITEC:(8)386SX,(4)486SX, Printers: (8) OLIVETTI: (2)386SX;(1) 486SX; Printers: (3); (3) COMPAQ 486SX, (1) IBM PS/2 486SX; (15) OLIVETTI 486DS, (1) Printer	VALISE IPT, LOGI, EDUC, NATHAN-RND, COKTEL VISION EXCEL 4, WORD 2; EXCEL 5, WORD 6, WINS DB3, CORELDRAW 5

2.2. Activity and results

The named educational institutions provide access to equipment only for the teachers (to control performance, etc.)and those students, who study a basic course of informatics, programming, etc. The state schools with special status provide these opportunities for every teacher, student, as well as administration. There is technological assistance and a permanent pedagogic counsellor on informatics at their disposal.

The means of informatics as a subsidiary tool for education (computerised experiments in some subjects, offering poor students scientific information)form some of the abilities (logic thinking, background for the new technologies) and practical skills (text processing, programming, etc.)

As a tool it develops teachers resourcefulness, a creative approach (diversity; "confidentiality" of applied school control systems, developed in educational institutions)

3. MANAGEMENT-ORIENTED EQUIPMENT

Table 3

3.1. The structure of information computer environment

ORIGIN and date	**Technical directoRATEs and establishments**	**Type of equipment and their number**	**used software and languages**
STATE-GABON, OWN FUNDS & SHELL 1992 AID 1992	3.3.1. ESTUAIRE State LYCEUM	(3) IBM PS/1, (1) ZENITH (1) BULL 486 & (3) printers 1 FAX BROTHER	WORD, EXCEL, DBASE III
OWN FUNDS 1992-1995 Canada 1994-1995	3.3.2. Applied Lyceum of the National Higher School	MAC: (1) CLASSIC, (2) LCII (1) LC475,(2)Print., 1 FAX (1) MAC LC 450, (2) IBM 286,(2) Printers EPSON	EXCEL 4, CLARISWORKS 2 & 4
France 1992 &1995	3.3.3. D.D.E.C.	(3) UNISYS & (3) printers ONDULEUR	WORD, PROGICIEL DG1

Table 3 (continue)

Gabon-Canada 1990 State-Gabon, 1995	3.3.4. D.T.V.E.	(1) IBM PS/1 80386 & (1) printer 4072, (1) IBM 486DX2 & APTIVA (1) printer LEXMARK	WORDPERFECT EXCEL POWER POINT
State-Gabon	3.3.5. D.E.2	(1) IBM PS/1 & (1) printer	WORD, Progiciel GBM
State-Gabon, 1984 France-Gabon, 1995	3.3.6. D.P.S.Q.	(1) BUKK,(2) printers BULL (3)IBM 466 & (1) IBM 486 (1) IBM 14L8 & (2) print.	PRPGICIEL ADS WORD, EXCEL, PROFIL
State-Gabon 1988 State-Gabon 1993	3.3.7. D.E.P.P.	(1) IBM PC & (1) printers (3) UNISYS PC, (2) PS/1 & (3) printers	ACCESS, WORD EXCEL, DBASE IV
State-Gabon 1987	3.3.8. D.F.I.	(1) CII HONEYWELL-BULL	Progiciel DGI

3.2. Activity and results

The activity of the educational institutions (e.g. technical Directorate), which have acquired equipment for managerial purposes, are aimed at the local development of applied systems, adopted for a partial automation of controlling activity, and to form an automated office environment.

Examples:

Estuaire State Lyceum (ESL) and Applied Lyceum of the Higher Pedagogical School (ALHPS): The development of an automated office environment, which is at the disposal of a the Co-operative (ESL and ALHPS), the nomination of a specialist to be in charge of informatics problems (ESL) and administration (ALHPS) for the current controlling operations (students movements in the school system, students lists for each class, accounting teachers working time, etc.). Teachers are able to use the installed equipment for self-education and educational documentation preparing (ALHPS).

Directorate of the Department of Examinations and Competitions: Computer application on each stage of examination control, when students are obtaining the certificate of finishing incomplete secondary school and exams on Service trades (2nd level, brief course).

Directorate of Technical and Vocational Education: Computer application in the current controlling operations of the Directorate.

Directorate of the 2nd level education: Computer application for controlling some documents, in relation with the Directorate's teachers (the change of employment, business trips, promotons, etc.). A special employee is in charge of it - the specialist in office informatics.

Directorate of investments planning and programming: Automated processing school statistic data bases and preparing some documents. The Directorate permanently connects with the Ministry of Finance and the Ministry of Planning, exchanges diskettes with them.

Besides, the centralised documents control system, prompted to the Director-General of the General Administration, Finances and Equipment to take a decision to install in 1987 two terminals attached to two of his technical Directorates and two external administrative services - the Ministry of Finance and the Ministry of Civil Service.

Directorate, responsible for personnel and social questions: Attached to the units of "Saldo" and "Civil Service", the Directorate offers the Ministry of Civil Service decisions on each decree, concerning personnel, which are in the competence of our Department. At present it implements the semi-automatic regime of management of 10000 employees.

Directorate of Finances and Real Estate: Attached to the unit "Directorate-General of Budget", this subdivision processes information on the Ministry Budget.

4. AUTOMATED CONTROL SYSTEMS DEVELOPMENT IN CENTRAL SERVICES: POLICY OF STANDARDISATION

On February 18, 1992, Minister of the National Education addressed the corresponding subdivisions the Note, which included the following:

1)facts statement: "...the project of information technologies implementation in the Department trends to be concretised with the promotion of the others..."

2)the following directions:

a) "to observe the integrity of the informational system of the Department and to seek for the conception integrity of its control, basing on the integral control scheme...";

b) "to charge one of the senior officers with all the projects of automated data processing..., to assign one of our officers for co-ordination...";

c) " to provide the division of the applied systems into modules on the base of the integrated scheme of control...";

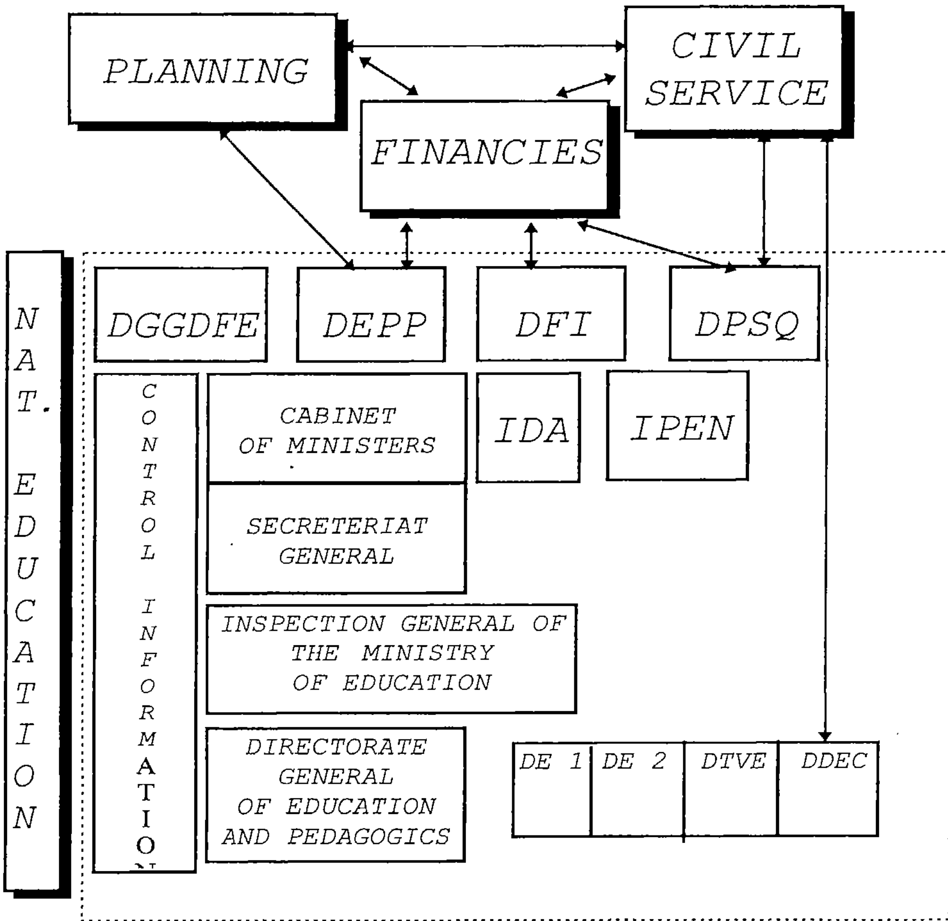
d) "to provide our participation in the quest of finances ..., purchasing software and hardware..."

The Director-General of the General Administration, Finances and Equipment is responsible for the conduction of the negotiation about foreign partners participation.

Besides other articles, financing concerns the automated control over teaching staff and school statistic data base; software for the personnel control system, developed by *ADS Informatique-Gabon*, taking into consideration the existing equipment.

The second goal of the Director-General is to provide the due regard of the Ministry surrounding, represented on the following scheme:

SCHEME 1


PLANNING
CIVIL SERVICE
FINANCIES
NAT. EDUCATION
DGGDFE
DEPP
DFI
DPSQ
CONTROL INFORMATION
CABINET OF MINISTERS
SECRETERIAT GENERAL
IDA
IPEN
INSPECTION GENERAL OF THE MINISTRY OF EDUCATION
DIRECTORATE GENERAL OF EDUCATION AND PEDAGOGICS
DE 1
DE 2
DTVE
DDEC

ABBREVIATIONS

C.I.P. - Centre of Information on Pedagogics
D.F.I. - Directorate of Finance and Real Estate
D.T.V.E.- Directorate of Technical and Vocational Education;
D.G.G.D.F.E. - Director-General of the General Directorate of Finance and Equipment;
D.D.E.C. - Directorate of the Department of Examinations and Competitions;
D.P.S.Q. - Directorate, responsible for Personnel and Social Questions;
E.S.L. - Estuaire State Lyceum;
B.P.P.E.S.G. - Branch Programme of Promoting the Educational System of Gabon;
S.T.S.A. - Science and Technology in the Sector of Attendance;
D.E. 1 - Directorate of Education 1;
D.E. 2 - Directorate of Education 2;
D.E.P.P. - Directorate of Investments Planning and Programming;
H.P.S.T.E. - Higher Pedagogical School of Technical education;
H.P.S. - Higher Pedagogical School;
A.L.H.P.S. - Applied Lyceum of Higher Pedagogical school;
N.P.I. - National Pedagogical Institute;
P.A.E.D.G. - Project "Administration and Education Development in Gabon".

CONCLUSION

The analysis of the existing situation revealed the following drawbacks:

- information technologies implementation is in the embryo condition, the most of control operations are done manually, which leads to the high risk of making mistakes;
- equipment and software are incompatible;
- computer systems are isolated, non connected with each other, developed without any general plan of the Department development;
- equipment is morally obsolete or hardware is scarce(in some subdivisions) for students and teachers education;
- qualified specialists in informatics are few.

Trying to improve the mentioned drawbacks, the Ministry faced the following problems:

- too high expenditures for the new technologies implementation on its services and establishments, for the maintenance of the necessary temperature regime in classrooms. It is especially difficult in province;
- personnel training for equipment maintenance in laboratories and technical schools;
- too high prices for the services of international telecommunicational networks.

For the solution of its problems the Ministry of the National Education followed the policy of costs cuts and information technologies implementation on their own, while promoting software and competence exchange (international and between organisations), as well as the development of international networks and servers.

MINISTRY OF THE NATIONAL EDUCATION,
YOUTH AND SPORTS AND WOMEN AFFAIRS

NATIONAL COMMISSION FOR UNESCO
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NATIONAL REPORT OF GERMANY

ASPECTS OF NEW INFORMATION TECHNOLOGIES IN THE FIELD OF EDUCATION AND TRAINING IN THE FEDERAL REPUBLIC OF GERMANY

INTRODUCTION

Because of the acceleration of technological and economic development and because of the dynamic processes in the society new efforts have been made to develop different parts of the educational system in Germany. One of the former aims of education: to accumulate a lot of knowledge and skills for being prepared for the future life becomes more and more doubtful. Since the knowledge grows so quickly in all subjects and since the 'half-life' of knowledge declines more and more (it is estimated that half of the knowledge is actual for only 3 to 4 years) it seems to be ineffective to learn specific topics with all the actual details.

At the same time one has to state that only few people do still the job they have been educated for when they were young. Changing of profession several times during a working life becomes more and more regular, staying in the profession of former apprenticeship the exception.

So there begins in Germany a discussion on the general aims of education, on the contents of learning and on the means and media to sustain the change.

New Information Technologies are insofar at the same time the reasons for the important change in education and the possible tools to realize the change and development.

I. THE FRAMEWORK OF EDUCATIONAL DEVELOPMENT

I.I. THE CONSTITUTIONAL SITUATION

The structure of the educational system in the Federal Republic of Germany is based on the exclusive responsibility of the Laender for the full range of educational and cultural affairs. It means that the curricula are regulated by the 16 German Laender which reach agreements on guidelines within the Standing Conference of the Minister of Education an Cultural Affairs. They are practically implemented in the different German Laender on an independent basis. In consequence, uniform educational planning only exists as recommendations made to the Governments of the different Germany vender. This includes plans regarding initiation into new information technology.

The Federal Government is responsible for the dual vocational system, i.e. the combination of industrial training and school vocational education In this area too, concerted action with the Laender should be reached.

Universities and institutions of higher education enjoy scientific autonomy. Since they train teachers, curricula require the approval of the supervisory state authority.

The educational targets of the Laender are guided by the Constitutions which aim at turning young people into responsible citizens, education them to human awareness, freedom, respect for the opinions of others, and peace. Self-responsibility and a democratic attitude are essential educational targets.

1.2. THE TECHNOLOGICAL SITUATION

In 1995 there were about 15 Mio. Personal Computers in Germany, for 1996 the number should raise up to 18 Mio. About 28 % of households have a PC for private use (5 Million) of which about 3/4 are MS-DOS or Windows PC's. It is expected that the number of private PC's will rise to 6-9 Mio in 1990.

2.7 Mio. private PC's are equipped with CD-ROM; two third are installed for private use, one third for occupational purposes.

Although actual general data for the equipment of schools are not available one can say that the majority of secondary schools have bought their computers in the middle or at the end of the eighties so that newest computer technologies are not found everywhere. Multimedia machines are still rare. Therefore new efforts are to be made soon.

More than 400 mostly SME's develop and furnish multimedia programs for a rich range of purposes, more than 4 000 software programs for educational use are offered (but only 80 of them are estimated as good examples for new media for schooling).

Germany has one of the closest cable-tv-network in the world, about 1.000 000 ISDN connections exist and the major cities are connected by ATM nets.

As the liberation of the telecommunication market is planned for 1998 the technological development will raise more and more.

2. NIT IN EDUCATION

2.I. NON VOCATIONAL EDUCATION

2.I.I. Aims for basic education in the field of NIT

The different targets of general school instruction when dealing with the new information and communication technology have also to be interpreted in the perspectives of general educational aims. The primarily target is not to instruct young people in skills and abilities appropriate for immediate professional use, but rather to develop and to strengthen their position as responsible citizens, as responsible and self-conscious human beings as well as members of a community Items, such as teaching how to handle new technologies are not of foremost importance, it is rather a matter of getting insights into and understanding how this technology works, the opportunities and chances it offers and the problems occurring for individuals as well as for society as a whole. Manipulation and technical skills are prerequisites for reaching and implementing the overall targets.

In the early seventies informatics, already a science taught at the institutions of higher education, became for the first time a specific school course as part of pilot projects so that it was possible to create specific courses at the second stages of secondary education. In the late seventies informatics became a standard subject, also included in the final examination.

In the early eighties as PC's and especially home computers began to be successful and were therefore increasingly used in the different areas of everyday and professional life, the Federal/Laender Commission for Educational Planning and Research Promotion and, at a later stage, the Standing Conference of the Ministers of Education and Cultural Affairs developed basic planning regulating the introduction of basic training in information and communication technology and involving all pupils of all schools' offering general education. It was agreed that this would not be a new separated school subject; however, a certain number of hours (as a rule approx. 40 to 80 hours) was planned for initiation into the basics, the available opportunities and problems that occur. The primary aim is not to develop programming skills, but rather to experience and test concrete applications of the technology to the specific school educational targets.

The report on the situation in my Land says: In the Land "North-Rhine Westphalia, when we talk about the use of computers in the classroom, we distinguish between 4 areas:

- basic training in information and communication technologies (ages 13 to15);
- computer science as required in compulsory choice/differentiation courses (ages 15 to 16);
- computer science as an elementary or advanced level course for upper grades of grammar school (ages 17 to 19);
- use of new media in individual subjects or for cross-curricular teaching.

Of these four areas the only one compulsory for all pupils of all types of schools is the basic training in information and communication technology. The objective of this training is for pupils to get to know, by means of three examples, how new technologies can typically be used. They are to examine the basic structures and functions of these new technologies by themselves and to reflect upon and judge the effects of their use. The training is carried out for approximately 60 lessons with topics such as 'Newspaper', 'Department Store', 'Ecosystem Forest', 'Carbon Cycles', 'Industrial Robots' or 'CAD/CAM' within the framework of those subjects which offer suitable points of contact with these topics .

In the following years pupils my deepen the knowledge acquired during the basic training by attending computer science lessons. However, as pupils decide by themselves on their individual school career, they may or may-not-decide to take up this subject. What is typical for all three areas outside the basic training is the fact that here the computer itself with its components and especially its software become the object of study. " (W. Weber: Advisory centres for new technologies - an addition to teacher training. To be published.)

In the meanwhile it may be assumed that about half the schoolchildren of the Federal Republic of Germany have already taken part in such basic training courses. However, the "new" German Laender are still lagging behind. In the older German Laender it can be said that the technical equipment and especially computers necessary for implementing any initial training and informatic courses at the second stage of secondary education (Oberstufe) are available in the schools.

The German Laender have drawn up extensive programmes for teacher training in the past few years at very high cost. The target was not only to train teachers of the subjects in the area of natural science and mathematics but also teachers which are able to use computers for educational projects in the area of humanities and fine arts. However, the majority of the teachers detaining qualification in further training programmes are in mathematics and natural science. Owing to the changes occurring in technology, continuous further training programmes are necessary and they should increasingly deal with the contents and significance of media. The function of computers as an aid is in this context only accessory.

To quote the report on North-Rhine-Westphalia again: "For these... areas in-service training has, in some cases been, been taking place for more than ten years in North-Rhine-Westphalia. Depending on which area the teachers want to qualify for these in-service training courses last for approximately 20 to 40 days; universities also offer additional courses for those teaching computer science as a subject in the upper grades. In some regions and in certain fields demand for this kind of training is already declining because schools no longer require the training ".

2.1.2. Media Competence as an upcoming target

Due to the technological changes and new developments in the field of education new perspectives and new tasks for schooling came up. There was a general shift in educational targets concerning NIT. since the beginning of the 90's the concentration on the computer as a tool for teaching and learning tends to be diminished step by step in favour to establish a "media competence" in the learners mind.

That means, that all different types of media, books as well as videos, magazines as well as audio-tapes, films as well as multimedia computer programs should be seen and taken as a highly differentiated but closely connected system of information and statements that influence the perception of the world. So NIT became a double bound target for schooling: On the one hand NIT is taken as a tool for teaching and learning; on the other hand it is an very important topic in nearly all school subjects to talk and discuss about, to show the chances, implications and problems for the individual and the society as a whole.

2.1.3. Using Media and NIT

Using TV and Radio

For almost 30 years in the Federal Republic of Germany there has been a large network of school television programmes broadcast by public stations. Programmes designed for educational purposes are broadcast daily for between 30 and 60 minutes. These programmes are mostly accompanied by written educational material, published either in special magazines or through editors specially founded for that purpose. School radio programmes, have been broadcast daily for over 50 years.

In some German Laender special self-instructional television programmes have been broadcast for over 20 years. Together with the attendance at lectures (every two weeks) and written material, they lead to an officially recognized general examination which entitles the student to higher education the "Telekolleg". Since then more than 50 000 people have been able to acquire a higher educational level in addition to their professional qualification. In-the past few years Telekolleg has been accompanied by computer software. Television programmes and partly the written material are also used in schools of general education and in vocational schools.

Specific further training programmes broadcast on radio have-also been supplied for 30 years to interested teachers and other persons. Within the "Funkkolleg" 60-minute radio programmes, written material and special lectures given at the institutions of farther education form a media compound for the sake of scientific further education; it is recognized by the universities as part of their curricula. The "Funkkollegs" will also be extended through computer software programmes. About 700.000 people have taken part in these "Funkkolleg", gaining thus a better professional and vocational qualification.

Using Multimedia and Telecommunication

Multimedia and telecommunication offer new chances for learning and are at the same time a new topic for education: By using new hypermedia learning environments pupils can learn much more self-determined, self oriented and self-responsible. They choose their proper way of learning, they select their items to learn in their own manner, and they define their learning pace in the way that is appropriate to them. Using self-guided multimedia learning tools it is possible to learn how to learn: the basic requirement for life-long learning and for managing the overwhelming amount of new information offered by media and technology.

It is a common trend in Germany's general education system to avoid more and more simple drill and practice programs or other programs based on behaviouristic principles. Newer discovery learning approaches, applied for multimedia programs, are preferred.

Some German schools could make experiences with the use of telecommunication for educational purpose Well known examples are the participation in world-wide projects such as G.L.O.B.E., an international project for environmental preservation. There is also international cooperation between different schools in other areas.

Several schools exchange E-mails on subjects and teaching projects of common interest. The experience gained is quite positive. Lectures enriched by the experience gained by other pupils in other countries widen the perspective and show international relations as well as common responsibilities (for instance for the protection of environment and preservation of peace).

More efforts are to be made and telecommunications/telematics should be used exhaustively. Some projects have been started this spring and are aimed at a larger use of telecommunication. The motto was "Connecting schools to the net". It means that 10.000 schools throughout Germany will be given the opportunity to make new and creative experience when learning, teaching, preparing lectures as well as in the qualification of the teachers. Some sponsors have promised their assistance, for example Deutsche Telekom AG; Siemens, Hewlett-Packard and IBM.

Although the chances and opportunities of these technologies can be estimated as high, there are still a lot of pedagogical experiences to be made: What are the new topics of education, what are the methods of teaching, what are the forms of organizing schooling and time-tables, what are the new teachable and learnable topics crossing or leaving the older school subjects? By answering these questions new insights in learning-objects, in the methodology of teaching and in learning objects, can be made. We are convinced that the aim of systemic thinking can be reached easier by using multimedia and telecommunication. It is expected to have new answers at the end of 1999.

2.1.4 Supporting systems

As for the audio-visual media there are in nearly all communities lending and delivery systems (media-centers) so that teachers can rent without charge videos, films and other media for the use during lessons. All Laender-together keep running a central institution, where films, videos and software are produced and delivered for educational purposes. Those products are available in more than 800 "media centers".

"Because of the dynamic development in the market of new media, it is nearly impossible for individual teachers to obtain and keep an overview of what is on offer and to find new media which can support their lessons effectively.

Here, great help is provided by the database SODIS (Software Documentation and Information System) which contains information on all new media for education available on the market. This database is a joint product of the German federal states and the Republic of Austria.

By means of this database every teacher can find out with little time and effort which new media are available for his subjects and topics. As there is already quite a wide range on offer, the teacher will usually have-the choice between various new media which might be suitable provides help:' for most new media it offers evaluation reports and, in some cases, practice reports on lessons actually held. Guided by these reports, the teacher is generally in a much better position to judge which of the media are really suited to his/her special purpose. "(W. Weber)

In all of the Laender regional support/media centers give additional and personal advice to judge new products and give hints for implementation in the lessons.

By the project SODIS more than 4 000 programs have been checked after -before all - pedagogical criteria, but only some 80'ies of the programs arc highly appreciated as "Examples of good new media for learning". Because software producers use this label ("Example..") for advertising this testing system has a positive influence on improving educational programs.

2.2 VOCATIONAL TRAINING

2. 2.1. Vocational schools

As mentioned earlier the highly differentiated vocational training system consists of various types of vocational and higher vocational schools, of the dual system during apprenticeship (a combination of organized training work in the firms and enterprises on the job with one or two days vocational schooling per week off the job). For the ongoing training on or off the job there are especially institutions of higher (university) education and training.

Using computers for training is familiar in those jobs and subjects that are related to the use in real working life Using media and NITs as a tool for teaching in other subjects still has to be improved.

2.2.2. Corporate continuing training

For years multimedia learning had been presented at fairs and in the trade press as a cost-effective and efficient form of learning. Although pilot projects for a training technology attracted great interest, the actual use of this technology in continuing training as limited. There was no basis for more extensive use, as the computers were not powerful enough, standards had not been harmonized, the programs were unsatisfactory and experience with programmed learning in the 1970s had been inconclusive. Moreover, there was basically no incentive to reorganize course contents and the way in which they were taught. Firms were for the most part satisfied with the continuing training standards and systems.

This situation has changed only quite recently. Owing to its greater performance range and falling prices, today's standard computer has obviously become a multimedia computer With new storage systems, video sequences several hours in length could be included in programs in 1996. Almost every new purchaser is therefore theoretically able to use learning programs which are becoming increasingly attractive New software platforms should also allow program swaps between operating systems whose compatibility is at present very limited.

Developments in the telecommunications field are another important incentive. As a result of new data networks, the imminent liberalization of the telecommunications market in Germany and the increasing inroads made by ISDN and Internet, telecommunications and multimedia are being associated fort he first time in the minds of the general public. This has also created increasing interest in telematics-based learning.

This turning point coincides with a phase of very great economic change that had been marked by worldwide competition, dynamic product development, new marketing strategies and quality concepts, new organization and production structures and above all by the business world's unprecedented cost consciousness.

Available studies in Germany on multimedia learning do not yet provide any information on this new situation. There are a great many reports on the multimedia market in Germany, but they give only economic and technical information on the market. Secondary sources are mostly used, and ad hoc representative surveys and specific case studies are dispensed with. As there is no body in Germany which collects or routinely collates data on multimedia learning, the statistical position seems unsatisfactory compared with the United States and the United Kingdom.

The Fraunhofer Institute has brought out a comprehensive study on the opportunities and risks for multimedia systems in corporate basic and continuing training. The authors consider that such systems provide a range of possibilities, even if basically they take a conservative view:

- decentralized training can lead to cost cuts,
- large target groups can be reached once programs are set up,
- training times can be cut in some cases,
- the workload of training personnel can be reduced,
- knowledge can be passed on in a way that suits the individual,

- training staff whose workload has been reduced can concentrate on "difficult cases",
- in-house learning, learning at home and learning in continuing training centres will be possible,
- the students' various preferences and experiences can be taken into account,
- redundancies will be avoided.

The state of research in Germany can be shown by the conclusions of a report on the effectiveness of multimedia and hypermedia learning systems. The authors conclude that "we do not yet know enough to make general statements about the possible effects on learning of multimedia systems". Even if multimedia systems have considerable potential for improving learning performance "the vast majority of the multimedia systems now in service have little or no positive impact on learning performance " Nonetheless, acceptance on the part of trainers and students, the hopes of positive impact on the learning process, and especially the expectations of a marked reduction in costs, are high.

2.3. ADULT EDUCATION

New technology is widely applied to general continuing educatio. Many public and private further education institutions offer lectures for initiation into the handling and use of electronic data processing It includes initiation into the use of computers in general as well as lectures dealing with some specific software (for example Word or Excel). Large enterprises work out their own training material for vocational further training and continuing education, or else they commission smaller enterprises. Computer-aided training material is used by the enterprises during work hours as well as for home-work. Some of these enterprises supply the participants of such programmes with the hardware necessary for home use.

2.4. DISTANCE EDUCATION

Distance Education in Germany can be divided into that part concerned with schooling and vocational training and into that part concerned with university level education and ongoing training. As for the first more than 140 providers prepare and sell studying material and other media to more than 150,000 learners. The part of learning material including computer programs is growing although mostly limited to subjects which are especially related to computer knowledge. Experiments have been made using NITs and telecommunication to improve learning simultaneously at different places via Tele-Conferencing and Tele-Teaching. CD-ROM and multimedia was introduced in training courses which had been led during vocational off the job training after Germanys reunification.

2.5. TEACHER TRAINING

Due to the quick development of the technology many efforts had to be made to train the teachers. Many in-service training courses were offered so that many thousand teachers could get professional experience in using media and NIT for education. But to implement NIT media in lessons others than computer oriented and "computer near" subjects the training efforts have to be continued.

Teacher education at university level in the area of information and communication technology has not yet reached the desired level. Special lectures are given at universities whereby teachers are trained in informatics as a subject for the secondary education; however media-related subjects in the training of teachers as well as new technology in the training of all teachers are still at an experimental stage. The reason is that few young teachers could be appointed in the past few years for budgetary reasons.

2.6. NIT FOR ADMINISTRATION IN SCHOOLS

In the past few years the Laender have made every effort in order to simplify and improve the efficiency of the administration of their schools by introducing computers for administration purposes. This simplifies the transmission of acknowledgments to the different ministries. However, such computers are seldom used for teaching since these devices are mostly used for school organization and administration.

2.7. NIT AT UNIVERSITY LEVEL

2.7.I. NIT and traditional universities

The use of new technology for research has become a rule in most cases. However, university teachers are only beginning to make use of the possibilities offered by the new media for preparing and teaching. There is a significant potential which can and should be used. Some obstacles are the limited availability of software as well as the different relation of the academic contents to new technology.

During the last month a growing position of universities are handing out themes for examination theses that are concerned with a NIT in educational contexts. Media and media competence become more and more an accepted topic in teacher education even producing videos or computer program as part of the exams. Additionally there are specialized universities for media.

2.7.2. NIT and Distance University level education

The German Distance University (Fernuniversitat) has more than 50 000 students, 15% of them are regular students, the others use the Distance University as possibility for ongoing studies and for vocational academic training.

In more than 30 projects NITs were implemented and evaluated, for example "Fernuniversitat by satellite", Video-Conferencing in the Department of informatics, having servers for mailbox purposes, computer conferences. The German Institute for Research on Distance Education (*Deutsches Institut fur Fernstudienforschung an der Universitat Tubingen*) has installed a special department which develops and evaluates new forms of learning using

NIT. There is cooperation with other European and overseas universities so that the materials can be used in different countries.

2.8. MULTIMEDIA AS MEANS FOR PRIVATE LEARNING

During the last years several hundred multimedia products were developed and sold for private learning purposes The spectrum of themes is very wide spread: it reaches from helping programs to fill in the tax bills to programs how to do sports, from cooking to traveling, from learning games for children (mathematics, foreign language etc.) to quizzes. The market for those products is vastly expanding and a good proportion of the world's largest book fair in Frankfurt/M is dedicated to those products.

3. CONCLUSION AND OPEN QUESTIONS

The recent developments of technology and educational discussions show that the educational system has to reflect a great variety of open questions. In order to get new experiences there should be a widely accepted framework of educational and pedagogical aims related to the media. The furnishing of the schools with computers and telecommunication machines should follow the pedagogical aims not vice versa.

Therefore efforts made by the European Commission and other official programmes are only helpful insofar they are closely connected with pedagogical ideas.

It is important that new information technologies cannot replace the teacher: Schooling cannot be reduced to the teaching of special knowledge to pupils. Schooling has before all the task to integrate young people in a human society.

It can be assumed that the teachers role will change In the future he will not be the only one who can transmit knowledge to the pupils, NIT can be helpful and can make learning better. But the teacher still has to-enable the pupils to bring the knowledge in a good system, he has to help to evaluate the information - and he has to help the pupils to integrate themselves in a social community.

Even if new technologies can help to learn it has to be stressed that learning will still be a hard work to do. Relying only on the technological possibilities can end in barking at the wrong tree. And it has to be said that it will need time for parents, teachers and the society to accept that new technologies can lead to 'a more human society.

As it is mentioned in the congress document one has to note that there is a strong challenge for the developed countries to help the others to take part in this technological and educational development. The running for the “pole position” in the international competition has to be bound up with the aims of international policies: international cooperation, economic welfare, saving cultural traditions and the struggle for peace and freedom.

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NATIONAL REPORT OF GUYANA

NEW INFORMATION TECHNOLOGIES AND EDUCATION IN GUYANA

ABSTRACT

This report provides an overview of the current state of information technology in Guyana from the primary to the University level; the provision of computer hardware and software in the education system, including educational administration; envisaged policies towards standardisation; and the factors limiting progress in the adoption of new technologies in education.

STATE OF THE ART OF NIT

Information Technology (IT) in education is a relatively new Field for Guyana. In many ways, it is still the embryonic stage; where there is a lot of development work to he done and is some instances, the correction of anomalies which exists. The chart overleaf captures the current state of Information Technology as it exists in the formal sector of our education system. This is further discussed in the course of the paper.

In the information education sector, the situation is somewhat different. That sector has shown increased activities in education in the field of information technology over the past few years. This is evident from the many computer schools and clubs that have mushroomed throughout the country. The focus of this paper, however, deals mainly with the formal education sector.

It should be noted that .the term "information technology" includes the computer as its primary device and other associated communications technology. However, for the purpose of this overview, new information technologies (NITs) will refer specifically to computers.

UNIVERSITY

The Computer Centre, which was established by the University of Guyana in 1993, is used mainly by students and lecturers of the University for time-tabled courses, additional practice sessions and some amount of personal work. This centre houses about 25 personal computers (PC's), which are networked and served by a Novell Netware V3 11 file server. The software offered, include generic applications such as word-processing, computer-aided design packages and programming languages. The university has one computer which is specifically used for sending and receiving electronic mail.

At present a diploma course in computer science is offered to students by the University of Guyana. The degree programme is scheduled to start in September 1996. (As the university has a student population of more than 3,000 students the computer centre is inadequate to fully meet the demands of the student body and staff, - results in a severe shortage of trained persons who graduate from the only university in the country.

TEACHERS TRAINING COLLEGE

At the beginning of the academic year '94-'95, an IDB funded project made it possible for the establishment of a Computer Resource Laboratory at the main branch of Cyril Potter College of Education (CPCE). An option course in Information Technology was then introduced to primary in-service teachers by the institution. These students were exposed to the use and application of generic, computer assisted learning (CAL) software and an introduction to programming. This was a progressive step by the institution, hut to date only sixteen (16) students have elected to choose Information Technology as an option course. In a country where the '93 - '94 statistics shows that there are 98,003 primary school students and 3,746 primary school teachers, one can immediately perceive the problem of insufficient trained persons to deliver IT, if the current trend of training in such small numbers continue. Little or no training is offered to In-Service Secondary School Teachers.

SECONDARY SCHOOLS

Some secondary schools in three (3) of the ten democratic regions have fulfilled their desire to have the new technology in their schools. Computers were acquired mainly through Old Students' associations. Parent Teachers' Associations, other donors and The Ministry of education. In most of the schools, there existed great anomalies with regards to IT, the most important being that:

- there was no policy regarding how the computers should be used to enhance teaching/learning;
- there was a lack of skilled persons to deliver an IT program to students,
- Computers were stored away because schools lacked the preparedness for their use.

In some of the schools. Voluntary Service Officers (VSOs) played an integral role in delivering a computer awareness programme - as they saw fit, to students and in helping to train local teachers.

PRIMARY SCHOOLS

As at the lime of writing, there are no primary schools that have computers used for the enhancement of leaching and learning. The Ministry of Education is. however, trying to access funds for the introduction of computers into 6 primary schools in Guyana - A Pilot Project for the academic year 1996-1997.

INFORMAL SECTOR

Many private institutions offer computer courses to students for a fee. Most of the courses are mainly introductory, bur they lack the hands-on time to develop confidence and dexterity in using and applying the software. These schools provide the largest component of IT education in Guyana. The standard of tuition is variable as is the content, and each concentrate on basic computer applications such as word-processing, database and spreadsheet management. Some training in programming, computer-aided design, desktop publishing and technician courses is also offered. The courses offered by these institutions have not been accredited or certified by the Ministry of Education.

COMPUTER HARDWARE AND SOFTWARE IN THE EDUCATION SYSTEM

The provision, acquisition and use of software in the educational system, are major issues for educational officials in Guyana. This hinges on the fact that as a poor third world country, Guyana lacks the financial resources necessary for industrialized development. Hardware and software used in the educational system originate from and are bought from developed countries such as England and United States of America (USA). These include the following:

- *Generic packages viz.; word-processing, database and spreadsheet;*
- *Educational games:*
- *CAL packages; and*
- *Programming software.*

The disadvantage of such purchases is that the programmes are not specifically designed to suit our educational needs. In cases where purchase is made from USA, one finds that there is also the US-English spelling problem.

Additionally, the purchase of educational software is a new phenomenon: hence, suppliers do not readily have them available on stock, and they do not have catalogues from winch selection can be made. As most of them are not familiar with the educational curriculum, they can offer little or no advice about the choice of software.

This situation could, however, be remedied with the advent of the proliferation of computers in schools. The Guyanese programmers may be co-opted to sit with educators to design subject specific programmes which are suited to our local needs. Additionally, established suppliers could target this new market and make available catalogues and preview copies of software.

FACTORS LIMITING PROGRESS IN THE DEVELOPMENT OF NEW TECHNOLOGIES (NITS)

SERVICE UTILITIES

The area of Guyana is 83,000 square miles, and has a population of about 750,000 persons. About 75% of the population are concentrated on the narrow, flat coastland, but many others live in small communities in the riverain, mountainous and other areas of Guyana. Educational Institutions exist throughout the length and breadth of Guyana. However many of these areas, particularly those external to the flat coastland, suffer from the lack of certain essential services, including:

- adequate and ready transportation facility;
- a ready supply of electricity (except where individuals own private generators);
- telephone system that boasts a penetration of 46,219 telephone lines has not yet been extended to many of these locations.

The National Broadcasting System is to date not powerful enough to broadcast all areas of Guyana.

The above mentioned utilities are integral the use of information technologies in all formal institutions of Guyana.

LACK OF TEACHERS WITH IT SKILL

Many of our secondary schools have acquired computers and attempted to start a programme of computer awareness in schools. Like many of their predecessors in other countries, the foresight to acquire skilled persons or offer training to existing staff before placing computers in the schools was sadly lacking. Many of the computers in some schools were and still are underutilized or not used at all, except in cases where VSO's help was sought.

Two of the secondary schools that have VSO's attached to them have done a remarkably good job in training students with few machines, this was evident in the Caribbean Examination Council (CXC) results obtained.. At one of our senior secondary school, about twenty students will be writing the CXC exam In June '96. These students suffer severe constraints, there are only 2 computers on which to prepare their practical pieces, complete assignments and have hands-on practice sessions.

FINANCE

The purchase of a computer still remains a big investment for schools. As a result, most of the secondary schools in Guyana have acquired computer through various donours. Unfortunately, many of these 'gifts' are very old versions of 4th generation computers and seems to be of little use in a school which has as its priority - the enhancement of teaching and learning through the use of CAL packages. For example, one school was given a few BBC computers, two others were given 2-each, 8088 computers Guyana has to be very careful in accepting these gifts, since it may prove very difficult to standardize our systems in the future.

NATIONAL POLICY FOR INFORMATION TECHNOLOGY IN EDUCATION

As the Ministry of Education, at the time of writing does not have a National Policy concerning the use of information technologies in education, the schools which took the initiative had no guidelines to follow in their work. Steps are now being taken to remedy this situation as a committee has been formed to produce a draft national policy in time for the new academic year '96-'97.

OUR VISION FOR THE FUTURE

Guyana which is now in an advantageous position of introducing information technology to schools after reviewing the successes and pitfalls of its predecessors, foresees a vision for the future to include:

- A population that is computer literate.

- Using IT as a planning and developmental tool in education.

- Production of a curriculum that integrates IT in the various subject areas.

- Preparation of students for the world of work and the existing new technologies.

- All teachers are skilled in using IT in vari-

ous subject areas.

- Produce a core of highly skilled IT specialists to satisfy the needs of the market at home and abroad.

- Formation of 3 support group which may lend assistance in the following areas:

1. Curriculum support for IT
2. Software support and development for IT
3. Technical support
4. Training support

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NATIONAL REPORT OF ISRAEL

PROMOTING SCIENCE TECHNOLOGY AND COMPUTER STUDIES: THE "TOMORROW '98" PROGRAM

INTRODUCTION

The overall objective of the Tomorrow '98 project is to improve the quality of science and technology education offered to children in Israel. The Ministry of Education adopted a five-year plan (1994-98) to implement the project.

Below are some of the key principles in the implementation of the project:

1. THE TEACHER AS THE FOCUS OF IMPLEMENTATION

The most important aim of the Tomorrow '98 project is to significantly improve the quality of science and technology education in Israel. The improvement of the quality of education will, first and foremost, be achieved by means of the daily academic interaction between teachers and students in the classroom. Thus, the implementation of the Tomorrow '98 project will highlight the advancement of teachers' level of professionalism, in terms of both content and teaching methods. The revision of study curricula will be accompanied by extensive activities involving training courses, in-service training and support, aimed at working together with teachers in adopting advanced methods of science teaching which devote special attention to the needs of the student, thereby generating a more meaningful level of study and enhancing the students' position vis-a-vis the school and learning in general.

Implementation of Tomorrow '98 involves emphasising the teacher's professional advancement through extensive training programs:

- Training professional primary school mathematics teachers
- Training co-ordinators for computer laboratories
- Training science and technology teachers for junior high schools
- Improving training for science teachers in senior high schools

2. THE STUDENT AS THE FOCUS OF INSTRUCTION AND LEARNING

The Tomorrow '98 project will devote special attention to the application of study curricula and teaching methods which revolve around improving the students' comprehension, mobility and enjoyment. This is a difficult objective to achieve, but not without precedent in Israel and throughout the world. The key to achieving these objectives is the emphasis placed on the qualitative aspects of the study material alongside the quantitative aspects ("principles in place of formulae"), particularly in mathematics and physics; the introduction of interactive teaching methods (with extensive integration of computer use); changing the perception of the student from a "material absorber" to that of an active partner in the evolution of concepts in his or her mind; and changing the perception of the teacher from a "material conduit" to an instructor in an interactive learning environment.

The primary means to be used in achieving these goals are the development of new programs which integrate science and technology, and the use of student-oriented teaching approaches - increasing the use of computers in teaching and extending individual learning.

3. COMPUTERS FOR THE ENHANCEMENT OF INSTRUCTION AND LEARNING

One of the most important tools, both in the enhancement of teaching and learning, and in the creation of change in teachers' attitudes, is the use of computers in all stages of teaching and learning. Thus, another area of particular importance for the Tomorrow '98 project is the introduction of "enlightened" methods of computer usage, which place the student at the center of the learning process and generate an interactive learning environment. The program entails the introduction of computers for teaching and learning at all levels of education, with the goal of reaching a ratio of one computer station for every ten students in the primary and junior high schools, and one per every twenty students in the high schools.

The program includes the establishment and operation of science laboratories with a view to maintaining a continuous link between academic and practical studies, and integrating scientific and technological aspects in teaching. The anticipated goal is that by the end of the project, every student will participate in 2-3 hours of laboratory activities every week.

4. SCHOOLS AS FULL PARTNERS IN THE IMPLEMENTATION PROCESSES

The school is the center of educational activity. Tomorrow '98 will devote a long-term and methodical effort to understanding the requirements of the schools, and will involve them in the decision-making processes and their implementation. The project will provide support for the changes which occur at the schools as a result of the implementation of the program, glean ideas from the schools regarding different programs and their method of application, participate in their deliberations, and involve them in the determination of tasks and their methods of implementation. The program will locate and promote initiatives from schools and individual teachers for the advancement of science and technology education.

5. QUALITY CONTROL

One of the main problems involved in the application of Tomorrow '98 is the question of quality control. Quality control is difficult to realise in the field of education, both in terms of the quality of teaching by teachers, and in terms of the quality of learning by students.

The reason for this lies in the fact that the levels of quality are inherent in the subtle aspects of the dynamics of teacher-student interaction that takes place in the classroom – a dynamic process whose quality level can be evaluated subjectively by the expert observer, but cannot be defined by means of a series of objective criteria which determine the desired mode of behaviour in terms of single values. Much effort is currently being invested in the improvement of learning evaluation methods in order to advance teaching quality levels which should, of course, be used as much as possible.

Nevertheless, the way to ensure "product quality" in the application of the Tomorrow '98 project is, first and foremost, through the utilisation of the best resources available in Israel teachers, academics. Ministry of Education officials and additional parties involved in educational activity and their involvement in the development of advanced programs and approaches, and the training of teachers required by their application. Product quality will be determined by the individual and professional standards of those people involved in the various stages of the report's application.

"TOMORROW '98: COMPUTERIZATION OF ISRAEL'S SCHOOLS THE PELED COMMISSION REPORT

The unavoidable process of computerization in education presents the school systems with the challenge of integrating computers as tools to assist teachers and students in all areas of teaching, learning and educational administration. The creation of a "computer culture" in the schools is the way to cope with that challenge. The use of computers as a means for creating innovations has prompted the Science and Technology Division at the Ministry of Education and Culture to make new preparations, over the last two years, for the absorption of computers in Israel's schools. In view of this, the Ministry of Education and Culture appointed a commission of experts to formulate a master plan for the computerization of the school system. The commission, headed by Prof. Elad Poled of Ben-Gurion University, drew up recommendations and a policy framework for the introduction of computers into Israel's schools.

The commission, consisting of experts from Israel's academic institutions, presented its recommendations in the following areas:

1. Integration of computers in teaching and learning.
2. Teacher training and in-service training.
3. Familiarisation with computers.
4. Research and development.
5. Research and evaluation.
6. Infrastructure, hardware and communications.

The commission recommended the promotion of innovative concepts in teaching and learning, principally: the creation of a learning environment rich in educational stimuli; the creation of a driving force for innovation in teaching and learning; and the improvement of educational administration as a pedagogical tool. The commission's recommendations included the following:

MODEL DEVELOPMENT

In order to encourage the use of computers and integrate them into all school subjects, the commission recommended the development of several models.

TEACHER TRAINING

The commission recommended the foundation, expansion, and intensification of teacher training in the integration of computers in instruction and learning. It also recommended that a training program in computer operation be made an integral part of the curriculum in teachers' colleges and of teacher training programs in universities.

IN-SERVICE TRAINING

The commission recommended the preparation and implementation of a 5 to 10-year in-service training program to train all teachers throughout the school system in the use of computer applications in teaching.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The commission recommended initiating activity focused on software and tutorial development, trials in experimental schools, and evaluation. The development program will include encouraging private companies to develop software and tutorials, and the allocation of resources for the evaluation of tutorial integration into the curricula.

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommended the establishment of a nationwide computerized communications network for the school system, to enable integration with other communications networks In Israel and abroad. The computerized communication network will permit communication with databases and electronic libraries, which will be at the disposal of students and teachers.

ORGANISATIONAL SYSTEM

The Commission recommended the establishment of an organisational infrastructure to assist the schools and the Ministry of Education and Culture in the operation and maintenance of computerization systems. A professional computer co-ordinator appointed in each school will be responsible for computer operations, and a municipal computerization co-ordinator will be appointed in every municipal system under the auspices of the local Department of Education.

FAMILIARISATION WITH COMPUTERS

The commission recommended the establishment of a professional team to prepare a new and detailed curriculum for the teaching of "Computer Familiarisation" or "Computer Literacy" in junior high school classes. This curriculum is intended to provide pupils in the early stages of their studies with the following:

1. Fluency in the skilled use of computerized tools for processing and presentation of information.
2. Fluency in the information which can be processed by these tools.

RECOMMENDATIONS OF THE PELED COMMISSION

In order to ensure the proper integration of computer software in the teaching and learning processes, the Commission recommended the following:

1. To acquire skills in computer use.
2. To raise achievement levels in various subjects.
3. To improve thought processes and problem-solving abilities.
4. To acquire information handling skills.
5. To increase motivation for learning.
6. To create a learning environment rich in educational stimuli.
7. To create a driving force for innovation in teaching and learning.
8. To improve educational administration as a pedagogic tool.

VOCATIONAL TEACHERS IN-SERVICE TRAINING

The Commission recommended the preparation and implementation of a five to ten-year in-service training program to train all teachers in the Israeli school system in the integration of computer applications in teaching.

The curricula of the in-service training program will be based on basic teacher training programs in colleges. The in-service training courses in computer application areas will be given at university schools of education, in teachers' colleges, and at in-service training schools for teaching staff.

A complementary means of implementing in-service teacher training in computer applications is on-the-job training within the schools, whereby teachers will be guided as they work in the classroom.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The committee recommended initiating activity focused on software and tutorial development. In addition, the committee recommended the operation of a five-year development program, including the adaptation of existing curricula, with the following components:

1. Cataloguing the current inventory of tutorials in Israel (both locally-designed and imported).
2. Determining priorities in software and tutorial development (by subjects, learning stages and software tutorial types).
3. Readaptation of curricula (goals, content and teaching method) and obligatory requirements (e.g. standard examinations, matriculation examinations) to the potential of computerization technologies.
4. Encouraging private companies to develop software and tutorials in accordance with clear, explicit specifications and Ministry of Education models.
5. Allocation of resources for the promotion of research and development centers in universities and teachers' colleges, in order to enable development of innovative tutorials in areas not commercially attractive to private companies.

HARDWARE

1. The equipping process is not a one-time campaign, but a continual process, which will require updating at least every 8-10 years.
2. The key to the proper equipping of any system is a ratio of one computer for every ten students.
3. Deployment of the computerization system in any school may be conducted on the basis of any of three configurations:
   a. Computer laboratory - up to 40 computers per laboratory.
   b. Regular classrooms - frontal teaching: one computer with suitable projection means; activity classroom: four computers per classroom.
   c. Special activity centers, such as science laboratories, art workshops, library, staff room, school secretary's office. Each school will deploy its computers on the basis of its own considerations and educational concepts.
4. Computers will have a minimal equivalency of 286 or 68080 processing levels; peripheral equipment will be commensurate with this standard.
5. The school computer system will be at the disposal of the community, and will serve extracurricular classes for children in the afternoons and during school vacations.

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommends the gradual establishment of the foundation for a nationwide computerized communications network serving the school system and enabling integration with other communications networks in Israel and abroad. Due to the high cost of this system, it is proposed to assemble it gradually, maintaining a reasonable range of implementation at every stage. The final structure of the communications infrastructure will include the following components:

SCHOOL NETWORKING

1. All computers in each school (in laboratories, classrooms and other activity centers) will be linked to a local network, by means of a server of sufficient power (equivalent to 286 or 68080) The number of servers required will be determined by the number of end stations (if the number of end stations exceeds 40, an additional server is required).

2. These networks will also constitute the sole system of school communications, and will enable communications between school computers and a main station in the Ministry of Education, and between teachers' and students' homes and the school's computerization system.

THE ORGANISATIONAL SYSTEM

An organisational infrastructure should be established to assist schools and the Ministry of Education with the operation and maintenance of computerization systems. This infrastructure is based on the following:

a. A professional computer co-ordinator appointed in each school will be responsible for the operation of computers.

b. The co-ordinator's duties will include: advising and guiding teachers, responsibility for maintenance and proper operation of equipment, assistance to the school principal in co-ordinating all activities related to school computers.

c. Scope of work: on average, the equivalent of about half a teacher's shift in an average-sized school.

d. These co-ordinators, most of whom will come from the teaching sector, will be trained in a special Ministry of Education training program.

A municipal computerization co-ordinator will be appointed in every local educational system under the auspices of the municipal Department of Education.

OUTLINE OF OPERATIONAL PROGRAM FOR 1994-1996

PROGRAM FOCUS

The main thrust of the program will be directed at junior high schools and teacher training colleges. At the same time, the needs of senior high schools, primary schools, kindergartens and special education institutions will also be addressed as far as possible within the budget framework.

PROGRAM HIGHLIGHTS

The following directions will be emphasised as part of the three-year plan:

1. Teacher training and in-service courses in the integration of computers in teaching.
2. Expansion of the educational instruction and support system for schools and local authorities.
3. Providing all Israeli teachers and pupils with basic technological skills (word processing, spreadsheet, databases and application generators) and the integration and use of these skills as part of the learning process.
4. Providing basic skills in database handling, computerized communications and additional innovative technologies (e.g. multimedia).
5. Equipping schools with hardware and software; replacement of outmoded equipment.
6. Setting standards for equipment and software for all age levels.
7. Encouraging development of special-purpose software and its integration into the curricula.
8. Encouraging special-purpose experiments, evaluation and dissemination of their results throughout the school system.
9. Development of technology and information-based organisational and communications infrastructure for use in improving educational administration.
10. Improving and modifying the teaching and learning processes, with a view toward promoting educational achievements.

ALLOCATION OF FINANCIAL RESOURCES

The program's financial resources will be directed to the following seven areas:

1. Hardware (equipment and maintenance).
2. Educational software and operational software.
3. In-service courses.
4. Education, consultation and guidance.
5. Infrastructure, communication and administration.
6. Research, development and experimentation.
7. Immigrant absorption - computer co-ordinators.

Areas of Activity in the Schools

ONE-KEY LOGO	LOGOWRITER		PASCAL, PROLOG, etc.
	DATA COLLECTION & PRESENTATION		COLLECTION & RESEARCH
	WORD PROCESSOR, DATABASE, SPREADSHEET		
	SIMULATIONS		
ACCORDING TO SUBJECTS IN CURRICULUM			
GRAPHICS & GAMES			

BASIC PREMISES

The program is based upon the following premises:

PEDAGOGICAL PREMISES

1. In the modern world, the capacity to use computers (computer literacy) is another basic skill in addition to the three familiar basic skills of reading, writing and calculating, and as such, every teacher and student within the educational system must acquire it.

2. Skills in data handling are vital to every modern, educated person, and must, therefore, become an integral part of instruction in all subjects. These skills can be efficiently acquired by integrating data technologies into the teaching of subject matter.

3. The computer's potential for contributing to effective learning and teaching is derived from its basic characteristics: interactivity, quick response, saving and retrieval of data, and rapid transition between different data displays (text, graphics, pictures).

4. A rich teaching environment, full of information technologies, may create learning stimulii and encourage meaningful and effective creativity and learning.

5. The integration of computers in instruction and learning may create two types of processes:

a. Preserving and reinforcing conventional teaching methods;

b. Creating change and innovation in instruction and learning. The process selected depends, to a large degree, upon the individual teacher's pedagogical viewpoint, the type of software used, and the manner in which computers are integrated into the teaching and learning processes. The program will favour trends toward change and encourage innovation in the field of active learning.

6. Any worthwhile study of non-trivial content cannot possibly depend on the model of "teacher-transfers-material" and a passive student who absorbs it; rather, the model must be that of dynamic, active and experiential learning, in which the student is involved in research and experimentation through an interactive medium.

7. The optimal effectiveness of the computer used by students will be achieved only when there is one computer station for every ten students, and when each student receives three hours of computer use a week.

8. The effective integration of computers in teaching is dependent on the teacher's approach to his or her profession, which should suit the type of software being used.

9. The teacher should be assisted in choosing the most suitable software which meets his/her needs of the specific subject material and teaching methods.

Mapping out those aspects of the software and their special features, and identifying the teaching patterns will facilitate distinguishing between software and computer applications which reinforce conventional teaching methods, and those that augment change and innovation in teaching and learning.

ORGANISATIONAL PREMISES

1. Integrating telecommunications in the education system will be the primary goal of educational policy for the next five years. This integration will be implemented by all units of the Ministry of Education.

2. The role of the Ministry of Education and Culture in this program will be to determine the principles of policy, create an infrastructure, allocate resources, set standards, initiate and encourage other groups to initiate a fuller integration of computers into the education network, stimulate R&D, and administer an experimental network and an ongoing control network of the hardware, software and activities.

3. All teachers within the school system, veterans and newcomers alike, must be computer-literate, as well as capable of integrating computers and telecommunication systems into their teaching.

GENERAL GOALS

The five–year program aims to create a technology-based learning environment within the schools, in order to achieve the following, in whole or in part:

1. To bring schools into the information era.

a. To narrow the gap between the school culture and the culture of the world around it, by creating an "information era" culture within the school.

b. To create a supportive environment and to aid the school in its process of integrating information technologies, through a wide spectrum of activities.

2. To improve and revitalise the teaching and learning processes by the following:

a. Increasing the effectiveness of learning and teaching.

b. Training an independent and creative student.

c. Encouraging the development of superior thinking skills.

d. Encouraging educated learning.

e. Applying sophisticated information technologies as an impetus towards revitalising and promoting teaching and learning.

3. To enhance the teacher's status.

By promoting his/her professional level, as well as improving his/her self-esteem and social standing.

APPLYING THE GOALS IN THE CURRICULAR STUDY PROGRAMS

Translating these general goals into applied educational curricula can be expressed through the following objectives:

1. To facilitate achievement of the defined objectives in existing curricula that have not been achieved via the traditional teaching methods, by upgrading both the teaching of current curricular content and the normative standards.

2. To enable rapid implementation of the standard curricula by accelerating the rate of learning or by changing the order of teaching.

3. To add new content to the standard study frameworks which, so far, have not been included in the current curricula.

4. To introduce new subject content that was not included in precomputer-age curricula, but are computer-related (such as algorithmic thought, familiarity with data processing procedures, data displays and systems approach).

5. To change the attitude towards current curricular programs, for example, by breaking with the conventional limitations of areas of knowledge, and defining multi-disciplinary syllabi into multiple study units, deviating from the normal curricular teaching approach, and enabling independent and open learning, based on a flexible learning program.

6. To change the conventional teaching methods. Such changes can be achieved by adopting alternative teaching methods, and increasing the pedagogic autonomy of school principals and teachers. Furthermore, change can emerge in the organisational/logistic aspects of teaching by use of the computer in the revolutionary reorganisation of teaching and, perhaps, of the school itself.

THE MAJOR EMPHASES AND FOCUSES OF THE TOMORROW '98 PROGRAM

1. The main focus of the program will be applied to the junior high schools and teachers' seminars. Notwithstanding, attention will also be given, as far as the limited budget will allow, to kindergarten (compulsory), primary schools and high schools as well.

The cost of working with the teachers' seminars will be met by the Ministry of Education.

2. The five-year plan emphasises the following activities:

a. Training teachers to incorporate computers in teaching (all teacher trainees in teachers' seminars, and all the teachers within the various teachers training education frameworks).

b. Expanding the support and training networks for teachers, schools, and local municipalities.

c. Equipping schools with hardware and software, and replacing obsolete equipment with modern equipment.

d. Setting standards for hardware and software for all age groups. Encouraging the development of special software packages and their integration into the study programs.

e. Encouraging special experimentation, followed by evaluation and distribution throughout the system.

f. Encouraging special experimentation, followed by evaluation and distribution throughout the system

g. Developing an infrastructure of data banks and computer communications to improve pedagogic management and the integration of data bases into teaching and learning.

THE PRINCIPLES OF APPLICATION AND IMPLEMENTATION

In view of the above, the program reflects the following principles of application and implementation:

1. Computers are to be integrated into teacher's training institutions, enabling teacher trainees to acquire technological skills as an integral part of their training program.

2. The current network of training and counselling in computer applications is to be expanded in order to meet the demands for counselling, advice in purchasing, guidance in developing school programs, teacher training and teacher promotion as a direct result of school training programs.

3. Computerization of the schools and educational institutions will only be implemented by using a "computerized package" which includes hardware software and teacher training guidance. The integration of all these components will ensure the successful implementation of new technologies in the educational system.

4. The program for equipping the school system, from 1994, includes allocation of resources for the purchase of hardware, operational/educational software, training and guidance, the incorporation of which is a prerequisite to the successful introduction of new technologies into the education system.

5. The target number of computers is one computer station for every ten students (as recommended by the Poled Committee report). Based on the proposed budget allowance, the rate of supply will aim to meet the following standards:

- Junior high and high school - one computer station for every 10 students.
- Primary school - one computer station for every 20 students.
- Special education up to 10 computer stations

per institution and as per specific requests.

- Kindergarten (compulsory) - one computer station for each kindergarten.

In the event that program implementation is continued for more than five years, the rate of supply in the primary school system will be matched to that of the secondary schools: one computer station for every ten students.

6. Allocation of resources (hardware, operational/educational software) to the schools will be carried out as follows:

- Approximately 75 percent of the resources will be allocated to the junior high schools (grades 7-9).

- High schools, primary schools, kindergartens and special education schools will be supported as the budget allows.

7. An extended training network within the school training framework will receive support as a direct spin-off of new salary agreements and teachers' needs, closely linked to the process of supplying hardware and operational/educational software.

8. Personnel will be trained for positions of responsibility in the field of computer integration in the schools, and training staff (especially new immigrants) as technical assistants at the schools.

9. Innovative projects which make use of new and unconventional teaching methods and technologies will be promoted. Within this framework, ten schools will be chosen from all school districts and sectors, to serve as model schools.

10. Schools in which alternative teaching methods are implemented will be. encouraged, so that computers may be integrated into the classes and help create a new learning environment.

11. The introduction of computers into special education schools will be encouraged at a rate of up to 50 schools per year.

12. The process of supplying computers to kindergartens is to be completed at a rate of up to 250 kindergartens per annum, by 1998.

13. Research which directly contributes towards the goals of the program is to be encouraged.

14. Operational and educational software are to be developed in Hebrew, applicable for optimum curricular coverage, without deviating from the conceptual nature of the program.

15. The program is to be implemented through the services of "implementation contractors" who will provide a computer package which includes hardware, software, training and guidance.

ORGANISATION STRUCTURE AND AREAS OF RESPONSIBILITY

The nature of the organisational structure and areas of responsibility for implementing the computerization program, as determined by the chief executive of the Ministry of Education during meetings of the Committee on Computerization, emphasises that the implementation of the program will be largely conducted by the existing Ministry divisions, each in its own area of jurisdiction.

Responsibility for operation of the program is defined as follows:

1. The Committee on Computerization chaired by the Ministry's Chief Executive formulates policies and follows up on their implementation.

2. A "Think-Tank" Staff - members: Chairman of the Pedagogic Council, the Tomorrow '98 chief administrator. Chief Scientist, Consultant to the Science & Technology Division - all of whom will consider and consolidate educational perceptions, work towards the integration of computers in education, and present their proposals for consideration before the Senior Computer Committee.

3. Operative Staff members: director of the Science & Technology Division, administration of the M.I.S. Division, administration of the Tomorrow '98 project, Director of Computers in Education Department are responsible for initiation, co-ordination and monitoring of the program's framework, as approved by the Senior Computer Committee.

4. Computers in Education Department, part of the Science & Technology Division: the implementary arm of the Senior Computer Committee and of the Operative Staff. Its main responsibility is to prepare the overall budget and monitor its use, as per the decisions of the Senior Computer Committee.

5. All divisions of the Ministry of Education are responsible for the initiation, planning and operation of the program, each in the area under its jurisdiction, following endorsement by the Tomorrow '98 administration.

Working Procedures

Procedures for implementing the computerization program, as laid down by the Chief Executive, chairman of the Senior Computer Committee, in applying computer integration in the educational network in both teaching and learning, will reflect the Ministry's work procedures:

1. Initiation: Under the jurisdiction of each division of the Ministry, and also open to other bodies outside the Ministry.

2. Policy-Making: Overall policy - the Senior Computer Committee, chaired by the Chief Executive. Sectoral policy - under the jurisdiction of each sector, in those areas under its authority, in accordance with general policy.

3. Co-ordination: The "Operative Staff" will co-ordinate the consequential results of the decisions taken by the Senior Computer Committee, which will also serve as the source of authority. Its organisational affiliation - the Science & Technology Division/Computers in Education Department, responsible of computer-related issues in the Ministry.

4. Budgeting: Initiation and general co-ordination of the program for computerization the Science & Technology Division/ Computers in Education Department. Discussion and authorisation: the Senior Computer Committee.

THE BUDGET

Budgetary Sources

The program will be based on an annual budget of NIS 72.8 million for a five-year period. The budgetary sources will be as follows:

- NIS 24.0 million - Ministry of Education's budget

- NIS 24.0 million - National Lottery budget
- NIS 24.8 million - Local municipalities' budgets

In addition to the above sources, the following points should be considered:

1. This budgetary framework is in draft form only. A detailed and up-to-date annual budget will be presented separately.
2. This program does not contain enough resources to computerise the entire educational system in the five-year period. As a result, an order of priority has been determined by means of which the upper school network will be computerized to a greater extent than the primary school network.
3. The five-year program should be planned while keeping in mind the project's continued operation beyond the five-year period.
4. Consideration should be given to supplementing the budgetary program with additional hours allocated from the Ministry's total programmed hours.
5. The cost of one computer station is estimated at about NIS 4,000. The final cost is subject to the outcome of the Education Ministry tenders.

Budget Set-up and Operational Procedures

The following are the principles and operational procedures of the budget:

1. The National Lottery, together with the local municipalities, will purchase hardware, including peripheral equipment, operational systems, local communications networks, with financing as follows:

a. All educational institutions: kindergartens, special education schools, and schools of all age groups 60% of the rate of financing the acquisition of hardware will be provided by the National Lottery, and 40% by the local municipalities.

b. Teachers' Seminars: full financing by the Ministry of Education.

2. The local municipalities will finance the acquisition of hardware together with the National Lottery, and acquisition of operational and educational software together with the Ministry of Education.

3. The Ministry of Education will allocate funds from its budget towards acquiring hardware, and operational and educational software for schools, teachers' seminars, training programs, guidance and counselling, communications infrastructure, research, experimentation, evaluation and development.

4. Efforts will be made to raise additional sources of financing from other government ministries in order to integrate new immigrants into the network.

5. General principles of financing:

a. The National Lottery will finance 60% of the cost of hardware operating systems, and operational software.

b. Local municipalities will finance 40% of the cost of hardware and operational software, and 50% of the cost of software and educational software.

c. The Ministry of Education will finance 50% of the cost of software and educational software, the entire cost of training programs, and the entire cost of ongoing guidance.

6. The budget of teacher-training institutions will be fully covered by the Ministry of Education and will operate under a separate program.

7. For every age group, an outline of operational and educational software programs will be determined, linked to the hardware and integral to the computerization package. The same applies to the training programs and guidance required by each institution, which will be supported by the program framework.

8. Those schools not equipped in keeping with the program's standards will be given the opportunity to acquire the equipment they lack. Old equipment will be transferred to other institutions and/or be taken out of circulation, as per procedures to be determined together with the National Lottery and implemented in the future.

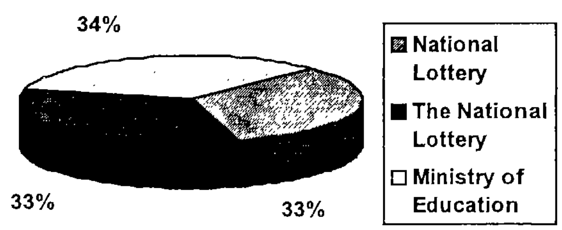
9. Responsibility for the program's operation: Science & Technology Division/ Computers in Education Department, in co-operation with the National Lottery and the local municipalities.

10. Decisions regarding hardware and software will be made in accordance with the Automation and Data Systems Division.

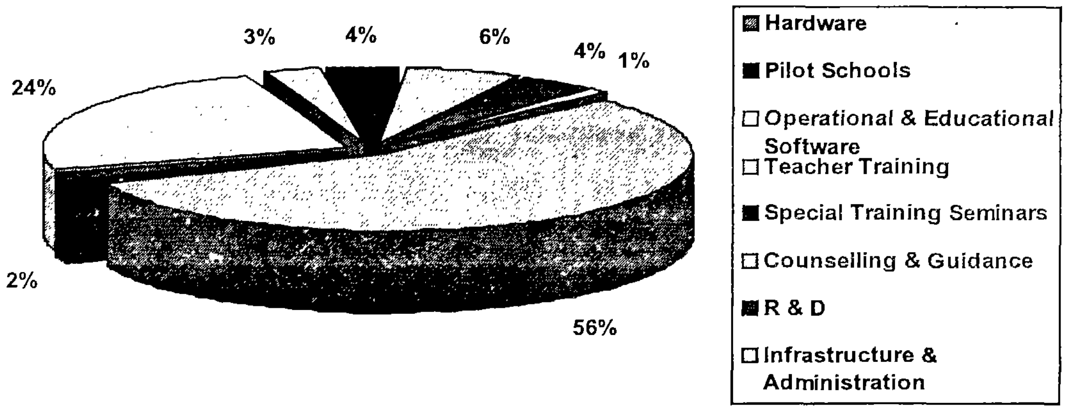
11. A forum for monitoring and control will be established; its members will include a representative of the Ministry of Education, a representative of the National Lottery, and a representative of the Center for Local Government.

BUDGET BREAKDOWN FOR COMPUTERIZATION PROGRAM

By Sources of Finance



By Areas of Activities



IMPLEMENTATION OF TOMORROW '98: COMPUTERIZATION

In 1994, a five-year computerization program was initiated, which was designed to introduce new technologies to the educational system. The main focus of the program is the computerization of the educational system, particularly the junior high schools and teachers' colleges.

GOALS OF THE PROGRAM

1. To bring schools into the "information era" by creating a supportive environment capable of integrating information technologies in a range of activities within the school.
2. To reduce the gap between school culture prevailing culture outside the school environment.
3. To improve teaching and learning by training independent and creative learners, and to develop higher cognitive skills.
4. To enhance the status of teachers by promoting their professional level.

MAIN DIRECTIONS FOR IMPLEMENTATION OF THE PROGRAM

1. To train teachers to integrate computers in teaching, both future teachers in teacher training institutions, and teachers throughout the system, through various in-service training frameworks.

2. To expand the educational support and training system for teachers, schools and local authorities.

3. To equip schools with hardware and software, and replace outdated, unsuitable equipment.

4. To set standards for equipment and programs for all age groups.

5. To encourage the development of special programs and integrate these programs into the curricula.

6. To encourage special experiments, and to assess and distribute their results throughout the system.

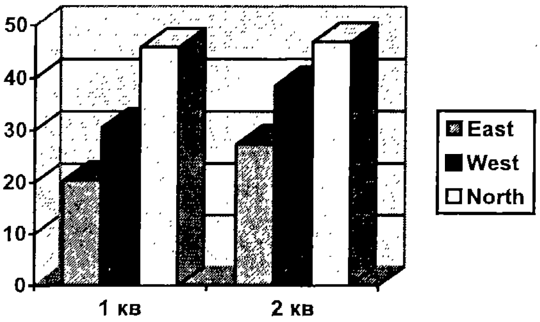
7. To develop an infrastructure of information and computerized communications systems which will improve the education system by integrating information systems in teaching and learning.

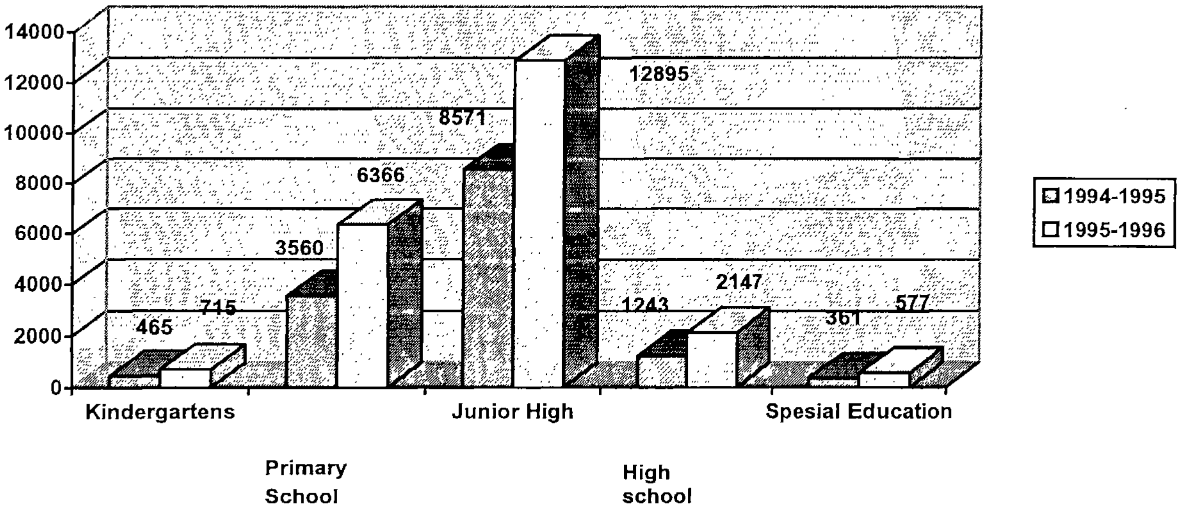
EQUIPPING THE SCHOOL SYSTEM

Computerization of the schools and educational institutions commenced in 1994, with implementation of a "computerized package," which included hardware, operational and educational software, and teacher training and guidance.

The schools were equipped in a combined effort undertaken by the Israel's National Lottery and the local municipalities. The equipment was supplied by seven contractors, who also provided software and computer training services. As part of the ongoing process of computerization in the Tomorrow '98 program, 450 secondary schools were equipped with computers during the 1994-1995 school year, realising the goal of one computer per ten students.

Allocation of Computer Stations
(Cumulative)





TEACHER TRAINING

COMPUTER TRAINING COURSES IN THE SCHOOLS

The fundamental premise of the computerization program is that the training of teachers, in preparation for school computerization, is an indispensable step in the application and implementation of the computerization of schools and educational institutions. The planning of school training courses is formulated with the full co-operation of the school principal and school computerization advisory team.

Training courses will help to implement the school computerization program, and will provide solutions for the following:

1. Implementing of training course instructions and guidelines.
2. Providing a solution for the achievement of the computerization program's objectives and school priorities.
3. Ensuring that teacher training programs include individual familiarisation and practical experience based on teaching methods which enable optimum utilisation of the integration of computers in the learning process.

School training courses are designed to achieve different objectives. The planning and consolidation of training courses will be implemented on a number of levels in order to achieve the following objectives:

1. Preparatory

This level applies to those teachers with no experience in computerized communications. Teacher trainees will receive 28 hours of instruction on the subject of teaching in a computerized communications environment.

The training course covers the following topics: computers and society, computers and education, computerized work environments in the school, an introduction to communications and data bases, an introduction to multimedia and Windows, and the operation of computerized presentational materials and equipment.

2. Computerized Equipment

The second level of courses, following implementation of the preparatory training courses, is based on working with spreadsheets, data bases, and graphic packages, offering 28-56 hours of training in a computerized communications environment, according to the teachers' work program.

3. Integration of Computers in Teaching - Beginners

Another type of training course involves the integration of computers in the instruction of specific study subjects. The course can be given to relatively small groups of teachers from a number of schools. Teachers undergoing the courses will familiarise themselves with various computerized materials which relate to their study subjects, and will learn to utilise computer-integrated study curricula in those areas.

4. The integration of computers in Teaching - Advanced

This course level is designed for teachers and co-ordinators with different areas of expertise, who have completed training courses for beginners and are interested in attending more advanced courses. These courses will include workshops covering the preparation of auxiliary materials suitable for the school study program.

5. Training Courses for School Staff

The computerized training course program also offers a range of courses for school staff conducted on a regional basis. School administrative staff, supervisors and co-ordinators will be offered courses by regional supervisors or training center managers. These courses are conducted by the training centers, and not part of the hours allocated to each school.

THE ROLE OF THE "COMPUTER INSTRUCTOR - ADVISOR"

In order to enable the introduction and proper implementation of computers in the school system, the Ministry of Education decided to allocate a number of training days for instructor-advisors, as part of the computerization program.

Computer instructor-advisors provide one day of training per week at most junior high schools. The instructor-advisor's role is to assist the school principal in the co-ordination of school computers, to help the subject co-ordinators and other members of the teaching staff with the proper integration of computers in the school's general education system, and to provide support for the different kinds of teaching-learning processes.

Together with the principal, the instructor-advisor formulates the annual work program for the field, as well as its implementation with regard to hardware and its uses, software, and the training courses in which the teachers participate during the year. It is also the instructor-advisor's responsibility, together with the principal and school staff, to lead and be actively involved in entire program while supporting and monitoring the initial stages of implementation. It is not his/her job to give the actual computer training courses at the school; however, he or she should be involved in their organisation, in determining their content and their operational framework, and in monitoring their implementation. The instructor-advisor is also responsible, in conjunction with subject co-ordinators, for helping teaching staff team how to integrate computers in their disciplines.

An extensive training system is provided for two types of instructors:

1. School instructor-advisors - for all age groups and types of education. The school instructors will act as tutors and instructors, supporting the process of computerization at the school.
2. Subject instructor-advisors - to work in conjunction and co-operation with the subject supervisors in the training of study subject instructors, as of the 1994-95 school year.

Implementation

1. 180 secondary school (junior and senior high school) instructors attended training courses.
2. 60 primary school instructors were also trained.

The training budget for the 1994-95 school year totalled around NIS 1.2 million.

The plan for the 1995-96 school year (some courses began instruction between July-August 1995) involved the following activities:

1. The training of an additional 150 primary school instructors.
2. The training of approximately 50 additional secondary school instructors.
3. The training of 30 special education school instructors.
4. The training of 300 instructors for the following subjects: Mathematics (30); English (90), Arabic (30), Geography (30), Bible (30), and Language and Expression (90).

The plan allows for the training of about 530 additional instructors.

The training budget for the 1995-96 school year totals approximately NIS 2.5 million.

IN-SERVICE TRAINING

In-service training for teachers is conducted on a regional basis, in teachers training colleges, universities, the Technion, the Weizmann Institute and at the Technological Education Center (the responsibility for implementation lies with the training center in co-operation with supervisors).

Training courses are held for teachers of all age groups: pre-school, primary school, junior high school, high school, and for instructor-advisors in the following areas: mathematics, biology and natural sciences, physics, chemistry, computers and technology. Most courses involve the use of computer applications.

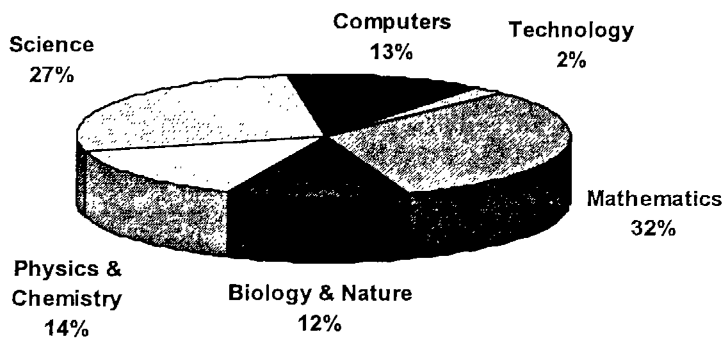
The object of the training courses is to consolidate the teacher's professional expertise, to familiarise teachers with different study curricula, to equip teachers with the necessary skills to integrate computers in their teaching subjects, as well as training teachers in educational leadership at various levels - subject centers, teachers' trainers and instructors, etc. The composition of the courses will be adapted to the development of new study curricula in different fields and to the wide-ranging activity involved in the computerization of the system and the equipping of laboratories.

In the 1993-94 school year, 232 training courses were conducted for 4,600 teachers, consisting of 21,000 hours. In addition, a training center for science and technology teachers was opened in Shiomi, which held courses for 4,000 teachers, with each teacher receiving one week of instruction.

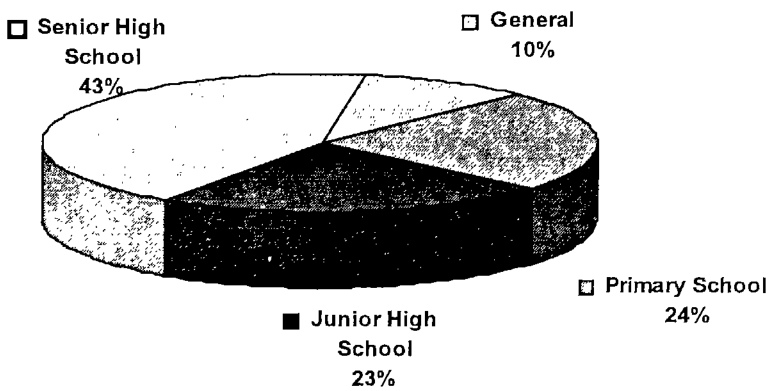
The schedule for 1995-96 includes around 260 courses for approximately 6,500 teachers. There will also be approximately 220 courses for about 4,000 pre-school teachers.

TRAINING COURSES - 1995 – 1996

Training Courses per Subject



Training Courses per Age Group



TEACHER TRAINING AND TEACHER TRAINING COLLEGES

Strong emphasis has been placed on the computerization and introduction of computerized communications to teachers training colleges. The Specialist Primary School Mathematics Teacher course is held at 7 academic colleges, and 10 college projects on mathematics, science and the integration of computers in teaching are due to commence in January 1996. A committee is currently examining the study curricula of teachers training courses at colleges for junior high school mathematics, primary school science and technology, and high school science and technology.

SOFTWARE EVALUATION

Educational software is an integral part of modern learning materials. The educational software market is full of products manufactured by commercial enterprises, with a minority of software designed by research bodies (e.g.. the study curricula department, universities, etc.). Developing educational/learning software is a costly business and the Ministry does not have sufficient funds to do this itself. It was, therefore, decided to use commercially developed products.

These consumers pay for educational software out of their own budgets, and decisions regarding the purchase of educational software are made by the consumers themselves (educational institutions). The Ministry of Education and Culture helps in an advisory capacity only. Unfortunately, educators don't have the resources to keep up-to-date with developments in the market and often buy products with which they are familiar, rather than the most suitable products.

In response to this state of affairs, the Education Ministry has established a software evaluation unit at the Technological Education Center in Holon. The Ministry wants to speed up the evaluation process in order to force the educational system to use software issued with an evaluation label. The evaluation unit has formulated a range of testing criteria for educational software, taking into consideration technical-pedagogic factors, hardware compatibility, and integration with approved study curricula. Thus, indirectly, the unit has become a source of guidance for educational software developers, thereby enabling the Education Ministry to become more involved in the supervision of educational software used by schools.

REGIONAL COMPUTER SUPPORT CENTERS

In an effort to make training and support services available to as many educators as possible, the activities of existing regional support centers have been expanded, and additional centers have been opened. In order to maximise use of existing infrastructures, the centers have been established in areas where pedagogical centers are operated, making it possible to expand their activities to include training in the use of computers.

In 1994, twenty regional centers were funded at an overall cost of NIS 6 million. An additional NIS 2.5 were budgeted for the purpose of expanding the centers' computer Infrastructure.

Last year, the support centers and training teams focused their efforts on preparing the integration of the vast quantities of computer equipment being supplied as part of the computerization program in the schools. Special attention was directed to providing support to the schools. Each of the schools budgeted in the computerization program was allocated a computer-advisor one day per week.

During the course of the year, the Science & Technology Division appointed six regional supervisors, as well as regional directors, to oversee implementation of the computerization process. The roles of the training staff, the supervisors, and the directors were redefined accordingly.

MODEL SCHOOLS

Model schools were defined for the following purposes:

1. To serve as "flagships" of the national computerization program.
2. To serve as a "laboratory" for the testing of advanced stages of the computerization program.
3. To serve as a source of inspiration and focal point for evaluation.

In 1994, ten schools were chosen to serve as model schools.

Each school is required to select an academic advisor to take on the following responsibilities:

1. To help determine school policies.
2. To guide school operations.
3. To assist the school in creating a definitive evaluation process.
4. To initiate innovate projects in the field of computerization. Two permanent bodies have been set up to administer the project:

1. A team of twenty principals and computer co-ordinators from the schools will meet periodically to discuss ongoing problems and developments.
2. A team of academic advisors (those working with the model schools), who will meet periodically to discuss the academic aspects of the project and its implementation.

SPECIAL PROJECTS

Tomorrow '98 includes projects which are operated in various regions, settlements and educational institutions. The applied initiatives are generated by schools and settlements, and reflect efforts, on various scales, to implement the recommendations of the Upper Committee for Science and Technology Education. The projects applied in schools reflect the desire for change and the emphasis placed on science and technology subjects in a learning environment, including the development of new interdisciplinary approaches.

Today, approximately 40 programs in operation, at various levels of implementation, including the following:

- The Regional Computerized Communications Center in the Northern Galilee;
- The Negev 180 Project;
- The Computerized Communications Teachers Center in Ramat Hasharon Media + ;
- The Computerized Communications Network at Teachers Training Colleges;

REGIONAL COMPUTERIZED COMMUNICATIONS CENTER IN THE NORTHERN GALILEE

As part of the Tomorrow '98 program in the Northern Galilee, a regional computerized communications center was established with which teachers can communicate via modem links. The regional computerized communications center enables teachers to exchange information via electronic mail, communications forums and to establish a computerized electronic newspaper. All the teachers participating in the project are linked to the regional computerized communications center and Communications Support Center.

COMMUNICATIONS SUPPORT CENTER

A center has been established to provide support for schools and workshops, and which trains subject and interdisciplinary school computerization instructors. During the 1994-95 school year, 35 school instructors and 15 regional instructors received computer training at the center.

Equipment

Teachers attending training courses were provided with notebook computers.

Some schools have been equipped with presentation equipment.

The project involves the equipping of computer schools as part of the computerization project.

The project involves the equipping of some primary schools and junior high schools with science laboratory equipment.

NEGEV 180

This regional center for the promotion of excellence and leadership in education was established in conjunction with the U.J.A. (Joint). The center is designed to provide the Negev and Arava regions with a facility for the operation of advanced education programs and the establishment of computerized communications study environments. These environments will be linked to each other and to research and science centers within the region, outside the region and with the rest of the world via a computerized communications system.

The center will initiate the establishment of data bases and activities for science and social studies-oriented youth at regional, national and international levels.

Project Negev 180 offers the following activities: the researcher-historian program, the young ecologist program, and computerized student newspaper programs.

Goals of the Center:

1. The development of knowledge and expertise in fields in which the Negev has unique advantages.
2. The reinforcement of co-operation between the regional communities.
3. The promotion of innovative education initiatives.
4. The development of training and research-oriented knowledge, programs and tools.
5. The promotion of co-operation with other communities in Israel and abroad.

Areas of Activity

1. The establishment of computerized communications study environments in schools.
2. The deployment and operation of a regional computerized communications network.
3. The establishment of a teacher and school principal training infrastructure.
4. The establishment of a support system for high school student diploma work.
5. The reinforcement and extension of activities for advanced students and science and social studies-oriented youth.
6. The operation of regional, national and international youth camps.

TEACHERS TRAINING CENTER – RAMAT HASHARON

A computerized communications teachers' center is being constructed in Ramat Hasharon, at which a model is being formulated for use via the educational communications network.

The center will serve 575 pre-school teachers in the area who teach around 8,300 students at 12 pre-schools and 43 kindergartens.

The goals of the center are:

1. To generate the teachers' creative thinking.
2. To encourage use of the data bases and computer applications.
3. To expose teachers to the educational concept of open tools, and to experience workshop learning.

Workshops for teachers and pre-school teachers will be conducted in the following fields:

- Communications - *Information systems
- Mathematics - * Science
- Learning

The center will help generate an educational environment, in which the teachers and schools are linked via a communications network for the following purposes:

- Electronic mail - * Use of data bases
- Reviewing scientific articles - * Remote study
- Curricula revision - * Use of computerized advice centers

MEDIA+

The aim of the project is to create a new learning environment in which students study independently and design presentations for the subjects they study. Learning progresses in accordance with the ability, areas of interest and individual learning approach of each student. The teacher acts as a guide who helps students and supports each student's learning processes.

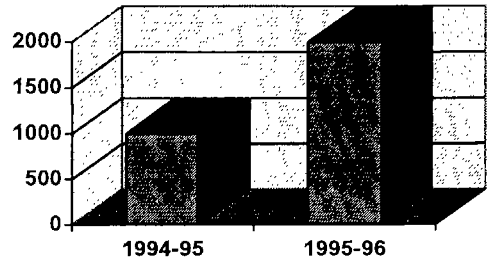
The program concentrates on four subjects: the sciences, history, literature and geography. In the future, the program will be implemented in all junior high school subjects.

The goals of the program are:

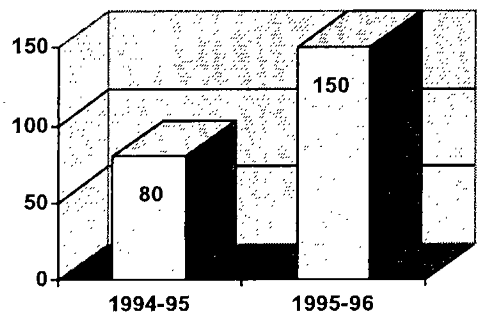
1. The operation of advanced technologies in all schools.
2. The integration of computers in all subjects.
3. The integration of computers by all teachers.

THE DEPLOYMENT OF PROJECT MEDIA+ ACTIVITIES

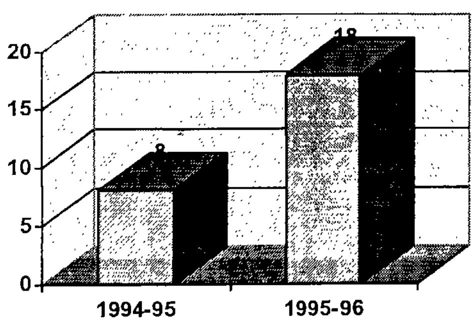
No. of Students

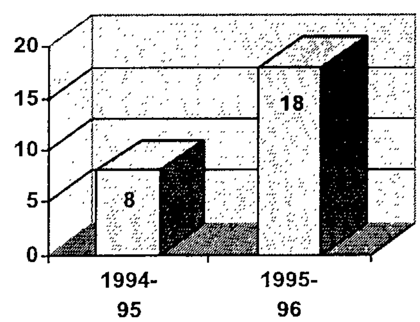


No. of Teachers



No. of Schools





COMPUTERIZED COMMUNICATIONS IN ISRAEL

A COMPUTERIZED COMMUNICATIONS NETWORK AT TEACHERS TRAINING COLLEGES

The process of college computerization is being conducted in three stages and is designed to achieve a ratio of one computer for every ten students. By the end of the 1994-95 school year, 29 colleges had achieved a ratio of one computer for every 13 students.

An inter-collegiate communications network has been established, linking the colleges with the Internet international academic communications network. At first, 14 colleges were linked up. A computerized communications course is being given, involving 27 teachers' instructors in the field of program design integrating computerized communications in teaching. An extensive deployment plan has been drawn up to implement the program.

COMPUTERIZED COMMUNICATIONS IN THE SCHOOLS

The Science and Technology Division is currently planning a national computerized communications project, with the following objectives:

1. The development of a national computerized

communications model which addresses pedagogic, organisational and content aspects. The model is designed to provide support for all educational institutions through out the networks, and to help them operate their communications systems.

2. To provide instruction in the operation of advanced computerized communications technologies, with particular attention given to teachers' in-classroom work requirements, in order to enhance study levels

USE OF DATABASES AND COMPUTER ENVIRONMENTS IN ISRAEL'S SCHOOLS

Students using of educational databases require revised curricula to include updated content. To this end, the Ministry of Education and Culture's Science and Technology Division supports the production of new databases appropriate to the curricula. The Division coordinates and guides the development of these databases on the basis of pedagogical considerations, such as support of curricula, encouragement of students in research learning, problem-solving and independent study. One of the important objectives of the Science and Technology Division today is the development of student potential for independent study; the use of computerized databases is intended to realise that objective.

The Ministry of Education and Culture does not initiate the establishment of computerized databases itself, but encourages local projects and initiatives in schools, pedagogical centers and development centers. The Pedagogical Committee is responsible for the co-ordination of all local initiatives regarding the establishment of databases and for determining standards for database production.

The Ministry of Education and Culture supports the development of some 40 computerized databases in the following fields: technology, biology, history, civics, geography and literature.

EDUCATIONAL CD-ROM PROJECT

The Science and Technology Division has initiated an experimental educational project, the first of its kind in Israel, as part of the policy of promoting open-mindedness and innovative educational experimentation.

The experiment, which commenced in 1993, has led to the installation of computerized databases in some 90 schools throughout Israel. All of the databases have been produced in CD-ROM format. Every CD-ROM installed in the school system includes some 25 educational databases with information on four areas: science and technology, the humanities and social sciences, educational counselling, and pedagogical instructions/guidelines provided by the Ministry of Education and Culture (director-general circulars).

Every CD-ROM includes 350,000 pages of text and a sophisticated information retrieval program.

Information retrieval is simple and user-friendly, operated via a personal computer at the school, without the need to access remote computers and communications lines. The CD-ROM stations in the schools have recently been linked to an educational local area network (LAN), enabling classrooms to access the CD-ROM stations in the school library and to retrieve information.

The educational experiment with the CD-ROM is motivated by the need to adapt the study environment to the accelerated rate of the development of technology. One way of achieving this is through the use of available, updated information which enables learning through investigation and discovery, and helps develop innovative directions in education and learning methods.

In order to promote the use of databases in Israel's schools, the Science and Technology Division has established a nationwide Project Administration responsible for applying the project to the educational reality of the schools, training teachers, and supervising the quality of the databases integrated into the educational CD-ROM.

The project has a team of experienced pedagogical instructors who visit the schools and provide in-service training to teachers and educational counsellors.

Teachers at those schools using the educational CD-ROMs undergo special in -service training in the operation of computerized databases, both in the schools themselves and in the Educational CD-ROM Project Administration's training facilities.

DEVELOPMENT OF MULTIMEDIA BASES

Multimedia is defined as a system will co-ordinatestes various forms of media, operated by means of a single device: a computer. Multimedia systems enable access and handling of a wide variety of media (audio, video, text) by means of previously-unavailable methods. The Science and Technology Division encourages development organisations in Israel to develop multimedia systems in many and varied areas of learning. The Division encourages pedagogical centers, which belong to the country's technological education networks, to take an active role in the development of multimedia systems in education.

NATIONAL REPORT OF KAZAKHSTAN

NEW EDUCATIONAL SYSTEM FORMATION IN THE REPUBLIC OF KAZAKHSTAN AT THE AGE OF INFORMATION TECHNOLOGIES

1. GENERAL PRINCIPLES OF EDUCATION SYSTEM DEVELOPMENT ON THE BASIS OF NEW INFORMATION TECHNOLOGIES

While humankind is entering the epoch of information (post-industrial) civilisation, when the most important products of a social activity are information resources, there is a demand for a new educational system, adapted for the XXI century.

In the conditions of radical changing, taking place nowadays, the first reforms of the Ministry of Education were related to the enlarging of higher educational institutions and to the implementation of test-rating system. These reforms are the first stages of the renewing process of the Kazakhstan educational system. However, these measures are opposed by the conservative teachers. In this connection, we would like to express a trivial idea: today the reforms in the field of education will benefit only if information technologies are more actively and consciously implemented in this system.

At present, the educational world is entering a new phase of its development - gradual introduction of the new teaching/learning technologies, based upon the maximum sinking into the "intellectual medium of knowledge" with the aid of computer and telecommunication technologies. This process is caused not only by the modern tendencies of information technologies development, but also and first of all by the crisis situation, which takes place in the modern system of education. Nowadays we are witnessing an increasing gap between the fast development of various fields of social activity and the system of education, which turned out to be incapable to keep pace with the changing in life conditions. The scientific and technological development of society is so fast, that the traditional educational system cannot change curricula, teaching/learning methods and programs of teachers' in-service training so often according to the up-to-date situation.

It's obvious now, that the further social and economic development of the country needs mutual adaptation between the society and the system education, otherwise the increasing gap between them will turn out to be ruinous for the country on the whole and the system of education in particular.

The realisation of this fact leads to radical changing of the content and organisation of teaching/learning process, to the development of the new educational system on the basis of computer and communicational technologies. In this connection we are talking not only about the methodological and organisational improvement of the existing system, but also about the search for a radically new model of education, corresponding the demands of the coming epoch of information. This system is to provide continuous, distance, open and virtual education, as well as the intellectual improvement of the teaching/learning technology.

Now, it is rather difficult to realise the significance of the coming phase of the educational process. During this phase there should be founded the intellectual background for the further development of the country and estimated the achieved level of civilisation of each society. Consequently, the reforms in the field of education should be conducted with the due regard of tomorrow demands, so that for the further reforming activity not to become a sort of revolution.

In order to provide the evolutionary development of the educational process it is necessary to long for the information unity of politics, economy, education and science as the base for the society's integrity. It's conditioned by the fact that the new phase of the educational process is forming under the influence of scientific and technical progress, economy, administering structures, social and political content of education and teaching theory, which are closely connected and interacting with information technology. Hence, our society should consider education as a prerequisite for economic scientific and technological development, for the lowering of unemployment level, for social equality and political stability.

Under these conditions, one of the most important aspects of society's informatisation is the creation of the elements of information infrastructure, dealing with the educational process, which would provide a new level of personnel training. It is related to the society's entering the third phase of computer revolution, which should provide not only the opportunity of continuous data exchange through global networks, but also the development of network calculations. The conceptions of intellectual global networks are elaborated now for this purpose. These networks are to realise the accumulation of big volumes of information in an electronic form, which may be transmitted to any user through the networks.

The basic principles of the educational process transition to the new phase, formulated with regard of the trends in information and network technologies development, for the next decade:

- territorial independence of a learner's network access to any form of data and calculating resources;
- transparent site and the opportunity of an automatic call of any educational information or data on different disciplines, without reference to their physical situation;
- simple users' interface, providing learners' interaction with teaching systems in the forms, oriented at the mechanisms of human thinking, such as speech, gesture, imagination, etc.;
- on line help to learners for the acceleration of the process of digestion of information on different subjects, as well as mastering tools of computer and network teaching technologies;
- the variety of forms of information interaction between learners and teaching systems, namely teaching systems should be multimedia;
- flexible architecture of intellectual teaching systems, able to increase and modify due to the module principle of their construction on the basis of object-oriented technologies;
- the possibility of control over the complex levels of intellectual teaching systems organisation, which should be able to give the learners-friendly solutions to the increasing number of complex problems.

The main idea of the intellectual improvement of the educational process consists in the module multifunctional and multimedia presentation of educational information and the gradual creation of its structure and its activation. The intellectual improvement means the teaching systems adaptation to the individual character of every learner, to the level of his knowledge, to the methodology and teaching subject.

2. THE MAINSTREAMS IN THE EDUCATIONAL SYSTEM REFORMING

The modern stage of the reforms was initiated in April, 1995 by the President of the Republic of Kazakhstan Mr. N.A. Nazarbaev at the Republican Conference of Teachers. The Action Plan for the educational system reforming was fixed in the Governmental Program, related to the realisation of the conference recommendations, and in the National Policy Concept in the Field of Education, adopted by the National Council of the State Policy under the President of the Republic of Kazakhstan.

The creating Kazakhstan system of education should regard the following world trends:

- educational institutions curricula should meet the needs of labour-market;
- comprehensive training will provide manpower mobility;
- promotion of self-education as the main element of teaching/learning process and the basic factor of learning activity development;
- searching for and implementation of the various forms of education and science integration, unity of teaching and academic research;
- transformation of teacher's role as a source of information into an active organiser of the educational process;
- strengthening of educational institutions autonomy and interaction between them;
- development of the democracy in education administration;
- creation of the conditions, favouring innovations technologies implementation in education;
- international co-operation development in education.

However, there are some points in the home system of education that should be continued:

- education availability to the great masses of population;
- high level of background, in particular in natural sciences;
- possibility to train students in many fields of science, technology and industry;
- sufficient teaching and methodological support of each level of education;
- efficient application of educational resources;
- rational organisation of students' leisure time;

The program principles of forming the new educational system, adopted on the aforementioned base, determine the following priorities:

- development and putting into effect of the national educational standards for each level of the system of continuous education;
- improvement of financing mechanisms of educational institutions functioning, the development of their financial and economic independence, using additional funds, stimulation of their innovation activity;
- levelled regional educational system development, based on the flexible account of the regional and republic needs;
- development of informal forms of education, especially in secondary and high special school;
- organisation of an effective system of education administering on the Republican and Regional level, providing co-ordination interaction with corresponding Bodies of Government;
- introduction of an indicative planning for educational institutions according to the main indexes of cadres training and on the base of the prediction of the demand for them;
- modernisation of the educational institution on the base of increasing the practical importance of acquired skills and knowledge, humanisation of the entire content of education and New Information Technologies implementation;
- development of the rights and responsibility of the heads of educational institutions, promotion of

the practice of their contract employing and reports to their personnel;

- providing entering the world educational environment, raising the level of home education up to the world standards;

- creation of an effective legal base for education.

In general, the aims of the reforms in the field of education are to make it more humane, to address to the spiritual world of a learner, to create an individual-oriented educational system of the Republic of Kazakhstan. Its aim is to provide every citizen of the Republic with the opportunity to realise his ambitions and reveal his talents, to stimulate his searching for the field of activity, that will give him the maximum satisfaction and the maximum benefit for the country. In order to achieve this objective there should be integrated reforming of every level of continuous education.

The fundamental base for the system of continuous education is general secondary school. At present there are 8573 schools of general education, covering 3036500 students.

The three stages in the process of a child's growth - childhood, boyhood, youth - determine the three stages on school education: primary, fundamental and higher.

Today the aim of education is to create the conditions necessary for a child's development and self-realisation on the base of free choice of the educational institution, curricula and text-books, forming their ability to make independent decisions.

Many pedagogical institutions are oriented at the creative search activity. The major part of specialists are convinced of the necessity of school renewing. At present 30% of schoolchildren are studying the programs of gymnasiums, lycees and profile schools.

The Republic Basic Plan and 28 variants of the typical curricula are working in the mass school of general education. Every school has the right to create its own variant of a curriculum or to choose among the suggested ones, regarding its students' interests and abilities.

At present the Ministry of Education together with the Altasyrin Scientific-Research Institute of the Problems of Education n.a. Altynsarin is working out the educational standards and the new Basic curriculum, which are so necessary under the conditions of schools and disciplines variety. It provides for a radically new structure and content of the educational process, oriented at a child's personality, for the transition to a developing teaching, supporting the development of a practical, analytic and creative thinking, and for the education of the ability to make independent solutions in the process of their life activity. The renewing of the content calls for the education of the civic consciousness and for the Kazakhstan patriotism, for the good studying of foreign languages on the base of the principle of three languages (Kazakh, Russian, Foreign).

The ethnic demands of the population determined using seven languages for children's education in Kazakhstan schools. Besides, there are 14 native languages taught in the places of concentrated inhabitation of some nationalities.

In 1991-1995 the number of general secondary schools, where Kazakh is the language of teaching was annually increasing owing to the national policy of the national school development. During this period their number increased to 459 schools, and the number of Kazakh children, who are taught in their native language, - to 287500.

Twenty two universities and pedagogical institutes and 28 pedagogical colleges are training cadres for educational institutions. Recently, the number of trained specialities increased: we began to prepare teachers - psychologists, social pedagogues, specialists in economy and marketing of education.

The new content of education demands for a corresponding didactic, scientific and methodological support. In this connection, our main objective now is to create and publish a new generation of original text-books and didactic materials in Kazakh and Russian.

The reform of general secondary education is conducted under economically difficult conditions. Teachers' low salary debunks prestige of the profession.

The trouble situation concurred in the Republic schools provision with text-books and didactic and methodological materials. Deficient financing caused the double reduction of the volume of their publishing, comparing with 1991. We have almost stopped to publish materials for teachers and educators. Therefore they are insisting on publishing special magazines, such as "Mathematics at School", "Physics at School", "Chemistry and Biology at School", "Foreign Language at School", "School and Production", etc.

The economic and social course, followed by the Republic, demands for some new features of the system of practical and primary vocational training of schoolchildren. However, during the period of the last 4 years the number of interschool training and production combines decreased by 50 ones, the number of training workshops and enterprises, allowing for practical training, - by 340. There is also the reduction of the number of schoolchildren labour units.

In this connection the problem of students' early mass vocational guidance is of current interest. In order to solve it we need to develop a new type of educational institutions - vocational school. Teenagers, who have finished fundamental school, will be able to acquire complete secondary education and a working trade.

In the future, great attention should be paid to the problem of searching for, training and education of talented children. This solution of this problem is supported by the elaborating National program "Ability".

Rural and small schools also face a lot of problems. There are 6564 rural and 3825 small schools (with insufficient number of students). Their material and technical equipment doesn't agree with the present standards of the educational process: the majority of classrooms and production workshops have dated equipment, their computers and technical means of education are physically and morally worn out. There are no plants in the Republic to produce school furniture, equipment, no enterprises to repair and maintain computers and other devices and apparatus.

In order to improve the material and technical school base it is necessary to reconsider the expenditure norms for these purposes and to accommodate them with the new life conditions.

It's supposed to organise enlarged schools on the base of joining close schools and regional territorial school combines, with regard to the regional conditions of settlement and the achieved level of interaction between localities. It will allow to use rationally the material and technical base and school cadres.

One of the most important problems of 1996 is to realise the demands of Article 30 of the Republic of Kazakhstan Constitution about compulsory secondary education. After finishing fundamental school (9 years), children are able to acquire complete secondary education, continuing their training in a gymnasium, a lycee, at avocational school or school of general education with a special practical training in mass working occupations. There will be more opportunities for the working youth to acquire complete secondary education without attending lessons.

The difference between the students of various educational institutions demands the development of a concrete mechanism and special curriculum. Teenagers studying 2-years programs of lycees (with the majority of natural sciences) and gymnasiums (with the majority of humanitarian disciplines) gives the opportunity to improve the level of matriculates background, who are entering corresponding technical and humanitarian higher educational institutions.

Now there are 235 state secondary special educational institutions (SSSEI), which train teachers; 195 of them are in the system of the Ministry of Education.

Secondary special school of the Republic trains students in 203 specialities, herewith special attention is paid to the training of specialists of the general sectors of market economy. The structural reforms, which take place in the country today, the shifts of the priorities in the demands for manpower from production to service branches, entail the structural reform of secondary special education. International experience shows, that the majority of cumulative manpower and the most mobile part of it are the specialists of servicing fields of activity. Therefore now the number of educational institutions are changing their profile and a new specialities Classifier is developing.

Since 1994/95 school year a new generation of text-books was introduced in 192 specialities of SSSEI. The Program of humanitarian education is realised through the complex of humanitarian, general educational and special curricula. The bank of typical curricula and teaching programs was created under the Ministry of Education.

When the Ministry of Education became in charge of branch SSSEI, it began to develop new educational and methodological combines, simultaneously it made the analysis of the curricula in order to find new opportunities to shorten the period of education to 2-2.5 years for those, who have general secondary education.

The planned 30% reduction in 1996 of the number of students, admitting to SSSEI, may affect in the considerable reduction of educational institutions. Today SSSEI is quite an adapted type of an educational institution, which corresponds the demands of our economy. The experience of a number of developed countries (e.g. USA) shows the same tendency. USA 2- or 3-years colleges are similar to our vocational schools. Today they represent flexible multitarget educational institutions. Their further development is considered to be the most reliable strategy, which is conditioned by their maximum orientation at students and industrial demands.

Nowadays, 28 SSSEI are the structural subdivisions of the universities. State farm vocational school are also reorganised now. Some of these schools, that are out of the agricultural market economy structure, are transformed into agricultural colleges. In 1996 74% of SSSEI will be financed from the regional budget. However, it dangerous for the future system of special secondary education, because it doesn't support the continuous system of vocational training. In 1996 and the nearest years we have to:

- continue the process of SSSEI inclusion in higher educational institutions (HEI) complexes and to agree their curricula with the educational programmes of first years of education in HEI;
- finish the development of a new legal base for special secondary education;
- introduce in SSSEI the system of multiprofile education and to organise the generally contract-based courses for the free part of the population, who are looking for a new job;
- reconsider the proportion between the sizes of cadres training for the branches of material production and service;
- renew the content and pedagogical technologies of specialists training; to shorten the period of education;
- provide not one, but a number of funds SSSEI financing; to develop them as multitarget schools.

During the last years the structure and the quality of HEI network has considerably changed. There has greatly increased the number of classical and profile universities and academies. 12 universities and 3 educational academies were organised in 1991-1995 on the basis of educational institutions transformation, many of them are developed as educational complexes, which consist of institutes (higher colleges) and SSSEI (colleges).

The Republic HEIs offer their students training in 225 specialities. Every state HEI has a licence for the right to teach.

Every year new Kazakh groups and departments are organised in HEI. At present 33.3% of students are taught in official language.

In order to increase the opportunities to acquire higher education by the representatives of the national minorities, in 1995 every HEI speciality has got a certain quota for the number of admitting students of the Kazakhstan Nations' Assembly.

The number of Doctors of Science increased in HEIs from 613 in 1991 to 943 in 1995, while the number of Candidates decreased from 8892 to 8314. The number of Degree specialists has also decreased from 41% to 32% of their total number.

On the whole, the Kazakhstan higher school has powerful scientific resources, permitting to provide a high level of graduating specialists.

The content of education is also renewing. Recently, there were adopted the normative document "State Educational Standard of higher education", basic principles and state standards for 122 specialities, which determine the compulsory minimum of the content of education, the maximum students load, the demands to level of graduate background.

The National Council of the State Policy under the President of the Republic of Kazakhstan adopted the Concept of humanitarian education. On the base of the Concept the Ministry of Education has developed and realises the corresponding program and has introduced the HEI general cycle of social and humanitarian disciplines.

Every HEI has included in summer examinations of 1994/1995 school year test forms of students certification, combining them with rating system of knowledge estimation.

According to the Government planned measures, the most important problems of higher education reforming will be solved in 1996. Herewith, we have to regard the following world trends in the field of higher education:

- considerable escalation of its development;
- administering decentralisation and the increasing of the level of HEI autonomy and academician staff independence;
- faculties transformation into departments, with the introduction of an interdisciplinary approach to specialists training;
- the organisation of the regional systems of higher education;
- the development of non-university sector and the organisation of far-out HEI, offering education on the base of New Information Technologies;
- the introduction of new organisational forms of HEI science.

We shall also have to take the following measures:

1. The optimisation of the HEI network: the development of the humanitarian profile; the enlargement of the university and academy sector; the active continuing of process of colleges inclusion in HEI complexes. In general, the course is aimed at the rational reduction of the number of HEI in the Republic.

2. The development of the regional HEI. It seems to be rational to provide the functioning of either one large HEI of the university level, or one multiprofile Western-type university in every region of the country.

3. The organisation of HEIs activity according to their status. It's going to provide integration between humanitarian, natural sciences' and technical education, as well as the improvement of the level of vocational university education.

4. The transition to a double-level structure of higher education: basic higher education (Bachelor, Diplomaed specialists - engineer, physician, agronomist, etc.) and the special higher education (Master).

5. The shortening of the terms of education is differentiated according to HEI types and specialities from 3.5 years (pedagogical) to 6 years (medical).

6. The renewing of the content of education and the modernisation of the educational process. The national standards for 103 more specialities are going to be adopted, the Classifier of higher education specialities will be renewed, the separate students' work will be promoted, the new generations of text-books and didactic materials will be worked out.

7. The integration between higher education and science: it's necessary to provide the continuous transformation of the scientific knowledge into the educational one.

8. The improvement of higher education administering. Some HEI will get the autonomy status; the activity rectors' regional councils will be organised on a qualitatively new level.

9. The creation of a number of financing funds, in order to provide the HEIs economic stability.

The important role of postgraduate education (PGE) in the system of continuous education is conditioned by its responsibility for the renewing and increasing of the intellectual resources of the society.

It is very important to realise social security and rehabilitation of employees not only due to the economical measures, but also through the system of education. The significance of PGE system is considerably increasing under the conditions of economy reforms. It provides an effective opportunity to upgrade the qualification or to acquire a new speciality within a short period of time for a great number of specialists, it helps them to return to the different branches of economy, education, science and culture and to stay in their positions.

The main problem here is to define the demands to the PGE educational institutions (subdivisions), to modernise the structure of their network, to improve the content, forms and methods of education.

Therefore he structure of PGE was changed: those educational subdivisions, which trained cadres in non-perspective specialities, are closed; some faculties of qualification upgrading changed their profile.

The main sources of highly qualified scientific and pedagogical cadres are the former students of postgraduate studies and doctorship.

During the last period, the number of students of postgraduate studies began to reduce. Although, the number of postgraduate studies has increased by 14 schools, comparing with 1992, the number of their students has decreased from 943 to 886. It is conditioned by the absence of any financial stimulus for Degree specialists and by the ruining of traditional scientific connections with CIS countries and industrial establishments.

The following measures are necessary to be taken in order to train cadres of the highest scientific qualification:

- to develop the network of Specialised Councils through the forming of the regional and inter-branch ones;
- to improve a mechanism of granting the best associate professors Professors Degree;
- to use the Mastership as a perspective way of scientific and pedagogical cadres training;
- to define the quality of their training though the mechanisms of HEI certification and accreditation.

The private sector of education is a part of many countries economy. The competitiveness of private educational institutions is determined by their capacity to meet the needs of labour market and to satisfy the demands of separate citizens.

The Kazakhstan transition to the market economy supported the creation of an informal sector of education. The adopted in 1992 law "On Education" became the legal base for it.

The majority of Kazakhstan informal vocational educational institutions don't possess their own educational and laboratory rooms, they don't have staff teachers and their source of financing is fees for education. Training is offered in the specialities, demanding minimum investing.

Nevertheless, the formation and development of the informal sector of the Republic system of education are one of the most important directions of the reforms in education. This process is natural for the market economy and therefore irreversible. Moreover, the role of informal educational institutions will gradually increase, because they can implement flexible and perspective forms of general and vocational training and support the realisation of the right to study. Besides, the reduction of the number of state HEI students is partly compensated by the students of private educational institutions.

Therefore the Republic Government promotes informal sector of education. Private educational institutions should have priority in vacancy leasing. It's necessary to develop the mechanism of inclusion on the competitive base of informal accredited educational institutions, training cadres in deficient specialities, in the scheme of partial national budget financing. In 1996 the normative base for the private educational institutions functioning will be improved.

The new educational system shouldn't emphasis the form of property of an educational institution. There should be common criteria for state and private educational institutions. The main index for their estimation should be the level of knowledge of their graduates.

Kazakhstan integration into the world community is impossible without educational systems integration. Since 1991 international and intergovernmental contacts are constantly developing. There have been signed and successfully realised 40 interdepartmental agreements. Kazakhstan HEIs concluded 70 direct treaties on international co-operation, organised 29 Kazakh - Turkish lycees. More than 1800 Kazakh pupils, students postgraduate students and teachers are trained nowadays abroad in the educational institutions of the developed countries, while 2000 of foreigners are studying in Kazakhstan. Certain measures were taken in order to meet the educational needs of the representatives of Kazakh nation abroad, in order to develop the entire educational environment on the territory of CIS countries. A considerable help in the educational system reforming was offered by some international organisations: Asian Bank of Development allotted $20 million credit; the European Community granted 70 thousand ECU; Soros Foundation allotted grants for educational literature publishing.

Special role in the international co-operation development plays the realisation of the Decree of the President of the Republic of Kazakhstan of November 5, 1993, regarding the establishment of international scholarships of the President of the Republic of Kazakhstan "Bolashak" for cadres training abroad. 171 scholars are studying now in USA, Great Britain, Germany and France. In general, the Kazakhstan students adapted to the foreign systems of education and soon make their contribution to the development of the country.

The following measures will be taken for the further development of international co-operation in the field of education:

1. To develop and annually correct on the governmental level the list of especially deficient specialities for the elite cadres training abroad, regarding the social and home economy needs.
2. To make the Ministry of Education in charge of the co-ordination of the Kazakhstan citizens training abroad. At present different private enterprises, associations and funds are working in this field without any control over their activity. Consequently, students are not provided with medical insurance, the necessary minimum of financing, social security and guarantees.
3. To create the nostrification mechanism for the documents, related to the system of education.
4. To think over the question regarding the organisation of an International university with English as the language of teaching, with foreign teachers and International Diploma, in order to train the intellectual elite of Kazakhstan.
5. To use the resources of the Kazakhstan embassies abroad, of the Kazakhstan Representations in UNO, UNESCO, EC and other International organisations for the international co-operation development and for the creation in Kazakhstan of a data bank on the world system of education

3. THE STATE OF THE ART AND THE PROBLEMS OF INFORMATISATION OF THE SYSTEM OF EDUCATION IN KAZAKHSTAN

The whole world pays great attention to the informatisation of all fields of activity, and especially of education. In the near future the Kazakhstan role in the world process first of all will depend on the determination of its government and citizens to achieve the strategic objective - the Republic transformation into a world intellectual power with the advantageous development of non-material intellectual and scientific branches of industry. But there are some prerequisites for the development of such kind of economy: 40-60% of adults should have higher education, while the part of scientific workers should be about 2-5% of the country. Scientific and technical resources of the country should be not "saved", but promoted. They must work and save the whole country and there is no other way out.

The aforementioned objectives may be achieved through some changing in the investing policy, which provide for economy stability improvement due to the education informatisation.

The complex approach to education informatisation in Kazakhstan permits:

- to provide every citizen the availability of knowledge and information;
- to develop individual intellectual and crea-

tive abilities;

- to promote co-operation, knowledge and data exchange;
- to upgrade the qualification and operatively change the field of activity during a person's active period of life;
- to improve the efficiency of correspondence and individual ("home") training through the system of distance education.

According to the statistics, the institutions of the Kazakhstan system of education are equipped with 58, 875 computers, while the number of modern ones is 3305. School equipment with computers is rather bad, because the majority of the modern ones are at the disposal of HEIs. In fact, the Republic school equipment with computers consists of 1,181 pieces, that is 2.5% of their total number. The majority of vocational schools don't have computers at all, SSSEI possess 160 computers, that is 6.4% of their total number. HEI have 1,694 computers (29.2% of the whole amount).

In order to provide a quality training in the field of informatisation, there is a demand for high quality software, which costs 50-70% of hardware. But there are many good specialists among the staff of general and vocational schools, of HEIs, who develop their own software, including software in Kazakh.

The quality estimation of the software, developed by the educational institutions of the Republic, was periodically carried out on the workshops, conferences, exhibitions (1993, 1994, 1995), held by the Ministry of Education of the Republic of Kazakhstan on the base of the Republican Centre of New Information Technologies (RC NIT). However, there are no funds for the purchasing of any software.

The basic legal and methodological documents are necessary for the implementation of information technologies in the Republic of Kazakhstan, in order to improve the quality of the educational process, scientific research and the educational system administering, to create an informational environment and integrate it in the world system of educational.

The analysis of the aforementioned basic documents showed that the Republic demands for the following normative documents:

1) the concept of informatisation of the Republic of Kazakhstan education;
2) documents, providing citizens with the right for information and informatisation;
3) the concept of the Kazakhstan system of education entering the international information and telecommunication system;
4) the concept of the satellite general information system for the Kazakhstan system of education;
5) documents regulating the development of the telecommunication network for control purposes and interaction, of distance training, of the creation of data banks for education;
6) the programme of informatisation of the Republic of Kazakhstan education.

The course of Informatics was introduces in school curricula because of the developed countries transition from industrial to information society. This transition was conditioned by the appearance and development of a principally new tool - computer.

If we consider the information flows "person-person', "person - computer", "computer - computer", it becomes obvious that the system "person - person", being very versatile and interesting, has been studied by many humanitarian sciences and long ago became a part of fundamental school subjects. The recently appeared system "computer - computer" represents a special technical problem and should not be compulsory studied in general school. The development of modern Information technology made the knowledge of the system "person - computer" a problem of everybody's concern. Consequently, a person should learn to interact with computers at school and therefore the global aim of school informatisation is the increasing of the efficiency of learner's computer application as a tool.

The policy of the Republic of Kazakhstan in the field of general secondary education should provide: the development and introduction of the national standards for primary, fundamental and complete secondary education; the improvement of the system of students' knowledge control; the development of different forms of training; the creation of New Information Technologies and didactic tools.

Many educational institutions are developing up-to-date automated systems, have animation and graphic illustration of some disciplines, elaborate tools for educational automated systems, software on mathematical statistics, math programming, health service, physical culture, etc.

It's worth to mention the development of the first Kazakh fonts for WINDOWS, graphic software, audio and video multimedia systems, medical and biological programs, the application of perspective tools (Borland Pascal 7.0., Modula-2) and hypertext technologies, etc.

There has already appeared software educational and controlling programs in Kazakh. We should also mention, that there are some original programs developed with the aid of the old computers.

The participants of the International Conference - Workshop on Software and Hardware, held in September 1995 in co-operation with Moscow Institute of Teachers' Qualification Upgrading, Moscow Institute of New Technologies in Education, and IST (International Software Trading, Switzerland), made the decision to organise annual conferences - workshops on New Informational Technologies on the eve of the August conference of secondary school teachers.

On December 22, 1995 the Republican Centre of New Technologies in Education held an International Conference - Workshop "Informatisation of the System of School Education". The Conference took place in the Grand Hall of the Ministry of Education of the Republic of Kazakhstan. The participants of the Conference were the school, teachers of Informatics, SSSEIs and HEIs staff from Almaty.

The participants of the Conference decided to elect a group of teachers for the development of a didactic complement, consisted of a text-book on Informatics for the students of 10-11 forms, a didactic material for the teachers and students of pedagogical HEIs, a book of problems on Informatics for secondary schools in Kazakh and in Russian. Now they are preparing variants of this complement.

Today one of the most important problems is the problem of organising the scientific and methodological developments and the licensing of educational software and workstations for organisational and controlling purposes of the system of Kazakhstan education.

The laboratory "The New Information Technologies at School", organised in the RC NIT, is carrying out scientific research project "The control system of the educational process on the basis of New Information Technologies at school, in the Regional Departments of Education and the Ministry of Education of the Republic of Kazakhstan", in the framework of the Republican target scientific and technical program "Informatisation of the National Economy of the Republic of Kazakhstan" (the Decree of the Ministry №400 of April 18,1994), according to the Protocol on the co-operative work, signed by the Ministry of Education and the Ministry of Science and New technologies of the Republic of Kazakhstan.

Since April 1, 1995 this scientific project is financed form the budget through the Ministry of Science and New Technologies of the Republic of Kazakhstan and is devoted to the problems of school education informatisation:

- the development of the control system for the school educational process on the basis of New Information Technologies (NIT);
- the development of the technology of education on the basis of NIT;
- the creation and application of a computer data bank on tests according to the levels of difficulty, adequate to the national standards of education;

In order to solve these problems, there was organised the studying of the technological operations of the educational process and revealed some "bootlenecks" in the system of education. There was suggested a scientifically based theory of the technology and control over the educational process on the basis of New Information Technologies on the different levels of management: school, regional, republican. It demonstrated impossibility of educational institutions control without corresponding standards of education. The complex of standards for general secondary education consists of the following seven positions:

1) the content of education;
2) the estimation of the quality of education;
3) teachers' qualification;
4) educational institutions;
5) educational institution administering;
6) educational process technology;
7) school Olympiads arrangement.

Certain results were obtained in the process of the program realisation. Information technologies development and implementation in the secondary school educational process will be continued in the framework of the program of cadres pre-service and in-service training.

The Memorandum about mutual understanding, signed by the Asian Bank of Development, UNESCO and the Kazakhstan Government for the project of the rehabilitation and improvement of the administration of the educational system, is a prerequisite for the future informatisation development in education in framework of the Program of the development and reforming of the educational system of the Republic of Kazakhstan.

The installation and realisation of a computer information control system for education provides a telecommunication system necessary not only for the solution of the problems of administration informatisation, but also for the New Technologies implementation in distance training.

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NATIONAL REPORT OF LUXEMBOURG

INTRODUCTION

The new information and communication technologies, as well as lhe computing tools used in audio-visual systems, are fundamentally changing our society. These iransformations affect not only the workplace but also social and cultural life and constitute a challenge to education. The children of today have to be prepared for the society of information and communication of tomorrow.

In the recent past, the Luxembourg educational system has taken up the challenge. Computing has become a compulsory subject in secondary and technical schools for pupils aged 15 and over. In vocational training, special courses introduce pupils to the use of the computer in the professional world. Furthermore, considerable efforts have been made lo integrate the computer as a learning tool throughout the curriculum and at all levels.

GENERAL OBJECTIVES

As far as the new information and communication technologies are concerned, the Luxembourg educational system has given priority to two general objectives. The first of these is to offer all pupils basic training in the new information technologies, to initiate them into the most common computing tools and to introduce them to the practical use of the computer as an aid and as a learning tool. The second objective aims at enabling teachers to take advantage of computing tools to improve and diversify their teaching methods.

The first objective has been achieved, at least to a great extent:

- on the one hand, by offering computer-awareness courses, which are to be considered a fundamental element of their general education, to all pupils before they leave school. Thus, a computer awareness course, introduced in 1986, aims at giving the young their First contact with the new information technologies. This course is obligatory for all pupils in their last year of compulsory schooling. The knowledge acquired in these courses will be developed and deepened, cither in the upper level of secondary education, or in vocational training, or directly in professional life.

- on the other hand, by creating two new courses which supplement the computer-awareness courses and during which pupils use the computer in practical project work.

The pupils of the lower level of secondary and technical education (age: 12 to 15) take part in interdisciplinary projects. Since the school year 1990-1991, this course has been compulsory in technical education and optional in secondary education. The aim of the course is lo introduce pupils to general computing tools such as word-processors or databases through practical project work which has a direct link wilh the other subjects on the curriculum.

In secondary education, pupils aged 16 to 17 can choose fiom various "pre-specialisation options" before they make a final decision on which orientation they want to give to their studies. A certain number of these optional courses introduce pupils to the computer as an aid and as a learning tool.

As far as the second objective is concerned, considerable efforts have recently been undertaken to integrate the computer across the curriculum with the aim of diversifying and improving teaching and learning methods. Pilot projects have been initiated, both in primary and in secondary and technical education, to explore the educational potential of the new information technologies and to develop means of integrating them into the curriculum.

It should also be noted that the Luxembourg educational system is currently trying to move away from a more teacher-centered approach, based on the delivery by the teacher, and the assimilation by pupils, of abstract knowledge, to a more student-centered approach, based on practical project-work, group work and autonomous learning. Such an approach was first experimented with in both computer-awareness courses and in interdisciplinary project work where the computer is to be used as a tool. Although this shift is still in a very early phase, it is hoped that teachers' awareness of the computer's potential for student-centered practical activities (learning by doing) will come to act as a catalyst on other subject-matters on the curriculum.

IMPLEMENTATION

To ensure the fulfilment of the objectives concerning the integration of the new information technologies in the Luxembourg school system, efforts have been concentrated on the following points:

- Systematic development of the hardware available in schools. Nevertheless, the recent introduction of new courses which integrate the computer into the learning process, as well as the constantly increasing requirements of the trachers who want to use the computer as a learning tool in their classes, have multiplied the needs both in hardware and in appropriate software.
- Information and teacher training, both initial and in-service. Teacheis should not only be fully aware of the new developments in computing and in its educational potential, they should also become competent in the use of the computer in their classroom.
- Software evaluation with the aim of assisting and orienting teachers in their choice of appropriate

software.
- Development, evaluation and diffusion of pedagogical models which teachers candirectly integrate into their courses.
- Development of adequate infrastructure to allow teachers to obtain information onthe new developments and to pool their experiences and expertise.

For a small country like Luxembourg, international co-operation, and more particularly on the level of the European Communities, has proved to be of the greatest importance. With the rapid developments of the new information technologies and their applications in education, it is essential for contacts with other countries concerning information about new software packages that are available, teacher training, pedagogical models and methods, ... to be made and developed.

1. THE LUXEMBOURG EDUCATIONAL SYSTEM

The Ministry of National education and Vocational Training ("Ministere de 'Education Nationale") is responsible for the whole of the Luxembourg national educational system.

Attendance at a Luxembourg state school is free, i.e. the State budget covers all costs resulting from the running, the equipment and the administration of the schools.

The teachers of primary education have attended, after their secondary education, a teacher-training cycle of three years of higher studies at the Institute for Higher Pedagogical Studies and Research (I.S.E.R.P. - "Institut Superieur d'Etudes et de Recherches Pedagogiques"). Teachers of secondary and technical education must have attended university for at least four years: they then attend- a cycle of three years of initial training, both theoretical (First year) and practical (last two years), co-ordinated by the Department of Pedagogical Training of the University Centre Luxembourg (C.U.L. = "Centre Universitaire de Luxembourg").

During their professional careers, primary school teachers are supervised by the inspectors of the Ministry of Education, secondary and technical school teachers by the director of studies of their school. What is inspected is the teachers' adherence to official methodology and programmes and to the prescribed school books.

The Ministry of National Education and Vocational Training is in charge of the co-ordination of the syllabuses. As far as primary education is concerned, the syllabuses are described in the plan of studies ("plan d'etudes"). A special commission, nominated by the Minister of National Education, defines the general outlines and objectives of the "plan of studies", the details of the curriculum being then worked out by special work groups. As far as secondary and technical education are concerned, the Ministry of Education bases its curriculum decisions on the suggestions and advice of the National Commissions for Timetables and Syllabuses ("Commissions Nationales des Horaires et Programmes") which are made up of practising teachers, each school being represented by one delegate.

The Ministry of National Education and Vocational Training is also responsible for pedagogical rescaich and innovation.

The Department for Research and Development ("Departement Recherche et Developpemeni") is in charge of the administration of research on a national level.

The Service for the Co-ordination of Pedagogical and Technological Innovation and Research (S.C.R.I.P.T. ^"Service de la Coordination de la Recherche et de 1'Innovation Pedagogiques et Technologiques") of the Ministry of National Education and Vocational Training is in charge of the co-ordination of the different programmes for pedagogical and technological innovation ;ind research as well as the co-ordination of in-service teacher-training and the diflusion of all information concerning them. It is to be noted that one of the most important innovation programmes co-ordinated by the S.C.R.I.P.T. is the implementation of the new information technologies across the curriculum.

Apart from its main function of a teacher-training centre, both initial and in-service, for primary education, the Institute for Higher Educational Studies and Research (I.S.E.R.P.) also carries out pedagogical research programmes.

It should also he noted that the Centre for Educational Technology (C.T.E. = "Centre de Technologie de l'Education") concentrates, at a national level, all logistic resources for both primary and secondary education. Finally, a certain expertise in research and development, particularly as far as the new information technologies are concerned, is being developed by the two public research centres: the "Centre de Recherche Public - Centre Universitaire" (C.R.P. - C.U.) and the "Centre de Recherche Public - Henri Tudor" (C.R.P. - H.T.).

TYPES OF SCHOOLS

In all types of schools, structures and syllabuses are strictly identical for boys and girls. All schools are mixed.

There are three distinct types of schools (see appendices I and 2):

Primary education which comprises nursery schools (2 years), the first six years of primary studies, complementary classes, special classes and classes for children with special needs. There are 433 primary schools throughout the country, of which 18 are complementary education centres.

Nursery schools are lo contrihute to the growth of the cliildren'.s personality through the development of basic knowledge and skills, to foster their awareness of the environment and to prepare their integration in society.

Primary edlicalion extends over a period of six years. Apart from languages (German, French and Luxembourgish), mathematics, local studies and elementary science, the syllabus also comprises optional introductory activities during which the computer is used as a tool. It should be remembered that children learn to read in German (which gradually becomes the major language for teaching) while French is learnt as a foreign language from the second year onwards.

Various schools and institutes exist throughout the country to cater for children with special needs.

Although the passage from one type of school to another is generally possible, *post-primary education* comprises three different itineraries:

Secondary education ("enseignement secondaire") which takes place in "lycees" (eight throughout the country) over a period of seven years and the aim of which is above all to prepare pupils for higher education. It is made up of three divisions: the lower division the aim of which is to allow pupils to get used to the new school system and for teachers and parents to get an idea of the pupils' chances of success in this type of school, the comprehensive cycle where, according to their abilities and wishes, pupils can choose between the literary itinerary or the scientific itinerary: the cycle of specialisation where pupils are expected to make a definitive choice between various specialisations (languages, human and social sciences, plastic arts, music, mathematics and physics, natural sciences, economics).

Technical education ("enseignement secondaire technique") which takes place in "lycees techniques" (fourteen throughout the country) over a period oi" six or seven years and the aim of which is to prepare pupils for a chosen profession or for higher education. It consists in the lower cycle which aims at deepening the pupils' general knowledge and at leading.them to the vocational training which best corresponds to their abilities and wishes, as well as in the middle and upper cycles comprising the professional itinerary, the itinerary of general technician and the technical itinerary.

Complementary education ("classes complementaires") comprises three years of studies. Its aim is to complete the basic knowledge of pupils, to develop social skills and to offer basic vocational training. From the school year 1994-1995 onwards, complementary classes will be integrated into technical education.

In Luxembourg different centres and institutes offer courses of higher education:

The University Centre Luxembourg (C.U.L. = "Centre Universitaire de Luxembourg") offers a first year of university education only, the courses being adapted to the syllabuses of foreign universities where students are expected to continue their studies.

The Higher Institute of Technology (I.S.T. = "Institut Superieur de Technologie") offers courses in higher technical education and trains future technical executives in production, applied research and the service industries.

The Institute for Higher Pedagogical Studies and Research (I.S.E.R.P. = "Instirut Superieur d'Etudes et de Recherches Pedagogiques") is responsible for the initial and in-service training of nursery and primary school teachers.

The Institute of Educational and Social Studies (I.E.E.S. = "Institut d'Etudes Edueatives et Sociales") trains educators for children with special needs.

The Higher Vocational Training Certificate (B.T.S. "Brevet de Technicien Superieur") is a high-level vocational training course.

The Service for Adult Education of the Ministry of National Education and Vocational Training organises special courses for adults to prepare for the various diplomas of secondary and technical education as well as intensive language courses offered by the Luxembourg Language Centre (C.L.L. = "Centre de Langues Luxembourg").

The proportion of private schools in Luxembourg is relatively small. Furthermore, pupils attending private schools have to sit official State examinations if they want to be awarded an official diploma.

2. HARDWARE AND SOFTWARE

Since the 1980s, the computer equipment in Luxembourg schools has been systematically developed and completed. Considerable efforts have been rnaile, both from a financial and pedagogical point of view and in as far as teacher-training is concerned, to integrate the computer as a learning tool across the curriculum.

Nevertheless, the needs in both hardware and software continue to increase at a steady rate: an increasing number of teachers are willing and ready to use the computer as a teaching aid in their classes, while new-courses have been introduced LhaL make compulsory the use of the computer as a learning tool.

PRIMARY EDUCATION

In primary schools, the local authorities are responsible for the purchase and the maintenance of all the equipment, hardware and software ineluded. About 75% of primary schools have at present been equipped by the local authorities wilh at least one computer. There is, however, at the moment, a strong move by teachers to have this equipment increased as a result of the emphasis laid in in-service teacher training on the educational potential of computers. Computer equipment in primary schools is thus likely to increase considerably in the near future.

As local authorities are responsible for the equipment of primary schools, the Ministry of Education does as yet not dispose of exact Figures of the quantity of computer equipment available. Computer-types and available software arc also very diverse. Therefore, to increase the portability of computer programs and applications and to advise the local authorities on the purchase of computer equipment, the Ministry of National Education and Vocational Training has issued recommendations concerning both hardware and software.

Hardware

Computers should ideally be able to run MS-Windows and should be laid out in such a way that they can be easily integrated into the teaching and learning methods of primary schools. A decentralised layout of computers should always be preferred so that children can have access lo a computer whenever needed and without having to leave their classroom. In complementary classes, however, computers should be brought together in one "computer room" with at least one computer for every two pupils.

Software

There is very little educational software development in Luxembourg and, consequently, extensive use is made of software developed abroad. However, although such software packages may be of great value, they can rarely be readily adapted to the specificity of the Luxembourg educational system, the methodology used and, especially, the linguistic situation in Luxembourg schools. This problem affects the whole educational system but is particularly serious in primary education.

Therefore, the Ministry of National Education and Vocational Training strongly recommends the use of generic or open-ended software such as word-processors or databases as well as LOGO as a programming language, and has developed guidelines for teachers about the possible ways of integrating such packages into their teaching practice. At the same time, teachers are free to use more specific software, particularly authoring packages which allow them lo create their own exercises, a specific work group having been created within the Institute for Higher Pedagogical Studies and Research (T.S.E.R.P.) to evaluate software packages (computer-assisted learning, dedicated software, simulations, ...) that might he appropriate for primary school classes.

A research project conducted by the Ministry of National Education and Vocational Training has resulted in the creation ofTEO ("Text Editor Oral"), an oral word processor which allows children to record, on the computer, spoken utterances, manipulate them and thus construct oral stories.

ORGANISATIONAL INFRASTRUCTURE

On the national level a group of teachers have been recruited and trained to offer technical advice concerning the purchase and maintenance of computer equipment. Various work groups have also been created to develop pedagogical models, the topics addressed being, among others, "writer's workshop", LOGO projects, the use of databases in the teaching of the humanities and natural sciences, the pedagogical applications ofteleinformatics and simulations.

On the local level, each primary or complementary school which possesses computing equipment is advised by a"computer co-ordinator" ("correspondant inforinatique") who is responsible for the administration of both hardware and software and who can offer colleagues technical assistance and pedagogical advice.

SECONDARY AND TECHNICAL EDUCATION

The Ministry of National Education and Vocational Training is in charge of the acquisition and the maintenance of computer equipment of secondary and technical schools. This centralisation allows a realistic assessment of the financial costs of computers at school (see appendix 3); it also offers a broad perspective that facilitates the co-ordination and the evaluation of the use of computers across the curriculum.

Hardware

A "group of experts in charge of the elaboration of computing standards in education" ("groupe d'experts charges de 'elaboration des normes concernant les equipeinents informatiques") decides on new acquisitions, standards to be observed, the layout of computers in schools, maintenance and safety regulations.

At present, each secondary and technical school has at least two computer rooms, each equipped with twelve IBM compatible computers with 80386 or 80486 processors, VGA colour monitors, 4 to 6 Mb of RAM, 20-80 Mb hard disks as well as two dot-matrix or inkjet printers per computer room. Computer equipment is generally up-graded every Five years.

Schools which otTer specialised courses in computing or any other courses that require special computing equipment have at their disposal further appropriate hardware (e.g. Macintosh computers for schools offering higher level art education classes).

Computers are generally brought together in special computer rooms, such a layout being very suitable for computer-awareness courses. However, further computing equipment is at present being installed in a more decentralised w ~ y to suit the needs of certain newly introduced courses which integrate the computer as a learning tool: the acquisition of portable units has contributed to making the use of the computer in the classroom more flexible; lurthermore, physics and chemistry laboratories have been equipped with appropriate computers and interfaces; each school also has at its disposal one computer upgraded for multimedia applications.

Software

The Ministry of National Education and Vocational Training provides all secondary and technical schools with the software prescribed by the official syllabus, as well as the software to be used in innovative educational projects. Software libraries have been installed where teachers can examine "inspection copies" of various software packages so that they can make an informed decision on which software is most appropriate tor their individual needs. The recent creation of a Centre for Technology in Education (C.T.E.) has made possible the centralisation of those inspection copies as well as of all the documentation concerning the use of the computer in education.

Being more versatile, software such as word-processors, spreadsheets and databases are generally preferred by teachers: they can both be used in computer-awareness courses and they can be more easily integrated into current teaching practices, as opposed to educational software packages which, although often of great educational value, hardly ever fit into the specific requirements of the Luxembourg school system and its complex linguistic situation.

A Lingua project has resulted in the creation of "LTV Deutsch", an interactive video CD- ROM training listening skills in German. The product is used mainly in vocational training. Various other CD-ROM development projects (in the field of language learning, citizen education and vocational training) are also on the way.

Organisational Infrastructure

A computer co-ordinator" ("correspondant informatique") is in charge of the administration of the cornputer equipment in schools. He/she is responsible lor the management of the computer rooms and can offer Pedagogical and technical advice to colleagues.

Teleinformatics

In order to develop the impact of teleinformatics in the Luxembourg educational system, the Ministry of National Education and Vocational Training has implemented the "Teleinformatics Network of National Education" (RESTENA = "Roseau Teleinformatique de l'Education Nationale") which links all schools of secondary, technical and higher education as well as all departments, services and institutes that depend on the Ministry of National Education and Vocational Training. Links with primary schools are under development. All secondary and technical schools have been equipped with suitable computers, modems and telephone lines to allow access to RESTENA. It is estimated that there currently are around 400 regular users of the RESTENA facilities.

Created in 1990, RESTENA offers electronic messaging, a teleconferencing system as well as access to both internal databases and to other teleinformatics networks. It is being used on different levels:

- communication between school administrations and the Ministry of National Education and Vocational Training;
- communication between teachers and the existing information infrastructure: timetables and syllabuses, teaching aids, calendar of meetings and in-service teacher training seminars ...:
- practical applications for the teaching of teleinformatics (computer-awareness course in class V of secondary education and class 9 of technical education, vocational training);
- inter-school and international teleinformatics projects;
- querying of internal and external databases.

The architecture of the network, it should be noted, has been designed in such a way that new gateways to other networks and new services and databases can be implemented progressively and whenever the need arises. H goes without saying the RESTENA offers a gateway to the global Internet.

Luxembourg schools, both from the primary and secondary sectors, have quickly realised the enormous pedagogical potential of teleinformatics. Many schools have already actively participated in teleinforinatics exchange programmes; various schools have set up information pages on the world wide web covering a wide area of topics ranging from information about the courses offered, on-line courses, on-line help for students, chat-lounges, newsgroups, pedagogical projects. The Ministry of National Education and Vocational Training also runs a server accessible on the Internet: information about school organisation and curricula, resource packs for teachers and parents, open and distance learning programmes particularly within the in-service teacher training programme.

3. THE COMPUTER AND THE LEARNING PROCESS

The main objective that the policy-makers of the Luxembourg educational system have given to the use of the computer at school is to make it one of the pillars of the learning process. As such, the use of the computer in education can be seen from two different points of view.

First, the computer is seen as a learning object. In this sense all pupils attend compulsory awareness courses that aim at introducing them to the most common computing tools: all pupils attend, in their last year of compulsory schooling, an obligatory initiation course, the knowledge and skills thus acquired being further developed and deepened during the last years of secondary and technical education.

Second, the computer is seen as a learning tool. Pupils must learn to use computing tools in an active way for project work across the curriculum in specially designed obligatory courses at all levels of education. At the same time, teachers who want to integrate the computer into their teaching method can rely on logislic support and a system of teacher-training activities, such an approach being recommended but not obligatory.

THE COMPUTER AS A LEARNING OBJECT

a. Basic Training in the New Information Technologies

Considering it desirable to make computing an element of the pupils' general education, policy-makers have introduced, in 1986, a compulsory initiation course for all pupils of class V of secondary education and of class 9 of technical education as well as in complementary education.

The aims of this initiation course are:
- to transmit basic knowledge of computing to all young people before the end of their compulsory schooling;
- to train them in the practical use of the most common computing tools;
- to prepare for vocational training;
- to prepare for the more detailed courses in computing in the upper division of secondary education and in the middle and upper cycles of technical education.

The pupils are initiated into computer applications, some of which are compulsory (Logo as a programming language, word-processing, databases) while others are optional (technical applications, teleinfoi-matics). Through practical exercises and project work, the pupils get to know the computer and the various uses that can be made of it.

Pupils attend these initiation courses for one hour a week. The Ministry of National Education and Vocational Training has edited specially designed course-books which are often accompanied by practical exercises on floppy disk.

b. Computer-Awareness Courses in the Upper Divisions of Secondary and Technical

Education

At this level, four objectives can be identified:

Above all, the knowledge and skills acquired in the initiation courses are to be developed and extended to other software types.

The perspective should he to form intelligent users of the computer who are able to solve more complex problems. The knowledge and the practical skills acquired will be useful to pupils who take up a profession and to those who will pursue their studies at university level - two areas where computing tools arc coming to play an increasingly important role.

Pupils who want to embark on a higher education course are to he introduced to formal thinking. If formal thinking has always been of great importance in some fields such as mathematics and natural sciences, it is undoubtedly gaining in significance in linguistics and the humanities - two areas where computers are on the increase.

The pupils' attention should be drawn to the social and economic aspects of the computer in the modern world. The discussion of the impact of the computer in the professional world and in private life should not lead to a negative and fatalistic view of technological progress but should help students develop an informed and critical approach to the achievements and future possible developments of modern technology.

One of the reasons why the upper division of secondary education was recently reformed was undoubtedly the necessity to adapt it to the requirements of modern technology. At present, all pupils of class IV in secondary education attend a onc-hour-a-week obligatory computing course covering such topics as computers and their operating systems, the use of spreadsheets, development and querying of databases,... The course is made up of theoretical lectures and practical project work.

Computer courses in the middle and upper cycles of technical education differ according to the sector chosen by the pupils and according to the level of training pursued:

- In the "administrative and commerce division" pupils are shown ihe various computing tools that can he used in management and commercial activities.
- In the "general technical education division", computer courses aim at introducing pupils to the problem-analysis methods of computing and to programming in Pascal.
- 'The various sections of the "technical training division" comprise special computer courses which introduce pupils to the computing tools used in the profession they are training for. In this context, the "computing section" of the "technical training" division should he specifically mentioned as a considerable amount of the available teaching time is taken up by computer studies.

THE COMPUTER AS A LEARNING TOOL

Apart from the specific computer-awareness courses described above, the integration of the new information technologies across the curriculum is one of the main objectives of the Luxembourg educational system.

a. Primary Education

The use of the computer in primary schools is based on the Findings of various pilot-projects launched by the Ministry of Education from 1986 until 1990. During these projects the computer was mainly used as a working instrument in various primary classes throughout the country. The projects made it possible to define areas in the general syllabus of primary education where the computer can be integrated to improve and diversify teaching methods: they also allowed the development of pedagogical models that fully integrate the computer as a learning tool. Moreover, it was proved that the computer can become a powerful educational tool which diversifies and vitalises the learning process, provided its use is well mastered by teachers and it is fully integrated into a pedagogically sound method. Under these conditions, computers can foster creativity, co-operation, group-work, as well as exploratory and autonomous learning.

At present, the use of the new information technologies in primary education is not compulsory.Their use as a learning tool to support the teaching of the subject matters of the curriculum is, however, strongly recommended. The suggested activities are the following:

- writing activities to develop the children's writing skills and to facilitate oral exchanges during group-work
- working with TEO and developing oral skills in foreign languages;
- the developing and querying of databases to give children the chance to explore their surroundings and to develop information-retrieval skills;
- projects developed with Logo as a programming language for children to create micro worlds,
- computer-assisted learning for remediation and further development of already acquired

knowledge and skills;

- teleiliformatics projects to develop communication skills and lo foster international and inter-cultural relationships.

b. Secondary and Technical Education

Since the beginning of the 1990-1991 school year, two new courses have been introduced into secondary and technical education. They are to be considered as complements to, preparations for, or practical developments of, the computer-awareness courses that already exist on the syllabus.

To introduce pupils right from the beginning of their secondary and technical education to the practical applications of general computer programs and to establish a link between computer applications and the general subject-matters of the curriculum, pupils take part in interdisciplinary projects which are optional in the lower division of secondary education but compulsory in the lower cycle of technical education. First introduced in 1990. the course "Interdisciplinary Projects - Technological Education" aims at giving pupils the opportunity actively to use computing tools such as word-processors, databases, spreadsheets, drawing and desk-top publishing programs during practical and purposeful activities during which they are to develop, through hands-on experience, basic computing skills and to become aware of the impact of the new information technologies in the modern world.

In the comprehensive cycle of the upper division of secondary education pupils can choose between various pre-specialisation options which aim at assisting them in their choice of the specialisation they want to opt for during the last two years of secondary education. First introduced during the 1991-1992 school year, the pre-specialisation options mainly consist of practical project work. The options which prescribe the use of the computer as a working and learning tool include the "mathematics and computing option", the "natural sciences and computing option", the "economics and computing option".

Apart from these obligatory courses, a steadily increasing number of projects integrating the new information technologies have been launched in different schools. At lhe same time, an increasing number of teachers have become aware of the computer's educational potential and use the new information technologies to change, improve and diversify their teaching methods, even in courses where their use is not compulsory.

4. INFORMATION AND TEACHER TRAINING

Every educational innovation, and even more so the integration of the new intorinalion and communication technologies across the curriculum, can only bear fruit if an adequate infrastructure of implementation and support is created both to inform teachers of the educational potential of these technologies and to train them, so that they are not only able to use the technology in their lessons, but that they can also actively take part in the discussion on the fTindainental issues concerning educational innovation and reform in general.

INFORMING TEACHERS

To pass the necessary information along to the teachers concerned, the Ministry of National Hducation and Vocational Training has launched an information campaign which, among others, particularly insists on the importance of the new information technologies.

At regular intervals, the Ministry of National Education and Vocational Training publishes the "Information Bulletin: New Technologies and Education" ("Bulletin d'inforrnation: N'ouvelles Technologies et Education"). Sent free of charge to every teacher, this bulletin is conceived as an open forum for all teachers of primary, secondary and technical education who wish to exchange information and discuss ideas and experiences concerning the use of the computer at school.

A whole range of other publications dealing with more restricted topics concerning the new information technologies can be ordered free of charge from the Ministry of National Education and Vocational Training. These publications can take the form of resource packs, dossiers, information brochures, catalogues, simplified manuals, didactic materials or descriptions of learning sequences that fully integrate the computer as a tool or support.

The "Evaluative Catalogue of Educational Software" is designed to attract teachers' attention to the educational potential of the computer and to assist and advise them in their choices of appropriate software tools for their courses. The catalogue provides bibliographical information, describes the aims apd contents of the listed software packages and contains comments by the teachers who have already used the programs in their lessons.

One of the aims of RESTENA, the Teleinformatics Network of National Education, is to facilitate the exchange of all kinds of information between teachers and all the departments of national education. RESTENA provides databases concerning syllabuses, innovation and research programmes, available publications and educational materials, software evaluation, in-service training sessions, ... The aim of the Internet server run by the Ministry <if National Education and Vocational Training is mainly the information of teachers, students and parents.

TEACHER TRAINING

One of the decisive factors determining the integration of the new information technologies across the curriculum is an adequate programme of initial and in-service training.

Teacher-Training in Primairy Education

Both initial and in-service training for primary education is organised by the Institute of Higher Pedagogical Studies and Research (1.S.E.R.P.).

As far as initial teacher-training is concerned, 90 hours of compulsory training are dedicated to computing and computer-assisted learning. This course aims at giving teachers sufficient knowledge so that they are able to use the computer as a tool and as a teaching resource in their lessons: trainees arc introduced to computers and their operating system and develop basic skills in word-processing, databases and spreadsheets. Tn addition to this course, teachers can choose a supplementary optional training programme of 120 hours which aims at developing basic skills and introduces teachers to Logo as a programming language.

The in-service training programme is organised as "proficiency modules" from winch teachers are free to choose those that interest or concern them more particularly. The modules deal both with the technical and educational issues linked lo the use of computers at school. Their main objective is to integrate the computer as a tool and as an educational resource across the curriculum and to show trainees how to make the best use of the educational potential of the new information technologies.

Teacher Training in Secondary and Technical Education

The initial-training programme for teachers of secondary and technical education is organised by the Department of Pedagogical Training of the University Centre Luxembourg (C.U.L.). During the first year of the probationary period for young teachers, trainees attend a compulsory initiation course which consists in a general introduction into computers as a tool for both teachers and pupils, a preseiitation-of the pedagogical issues linked lo the use of computers at school, an introduction to computer-assisted learning combined with a presentation of specific educational software packages that teachers might find useful for their particular courses, as well as an initiation into the basic functions of general purpose software. It should also be noted that trainees increasingly choose to write their pedagogical report on subjects related to the use of the computer across the curriculum.

The in-service teacher training programme is co-ordinated by the Service for the Co-ordination of Pedagogical Innovation and Research (S.C.R.I.P.T.). It concentrates particularly on topics dealing with the integration of the new information technologies across the curriculum, it works according to the "cascade model": a limited number of teachers attend an intensive training programme which lasts several months or even a year and is often organised in co-operation with a foreign institute or university. The knowledge thus acquired is then transmitted to colleagues, either during a complete cycle of training that extends over a year and gives trainees a general overview of [lie edlicationat potential of computers for a particular subject-matter, or during more isolated seminars addressing more specific topics. It should be noted that as yet no precise legal framework for in-service teacher training exists for secondary and technical education, that attendance at in-service teacher training activities is not compulsory, bui that teachers who participate in seminars or workshops outside their normal working Incurs receive financial compensation.

5. ASSESSMENT AND PERSPECTIVES

If computing has come to play such an important role in the Luxembourg educational system, this is mainly due to four factors:

- the dedication of teachers and teacher-trainers who have greatly contributed to making technological and pedagogical innovation possible;
- the efforts made by the Ministry of Education to create the information and training infrastructure indispensable for all innovation in education;
- the investments made in hardware equipment and in software over the last few years: co-operation on the European and international levels.

The first objective regarding the new information technologies in the Luxembourg school system, i.e. to offer all pupils basic training in the new information technologies and to introduce them to the most common computing tools, has been largely achieved. Great care must, however, be taken in future regularly to adapt computer-awareness courses to the consent and rapid developments of the computing world and to sensitise girls to computers and to technology in general.

The second objective, i.e. to show pupils the practical use of the computer as a learning tool and to allow teachers to take advantage of the pedagogical potential of the computer in their lessons, has as yet not been fully achieved. Considerable efforts have, however, been made in this direction by the introduction of compulsory courses that integrate the computer as learning tool. Furthermore, the spirit of innovation and experimentation with new educational tools shared by an increasing number of teachers must be supported and generalised because it alone can lead to the acquisition of technical know-how and pedagogical skills which are often missing and which cannot he developed by teacher-training alone.

It can nevertheless not be denied that in Luxembourg, as in many other countries, pedagogy itself, i.e. teaching methods and the ways learning is organised, has not yet been "revolutionised" by computing. Maybe the reasons for this are tlial educational systems are deeply anchored in the cultural traditions of each country, that learning processes are very complex and that teaching methods adapt only very slowly to changes in the world outside school.

PERSPECTIVES

The enlargement of the existing computing equipment and the development and diversification of teacher training programmes are the first priorities of the Ministry of National Education and Vocational Training. Furthermore, a certain numbei of existing courses will he adapted to fit the new requirements; finally, various innovation and research programmes are on the agenda.

Confronted to the rapid technological progress in computing, the Ministry of National Education and Vocational Training will have to develop and modernise the existing hardware and software equipment, besides, science laboratories will continue to be equipped with computers, interfaces and peripherals; appropriate hardware to run multimedia applications are also one of the priorities. Eventually, primary schools need to be more systematically equipped in hardware.

Both initial and in-service teacher training programmes must offer an always wider range of seminars and workshops during which particularly the pedagogical issues related to the use of computers across the curriculum must be given greater emphasis. Furthermore, there is a strong need both for a reform of initial teacher training and for a legal framework for in-service teacher training in secondary and technical education.

Ways must be found to integrate new developments in computers, particularly multimedia systems and teleinformatics, so that advantage can be taken of their educational potential.

The gateways to external networks and the information databases offered by RESTENA, the Teleinformatics Network of National Education, are to be developed and adapted to the needs of pupils and teachers. If, in this country, some classes have already communicated electronically with other classes both here and abroad, further international and inter-cultural relationships will have to be established through teleinformatics. Eventually, the potential of teleinformatics for open and distance learning will have to be further explored.

A certain number of research projects, concerning, among others, the integration of computer simulations at all educational levels, the use of multimedia tools in the humanities, the study of oral interaction around the computer, have already been launched. Ways must be found to apply their results throughout the educational system.

It is in the professional world that the new information technologies have so far had the greatest impact and where they developed most rapidly. In order to prepare pupils for their future professional careers, vocational training must regularly adapt to the new developments and requirements of the working world.

CONCLUSION: EDUCATION AND THE SOCIETY OF INFORMATION AND COMMUNICATION

The rapid developinenis of technology and of modern society are in themselves great challenges for education. Indeed one of the most important and uraent questions winch education must answer today is how to organise the education of the future so tlial the society of information which is inexorably developing becomes, for everybody, a society of communication and knowledge.

In this context, two important aspects of education should be stressed as they are essential elements of what general culture should be; as such. they are gradually becoming seen as absolute priorities by the policy-makers of the Luxembourg educational system.

First of all, much more importance should be given to the development of pupils' communicative competence; the learning process should be structured around the acquisition of communicative skills in speaking, reading and writing, and this - of the greatest importance for a small country like Luxembourg - in more than one language. The acquisition of these skills must include what has already become an essential component of general education; awareness and mastery of the media, boih the spoken and written media as well as the modern information and communication media which are strongly influenced by computers. How to use the new information technologies for practical and meaningful purposes is another skill to he included in what general education will mean in tomorrow's world.

Thus the use of the new information technologies will continue to gain in importance in the Luxembourg educational system; the computer allows a pedagogy of communication and exploration which presents considerable advantages; it facilitates the development of pupils' productive skills as well as their communicative competence. Furthermore, the use of the computer across the curriculum helps develop pupils' critical awareness of the role of technology in the modern world.

Computing tools, such as word processors, databases, drawing programmes, desk-top publishing software, ... are essential ingredients of the modern media of information and communication. Not only does their use across the curriculum help develop and increase pupils' communicative skills; by using these tools during practical and meaningful project work students will become aware of the advantages and drawbacks of modern technology. At school, the young should be given the opportunity to master modern computing tools and thus to develop an informed knowledge of technology and a critical awareness of progress. The understanding ol' the social, economic, moral, cultural and artistic implications of technological innovation must indeed become one of the principal ingredients not only of computer awareness courses but also across the curriculum.

Secondly, it should not be forgotten that, in a constantly changing and rapidly progressing world, education can no longer only mean passing on ready-made knowledge *to* the younger generations; teachers should also help their pupils acquire active learning strategies so that the world may become for them an autonomous source ol' information and knowledge. In this sense the mastery of the new information technologies, the new medium of tomorrow's knowledge, must become an essential ingredient ol education.

Furthermore, the interactivity of the new information technologies contributes to making them flexible educational tools which have at least the potential to diversify and improve learning. Teachers should learn to accept and take advantage of anything likely to help making learning active and stimulating, and refuse and discard anything that enslaves pupils by imposing inflexible structures that limit their autonomy.

To achieve these goals, the Luxembourg educational system will have to continue to adapt curricula and teaching methods so that every pupil is given the opportunity to acquire strategies for autonomous learning, to develop creativity, problem-solving and teamwork skills, to take the initiative and to accept responsibilities, to be open-minded and critical. It does indeed very much look as if the education of future generations in harmony with technological progress and constant social change is only possible in this way.

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NATIONAL REPORT OF MALAYSIA

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES: THE MALAYSIAN EXPERIENCE

1. INTRODUCTION

1.1. COUNTRY PROFILE

1.1.1 Malaysia is a tropical country - situated in the heart of South East Asia. It is divided into two parts, the Peninsula: Malaysia which shares common borders with Thailand in the north, Singapore in the south and Indonesia in the west and Sabah and Sarawak, two eastern states on the island of Borneo. Malaysia has a total area of 329,758 square kilometers and a population of more then 19 million.

1.1.2 Malaysia enjoys a parliamentary democracy with a constitutional monarch as the supreme head of state. The Prime Minister is the leader of the party which commands the majority of seats in parliament The Malaysian population comprises of three major ethnic groups - Malays, Chinese and Indians in Peninsular Malaysia and numerous indigenous groups in Sabah and Sarawak. The Malay Language is the official language. The national ideology, RUKUN NEGARA embodies the aspirations of the people of Malaysia and the principles that guides the effort to realise these aspiration.

1.1.3 Malaysia has developed from an economy highly dependent on the agricultural and mining sector to an economy based on the manufacturing sector which now contributes more than 30% to the GNP. The National Industrialisation Policy which started as early as 1967s has triggered the rapid growth of the industrial sector, especially in the manufacturing services. The 1990s saw the shift towards capital intensive and technologically sophisticated industries. Malaysia embarked on hi-tech industries through its policy of encouraging foreign investments and joint ventures between locals and foreign manufactures to enable the local workforce to gain practical experience and expertise. Malaysia has set a target to become an industrialised nation by the year 2020. In order to realise the goals of Vision 2020

Malaysia needs to have enough human resources in the fields of science, technology and information. The lack of manpower in the varied technical fields has become a major concern as it advances through year 2020. Malaysia has also to keep abreast with the rapid development particularly in information technology in the context of the global village. It services and communication sectors also need to be enhanced in order for it to remain competitive ~ the global market.

1.2. BACKGROUND OF THE EDUCATION SYSTEM

1.2.1. Education plays a major role in preparing the population towards Vision 2020. The RUKUN NEGARA and the National Education Philosophy guide the direction and the development of the education system. With a structure of 6-3-2-2 system of formal education, the system of education represents 6 years of primary, 3 years of lower secondary, 2 years of upper secondary and 2 years of post secondary education. Preschool education by the Ministry of Education (MOE) caters to children who are 5+ of age but who do not have the opportunity to receive pre-school either from privately-run institutions or other government agencies.

1.2.2. Within the government education sector, at the primary level there are 3 types of schools: a) The National Primary School; b) The National-Type Chinese Primary School; and c) The National-Type Tamil Primary School. These schools follow a common curriculum, the New Primary School Curriculum. (NSPC) and common public examination

1.2.3. At the secondary level of education the system has 3 stages: a) Lower Secondary (Form 1-3); b) Upper Secondary (Form 4-5) and c) Post Secondary (Pre-University). These secondary schools follow the Integrated Curriculum for Secondary Schools which is a continuation of the NSPC. On completion of primary education, pupils enter Lower Secondary Level for 3 years. Pupils from Chinese and Tamil media primary schools spend a year in the Remove Class before entering Form 1. Promotion from Form 1 to Form 3 is automatic and at the end of this level pupils sit for a centralised examination, the Lower Secondary

Evaluation (LSE).

At the Upper Secondary pupils are channelled into academic, technical, vocational and religious streams based on the LSE results. At the end of Form 5, pupils sit for the Malaysia Certificate of Education (MCE) or Malaysia Certificate of Vocational Education (MCVE). Based on the results of MCE selected pupils are given 2 more years i.e. in Form 6 lower and Form 6 upper. At the end of Form 6 pupils sit for the Higher Certificate (HSC) examination which is equivalent to GCE (A levels). Pupils may also attend matriculation classes to prepare them for entry into the local universities or sit for the GCE (A levels) or equivalent examinations organised by foreign universities. A substantial proportion of students of the post secondary level proceed to the private institutions that have twinning arrangement programmes with foreign universities.

1.2.4. *Higher Education:*

Institutes of Higher Education in the public sector include universities, colleges and polytechnics that prepare and produce professionals to meet the manpower needs of the country. There are now 9 universities. Several new institutions are being considered within the near future. In addition to that teacher education programme provides pre-service as well as in-services courses in 31 teacher colleges.

1.2.5. Organisation and Administration.

Malaysia has a centralised system of education administration. Its administrative structure is divided into the federal, state, district and school levels. The MOE at the federal level, formulates polices in accordance with national aspirations and objectives and oversees their implementation. At the division level, these policies are translated into plans, programs, projects and activities. The decision-making process at the federal level functions through a system of committees which consist of the Educational Planning Committee (EPC), the Central Curriculum Committee (CCC) and several policy level committees. The EPC which is chaired by the Minister of Education, is the highest decision-making body in the MOE.

1.2.6. Laws Governing Education System In Malaysia.

Prior to 1996, two laws regulate education in Malaysia namely the Education Act, 1961 and University and University Colleges Act, 1971. These two legislations have now been replaced by two new legislations in late 1995. With the passing of two other new legislations in early 1996 and one other legislation which will be tabled in Parliament in July 1996, education in Malaysia will be governed by Five major laws. These are:

(i) Education Act. 1996,

(ii) University and University Colleges(Amendments Act, 1995,

(iii) Private Higher Educational Institutions Act, 1996,

(iv) National Council of Higher Education Acts 1996; and

(v) National Accreditation Board Bill, 1996 (to be read in Parliament in July 1996).

(i) The Education Act, 1996.

The principal law that regulates education in Malaysia is the Education Act 1996. This law enshrines the education policy that was initiated by the Razak Report, 1956 and the Rahman Talib Report, 1960. Among the major components of the Education Act 1996 are statements of goals and mission of education; definition of the national education policy; categories of educational institutions; status of the national language; national curriculum; evaluation and examinations; Islamic education; levels of education; technical education, higher education; private education sector; status of the national type primary schools; and power of the minister to enforce the law covering pre-school, primary, secondary, post secondary, higher institutions.

(ii) University and University Colleges (Amendments) Act, 1996.

The University and University Colleges (Amendments) Act, 1996 is an amendment to the original University and University Colleges Act of 1971. The principal aim of the amendments is to update as well as to incorporate, among other matters, provisions to enable the corporatization of public universities. Some of the major aspects of the amendment Act are:

- governance and management system, of public universities;
- right-sizing of the Senates of the public universities;
- flexible and proactive financial management system;
- accountability and contra procedures; and
- student welfare and disciplinary procedures.

(iii) National Council of Higher Education Act, 1996.

The main purpose of the National Council of Higher Education Act, 1996 (NCHE, 1996) is to enable the creation of a body that will be responsible for the planning and strategic policy formulation of higher education in Malaysia. This law is part of the continuing efforts to reform higher education in the country. The University and University Colleges Act (Amendments) Act, 1996 enables public universities to be corporatized as public corporations which will be endowed with flexible powers in finance and personnel management as well as academic and research and services matters. However, the universities will remain government owned and will be supported through government grants. The establishment of many private universities, and the corporatization of public universities, necessitate the creation of an effective regulatory agency to monitor and ensure that higher educational institutions function in line with national policies and requirements.

The Act provides that membership of the National Council for Higher Education shall comprise representatives from government, public and private universities and individuals who are expert and experienced in relevant Acts.

(iv) Private Higher Educational Institutions Acts, 1996

The Private Higher Educational Institutions Act, 1906 (PHEI, 1996) was formulated to enable the establishment, registration, management, regulation and quality control of private higher educational institutions in Malaysia. Among the more important focus of the provisions of the law are:

- procedure concerning the setting up of private institutions of Higher Education with the status of university or university colleges and branches of foreign universities;

- the system of governance and constitutions of private higher education institution,conduct of courses of study after approval by the government, norms and standards of physical facilities and infrastructure;

- power of the Minister with respect to the medium of instruction, required core subject areas for local students, and the rules and procedures of student discipline are the same as for public universities.

The purpose of the PHEI, 1996 is to facilitate the establishment, management and development of quality private higher education in Malaysia to complement that which is provided for by the public sector.

(v) National Accreditation Board Bill, 1996.

The National Accreditation Board Bill is in the process of being prepared for reading and approval by the Parliament. The main purpose of this Bill is to enable the establishment of a National Accreditation Board (NAB) that will be responsible for determining and evaluating the quality standards of courses offered and conducted by private higher education institutions. The proposed Bill is also part of the larger efforts to reform higher education in Malaysia.

The NAB Bill will be established as a public corporation headed by an Executive Chairman appointed by Y.D.P Agong on the advice of the Minister of Education. A maximum of 10 members of the Board will be appointed by the Minister of Education. NAB will be allowed to employ and utilise the expertise from many sources, including from other countries to ensure that degrees and diplomas awarded by Malaysian universities are comparable with established world standards.

1.3. INFORMATION TECHNOLOGIES IN THE EDUCATION SYSTEM

Greater emphasis is now being placed on mathematics, science and technical subjects in schools to prepare students for training in high technology in order to meet the demand for highly skilled labour. Research and planning have to be carried out and policy formulated to enable the education system to address the shortage in quality skilled human resources Computerisation of the Ministry of Education (MOE) and office automation are being undertaken to speed up work and increase efficiency. A good information system is needed to provide reliable and up-to-date information for operational activities, informed decision-making and planning for the future development of education. The MOE is now undertaking a project to strengthen the Educational Management Information System (EMIS).

The development in IT, multimedia, networking and the Internet provide new possibilities For enhancing the teaching and earning process, searching For and sharing of knowledge, communication, distant learning, and better and faster methods of doing things. Computer in Education (CIE) is an important: aspect of the development of the education system and the nation as a whole.

IT has introduced new concepts and possibilities such as intelligent buildings, intelligent city, multimedia super corridor, cyberspace, cybermoney, digital cash, virtual reality and access to a variety of information in the Internet and the World Wide Web (WWW). On the other hand the development of IT also brought with it high-tech crime such as hacking into private data bases, deployment of computer viruses and extortion through 'time bombs' programmes to destroy other people's works. There is also the risk of people accessing unwanted materials from the Internet that could pollute the mind and the values of the society. In this respect how should the dark side of IT be tackled in the light of CIE.

The IT in MOE is operationalised according to a conceptual framework. The following section of the paper will discuss the strategies adopted within the context of information technology' in the Malaysian education system under four main topics.

a). Computerisation for Administration and Management

b). Educational Management Information System

c). Computer in Education

d). Education Networks.

2. COMPUTERISATION FOR ADMINISTRATION AND MANAGEMENT

2.1. THE DIVISION, STATE AND DISTRICT/REGIONAL LEVEL

2.1.1. Computerisation was started in the MOE in 1976 and managed by a small unit in The Examination Syndicate to process national level examinations. Due to the need of computerisation of the other divisions in the Ministry of Education a Computer Service Division was set up in 1986 to serve the Ministry. This division is now known as Information Systems Division (ISD) In the first phase of the computerisation programme terminals and terminal printers were installed in various divisions in the MOE and linked to the mainframe computer at the ISD

2.1.2. The strategies for computerization of the MOE are:

- Integrated application systems
- Office automation towards paper-less administration
- Networking infrastructure

2.1.3. More than 45 applications were developed to help divisions manage their functions. These includes:

• Examination system at the Examination Syndicate,

• Scholarship and training system the Scholarship and Training Division

• Book loan system at the Text Books Division

• Financial system at the Finance Division

• Trainee Teacher intake system at the Teacher Training Division

• Staff system at the Establishment and Service Division

• Student selection system at the Higher Education Division

• Student selection system and teacher deployment system at the Schools Division

• Student selection system at the Technical and Vocational Division

• Supply information system at the Development and Supply Division

2.1.4. The Educational Planning and Research Division (EPRD) is one of the main users of the mainframe computer at ISO. EPRD develops its own applications, collects, manages, analyses basic educational data and disseminates information. This collection provides the information needed for policy analysis, planning, research, evaluation and monitoring and information needs of other divisions in the MOE and other government agencies.

2.1.5. The computerisation of the State Education Department (SED) started in 1990 and was completed in 1992. IBM RISC System 6000 with several personal computers (PC)s and line printers were installed in the SED. The SED is linked to the ISD, MOE using a Wide Area Network (WAN) through leased lines (X.25) running TCP/IP and the District Education Office/Regional Education Office (DEO/REO) is linked to its respective SED through a dial-up system.

2.1.6. An Information Unit (IU) was established at the SED to manage the computer hardware and software and manage the staff system developed for the SED. Divisions that require staff information could extract the information from the staff system. However the SED was unable to maintain up-to-date staff information due to lack of manpower, and technical expertise and the voluminous data that they have to update. In addition to that the esponsibilities of the IU and its personnel, who are technical peoples, were not clearly defined in terms of data collection.

2.1.7. The Information and Computerisation Committee, chaired jointly by the Deputy Secretary General and the Deputy Director General regulates the purchase and upgrading of hardware (HW) and software (S/W) throughout the MOE. A similar committee was set up at the Division and SED to co-ordinate procurement of (H/W) and software (SAV) at these levels. The MOE has set standards for H/W and S/W for application development at the SED and S/W to be used on PCs for word-processing, spreadsheet, data base management and presentation to facilitate exchange and sharing of information.

2.1.8. The MOE had signed a contract with a computer company to supply H/W and S/W and all agencies in the MOE including schools must procure their H/W and S/W requirements through this central contract.

2.1.9. As a part of the MOE office automation programme the ISD has supplied 486- based PCs installed with standard SAV to all divisions. Under the project KPMNET (MOE network) the ISD has planned to network all Divisions, SEDs, and DEOs/REOs and provide linkage to the Internet in 1996.

2.2. THE SCHOOL LEVEL

2.2.1. The ISD starting this year. 1996, is trying a new strategy to have educational data updated at the school level, the objectives of the project are two-fold:

a) Short-term:

To assist the school in its administrative work so that focus can be given to *ifs core business i.e. Teaching and Learning.* At the moment principals and headmasters are heavily burdened with administrative work. Computerisation involves simplifying work processes and updating of information.

b) Long-term

To have a high quality school administrative system that will ensure the school delivers world quality education.

2.2.3. The .project will cover computer applications for all aspects of . the School Administration which among others includes:

• Personnel Management

• Financial Management

• Student Management School Inventory

• Time tabling

2.2.4. The approach will be process driven as against a functional approach. Teacher data are captured as soon as the trainee teacher is admitted to the teacher training college and updated when he is appointed by the Establishment and Service Division, posted to SED and finally reports for duty in his school. This will help in reducing duplication of work and redundancy in the collection of information. Each of the above mentioned areas will be further broken down into modules as necessary. It has been identified and established that the information from the school will be needed at all levels of the Ministry. Thus there is a business need for the whole system to be networked.

2.2.5. Status of Implementation

a) Presently all schools with electricity have been supplied with a PC and PC based Personnel System. The Staff Information System is in the process of being installed after training was give", to School Administrative Assistants (7000 schools completed). It is at the moment a stand alone system. Updated data are submitted to the SEDs in diskettes.

b) Work is underway on the development of two other applications namely:

• Students Information System.

• School Physical Facility Information System

3. EDUCATIONAL MANAGEMENT INFORMATION SYSTEM (EMIS)

3.1. BACKGROUND

3.1.1. The existing EMIS consists of data bases managed by different divisions in MOE. EPRD manages basic educational data for policy analysis, and macro planning, and to fulfil the requirement for basic data by other divisions in the MOE and other government agencies. The other divisions manage data closely related to their functions. At the same time they also collect basic data from schools. This creates duplication in data collection, questionable data reliability, and extra burden to schools.

3.1.2. The success of the vertical integration through a network of information collection, the schools, DEO/REO and SED has resulted in the collection of a substantial amount of information about the education system However, the utilisation of these data in policy analysis and planning is hampered by problems encountered in horizontal integration of data, i.e. working relationships among divisions due to restrictions imposed by divisions, isolation of data bases by division, insufficient facility for access and inadequate training of staff in data analysis.

3.1.3. The weak horizontal integration leads to inefficient use of resources and impediment to effective planning and management, deprive education officials from getting information relevant to decisions they are making and results in divisions initiating independent collections of data that are already available in other divisions of MOE

3.1.4. A comprehensive system-wide EMIS is therefore required to overcome this weakness and ensure efficient and effective planning and management. EMIS is an important part of improving the quality, efficiency and effectiveness of the education system and building a "World Class" education system for Malaysia. A successful EMIS will depend on co-operation among those who share responsibility for the development and management of the education system - policy makers, managers, administrators and teacher in the MOE, SED. DEO/REO in both public and private schools throughout the country. The EMIS must be capable of providing relevant, reliable and timely data/information to support policy-making, planning, management and administrative activities if it is to support the development of an information-based decision-making culture in the education system.

3.1.5. In recent years a number of attempts have been made to achieve higher levels of co-operation across divisions and levels of the education system in an effort to minimise duplication of data collection, improve the collection, flow and use of data and information in schools, DEO REO, SED and MOE. While notable progress has been made in terms of IT set up and infrastructures there is still much to be done. Relevant data and information is still often not available when needed and when available it is often of questionable quality Educators and staff at all levels express concerns that:

- efforts to develop EMIS have been dominated by the particular needs of selected divisions in the Ministry,
- the needs of, impact on, and operational constraints on state, district and school-level managers and administrators have not been sufficiently considered,
- directives and instructions from those responsible for EMIS development have not always been clear,
- the overall effect of introducing new IT and associated applications has been a net decrease, not an increase, in their effectiveness. Principals reports of increasing amounts of their time being spent on responding to requests for data and information at the expense of time for supervising teaching and learning activities.

3.1.6. EMIS development has been hampered by Four dominant factors:

- lack of sufficient involvement of professional educators from all levels both in design of the overall conceptual framework for EMIS and the development of specific computer applications,
- insufficient communication among the various levels across divisions in the education system and between education professionals and technical professionals.
- lack of adequately trained staff at all levels
- insufficient resources allocated for human resource development.

3.1.7. Until recently EMIS design and development has been approached largely as an effort to place enough of the right IT through the education system but EMIS is more than computers and computer-generated products. EMIS development represents an organisational and institutional challenge. Its success depends on improving existing channel of communication and opening and maintaining new communication paths and requires change in the work culture.

3.2. THE EMIS OBJECTIVES

3.2.1. The primary objective of EMIS is to monitor the implementation of education system policies and progress towards the realisation of Vision 2020, the National Education Philosophy, the National Education Policy, the 12 Fundamental Shifts and attainment of goals and objectives of the education system.

3.2.2. The EMIS will be both an Early Learning/Early Warning Indicators System to identify schools, programmes, districts and states that are being effective and to identify those that are not achieving standards.

3.2.3. The EMIS will provide a core data set that can be used by all divisions. This involves the integration of data from various databases sources to a system which will be able to disseminate and provide comprehensive information for purposes of planning, management and policy analysis of education. The core data set may not reside in the same physical location but follow standards in data definition, codes and key variables to identify *schools and personnel and to allow merging of* different databases for analysis across divisions. The core data set will consist of data elements commonly needed by every divisions, SED.DEO/REO and school.

3.3 STRATEGIES FOR STRENGTHENING EMIS

3.3.1. Development of an EMTS Policy

a) An EMTS policy is essential for the success of EMIS and covers the following items:

- Clear objectives on Information needs
- Data and Information Standards
- Management principles
- Procedural Standards for vertical & horizontal integration,
- Changing standards
- Reporting Standards for dissemination
- Security and access.

b) The objectives of Information Policy are as follows:

- Achievement of more effective and efficient creation and use of information for educational policy and management activities through:

- the creation of organisational arrangement for information management, structures, positions, funding, procedures, and authorities:
- the creation of controls for *ad hoc* data collection,
- the creation of authoritative calendar for data collection, and
- the creation of standard data definitions and collection procedures for core data.

Achievement effective links between educational goals of the Ministry and the information available for policy and management decision making and action through the definition of indicators for assessment of goals and procedures for indicator ratification, description of procedures and policies for publication of educational performance indicators.

Linking Information to Management Performance by defining incentives and procedures for assessment of system performance and administrative effectiveness linked to indicators and information-based assessments.

Linking Information to Accountability for school performance by designing school performance profiles and policy for access and publication of performance results.

Linking Information flows to organisational interactions to promote Integration of operations and management by:

- defining role of EMIS committees, including membership, basic agenda, scope of responsibility, subcommittee structures, and decision making authority.
- determining use of working task forces or other co-ordinating mechanisms needed to implement and supervise information integration activities
- designing procedures for annual review and assessment of EMIS operations.

c) Elements of Information Policy:

- Articulation of the Government's commitment to improving the management and effective use of information in education.
- *Identification of the nature and extent of* improvements and outcomes desired.
- Identification and specification of the means through which these improvements are to be achieved:

new rules and regulations

new organisational arrangements

allocation of necessary resources: staff, finances, space, equipment, etc.

3.3.2 .Strengthening Management in EMIS

There are several aspects of management in EMIS that have to be worked on. They are as follows:

a) Information management which includes:

- access, documentation, dissemination, linkage with user communities
- Reporting, monitoring, evaluation, analysis and communications tools
- *Infrastructure*
- Data flows and updating
- Maintenance - archiving (securing data from loss)
- Data security (securing data from falling into unauthorised hands)
- *Documentation centre (data documents,* application documents),
- Dissemination and communication of information
- Integration, packaging, and distribution of information

b) EMIS management which involves:

- Formulation of terms of reference for EMTS units and EMIS committees
- Integration of data and personnel across divisions and levels
- Ongoing and annual reviews
- Establishment of EMIS committee - role and responsibilities
- Identification of Chief Information Officer - role and responsibilities
- Identification of State Information Officer - role and responsibilities

c) Technology management which covers:

- H/W and S/W purchase, upgrades, maintenance
- Maintenance of an Inventory.

d) Application management or management of development tools which covers

- Design & development of applications
- Liaison with relevant user groups
- Maintenance & modifications.

e) Human Resource Management which deals with human resource development and investment. This includes:

- Training objective and schedule
- Prerequisite and types of training required
- Assessments - procedures for assessing utility and success of education and training activities.

f) Resource Requirements which deals with phasing activities and priorities in terms of:

- Management resources
- Work Groups

- Training
- Equipment
- Cost implications
- External inputs

3.3.3. Horizontal and Vertical integration of Committees and Information Centres.

EMIS involves horizontal and vertical integration of MOE EMIS Committee MOE Information and Computerisation Committee, Division/SED Information and Computerisation Committee and other related committees and co-ordination of information management and administration of all levels of management into a network of information collection and dissemination centres.

4. COMPUTERS IN EDUCATION (CIE)

4.1. BACKGROUND

4.1.1. IT and the use of computers as a technology was introduced to the Malaysian education system since 1980s through computer clubs as a part of the schools extra-curricular activities. The MOE encouraged schools to set up computer clubs with the help of Parent-Teacher Associations and later initiated pilot projects using computers and telecommunications for teaching and learning across curriculum in primary and secondary schools as part of an on-going effort to integrate the use of computers and computer-based technologies in the Malaysian Education System. Looking at the development in computer and communication IT has potentials and role in education and is an important means of developing a Malaysian society who is knowledgeable, informed and skilled in IT as aspired by vision 2020. The use of IT in education has been seen to have brought about changes in methods of teaching and learning, the orientation of students towards information and the process of school administration and management.

4.1.2. Most computer clubs were leaching members how to use application software such as Wordstar, dBase III. Lotus 1-2-3 and graphic packages such as Print Shop. Many of the computer clubs in schools are managed by computer companies who provide the hardware usually on a hire-purchase scheme and a teacher to instruct club members on how to use the software. The school will appoint teachers as club advisors. As the clubs are usually present in schools situated in the urban area, this has resulted in disparities between the rich and the poor as well as the urban and the rural.

4.2. THE ROLE AND INVOLVEMENT OF MOE IN IT

4.2.1. From time to time Malaysia leaders have expressed the importance of computer in education so that our pupils will not be left behind in the current educational development of the world and will be able to fit into future socioeconomic development. Nevertheless the government is very cautious on investing in IT in education. The Government will have to spend more than RM 1.3 billion (US$ 0.52 billion) to implement CIE nation-wide. This budget includes the cost of buildings and equipping computer laboratories in 6965 primary and 1470 secondary schools and 31 teacher training colleges and the cost of upgrading and maintenance in order to provide CIE fo7 about 4.42 million pupils.

4.2.2. A CIE unit was established in the MOE to handled CTE projects. Several pilot projects have been carried out in selected schools to ensure the feasibility of CIE programme. MOE set up a joint committee with the Malaysian Institute of Microelectronics System (MIMOS) a R&D government agency to implement CIE programmes.

MIMOS set up the Joint Advance Research Integrated Networking (JARING) which is the Malaysian information highway for linking to the Internet. The MOE-MIMOS Computer Technology Laboratory developed a courseware authoring tools called ComIL (Computer Integrated Learning System) which could be used by schools and training centres for CAI/CAL courseware development. A Window version which could handle multimedia application is being developed.

4.2 3 The role and involvement of MOE in IT is spelt out in the 3 principal work targets of the MOE

- to educate and teach computer literacy to the whole population through the learning programme
- to teach and guide in effective application of IT as a tool for innovation, creativity and increasing productivity
- to produce experts in science and technology in order to continue the advancement and development in IT

4.3. DEFINITION OF IT

- IT is normally defined as a field of computerisation and communication which covers all techniques of information management. It is a combination of computer, communication tools, management techniques, processing, and gathering of information.
- In education IT is defined as the use of computer based technology, telecommunication and electronics to fulfil the requirement in education. It involves control, gathering, processing, storing, and dissemination of educational information.

4.4. THE IT POLICY FOR CIE

The overall goal of Information and Computerisation policy is firstly, to provide up-to-date, valid and timely information for the formulation of policy, educational planning, programme monitoring, research and evaluation through the integration of information, secondly, to strengthen the teaching and learning process towards improving the quality of education using the latest and appropriate technology as an effort to realise the mission and objective of MOE, and thirdly, to realise the concept of democratisation of education through the IT programme which would provide students with the opportunity to gain knowledge, skill and develop acceptable attitude to face the challenge of the information era. The implementation of IT will cover all schools, polytechnics, teacher training colleges, higher institution and the MOE.

4.5. GOALS AND OBJECTIVES OF IT PROGRAMME

• To produce a knowledgeable and Information Rich Society to Face- the challenge of information era in the 21 century. This goal can be achieve through the following objectives:

- to produce students who are skilled in the use of computer and using it as a tool for learning, a tool for communication and a tool for expanding creativity
- to develop knowledge culture among the students in line with the information era.
- to encourage individual development without depending too much on teachers as the source of information.
- to upgrade standard of education through the use of computer and telecommunication technology.

4.6. CATEGORIES OF COMPUTER-IN-EDUCATION

The use of IT in education can be categorised as follows:

Teaching about computers

- Computer Literacy of students - Teaching students about the use of computer hardware and software.
- Specialisation in IT:

Using computer in teaching and learning

- Facilitate student learning and enhance teacher effectiveness
- Using application packages such as accounting packages and CAD/CAM packages for innovation & creativity in technical schools, besides spreadsheets, databases or word-processing packages.
- Using computer as a tool or means for performing some educational or administrative function such as accounting packages and CAD/CЛМ packages for innovation & creativity in technical schools, besides accessing and sharing information and communication.
- Application packages spreadsheets, databases or word-processing packages.
- Resource centre/Internet. E-mail to enhance access to a wide range of information databases and as well as interaction between student and teacher, and between student and other computer users world-wide.

4.7 . STRATEGY

- Equipping schools with computer laboratories. The schools that are selected for the CTE project are equipped with computer laboratories at the ratio of two laboratories for school with more than 750 students 2nd one laboratory for schools with less than 750 students. Each computer laboratory is provided with 21 computers.
- Introduction of curriculum on computer literacy and computer aided instruction Teacher Training and Technical Training Levels. Computer and telecommunications are used in teacher training and technical training as a medium of instruction and also a tool for communication.
- Distance learning in Higher Education.
- New information technologies such as computer-mediated-communications, video-conferencing- and audiographics are used in higher learning institutions as instructional medium either for on-campus or distance education, and as a tool or means in performing some educational or administrative functions.

4.8. STATUS OF IMPLEMENTATION

Pilot projects

1986 - Computer Literacy in 20 secondary schools, involving Form 4 (Grade 9) students.

1992 - Computer Literacy for Form 1 and Form 2 students in 60 rural secondary schools.

These two pilot projects covered the fundamentals of computer hardware and software and exposed students to some standard application packages, such as word-processing, graphics, spreadsheets or databases. To minimise cost the schools were supplied with PCs designed by MIMOS.

1994 - CAI/CAL in 15 primary schools, confined to the teaching of Mathematics and English using courseware.

In this instance, the computer was used as an adjunct to other forms of instruction. Typically, the content was presented through class presentation, and tutorial or drill exercises provided on a computer using courseware developed by the CIE Unit of the ministry. The courseware were developed using Linkway or ComIL system authoring tool.

1995 - Education Networking, whereby 50 secondary schools were linked to the Internet.

- Electronic Resource Centre, which provided 14 secondary schools linkages to the Internet. The activities carried out were electronic messaging, on-line access to library catalogues, access to databases, and file transfers.

1996 - 90 Secondary and 20 Primary schools will be involved in the CIE programmes. Computer equipment are being procured.

Full implementation

1989 -Information Technology course at Diploma Level was introduced in 2 Polytechnics. Other polytechnics will follow in phases.

1993 - Computer Literacy was made compulsory in 31 teacher colleges

1994 - 14 weeks CIE training for teacher in teacher colleges was introduced.

4.9 . PRIVATE CONTRIBUTORS TO CIE

The private and non-government bodies played a significant role in CIE. This includes:

a) the Malaysian Council for Computers-in-Education (MCCE) a non-profit non-governmental organisation that serves as a clearing house of information on developments in educational computing. The MCCE organise EDUCOMP (National Educational Computing) symposiums where IT educators and professionals and teachers gather and exchange idea and experience in CIE.

b) Computer-Assisted Learning Laboratory (CALLAB) introduced by a local computer company where courseware it developed for Mathematics, English and Malay are used.

c) Knowledge Resource Centre (KRC), a project by a private company which involves the setting up of an Electronic Library System in participating schools using the latest computer technology featuring multimedia CD-ROM based software.

5. EDUCATION NETWORKS (EN)

5.1. This is an integrated EN project which includes the incorporation of Internet activities in schools for leaching and learning and use of E-mail and Internet for information, communication, administration and management. For the schools the objectives of the project are:

- to enhance communication and information exchange among teachers and pupils;
- to enhance the skills in finding equating and sorting of information among pupils;
- to provide the opportunity for teachers and pupils to communicate and to retrieve information from various sources around the world.

5.2 .As a part of CTE pilot project severs have been installed for the EN at the Computer Technology Laboratory. CIE Unit and EPRD and linked to JARING and the Internet. This enables schools participating in the pilot project to use the Internet. Homepage on the MOE are being developed at EPRD. Some schools have also developed their own homepage.

5.3. Under this project Divisions, SED. DEO/REO Teacher Colleges, Polytechnics, Teacher Activity Centre, Electronic Resource Centre and schools, will be networked to JARING taking into consideration the CIE pile: projects and the KPMNET. MIMOS have been identified to implement the nation-wide EN.

6. FUTURE DIRECTIONS

6.1. MOE will network all agencies in the MOE from the federal level, SEI3, DEO/REO to schools through wide area network for administration and management. This includes networking to the Internet through JARING.

6.2. The Education Network Project wil1 be implemented nation-wide in 3 phases during the 7th Year Plan The network will allow people to send and receive electronic messages, communicate, contribute and access information. It will also be used for administration and management

6.3. A CIE Division will be established to expand and implement the CIE programmes. The main Functions of this division are:

- to plan, implement and supervise the activities of CIE, in the MOE, and
- to plan and implement research and development on the use of computer and computer network in teaching and learning.

6.4. A computer subject will he made compulsory in schools to ensure that the country will have more people who will be able to manage high technology projects.

6.5. Higher education will he expanded through distant learning using the Education Networks (EDUNet), a nation-wide fibre-optic and digital microwave networks which will facilitates video-conferencing between and within the institutes of higher education.

6.6. MIMOS, the R&D government agency that has collaborated with MOE in CIE will develop cheap multimedia computers costing less than RM 1000 (US$ 400) a unit. This will enable MOE to provide each school with between 40 to 45 units of computers and every student the opportunity to benefit from CIE programmes. The production of cheap multimedia computers will ensure that MOE's goal to network computers in schools nation-wide to the Internet in the 7th Malaysia Plan is successful. RM 1.6 billion (US$ 0.64 billion) has been allocated to support computer supply to schools.

7. CONCLUSION

Malaysia has a clear vision of what it wants to be in 2020 and that is to become a developed country that will have among others an information rich society to enable it to be a competitive player in the 21st century global market. In order to realise this Malaysia will adopt and master the technology that will fake it there. The development of the Information Superhighway and Multimedia Super Corridor between Kuala Lumpur, the capital and the new International Airport and the launch of the First

Malaysia East Asia Satellite (MEASAT) which marked the country's entry into space technology will give us the structure needed for IT development.

Malaysia will require a variety of IT skills, experience and expertise to enable us to become an information-rich society. Education is the key to acquiring these thus the MOE has taken serious measures to equip all schools before the end of the 7th Year Plan and has launched the EN Project. Information network has become an educational need in line with the change in socio-economic activity which is increasingly dependent on IT as the strategic technology For national and educational development. An integrated network system covering the whole country must be implemented for the MOE to make educational activities, administration and management more efficient and productive.

Through the CIE programme students are exposed to computer literacy programmes that will enable them to use and manipulate the computer as a tool for learning and doing works while teachers are learning to the use IT in enhancing their teaching and facilitating their works. The Internet provides a new mean of communication and a source of information for both students and teachers. Institutions of higher learning are now venturing out to more sophisticated and advanced areas in IT like internetworking and multimedia. The private institutions are offering more specific IT related courses including twinning programmes with foreign universities.

With the launching of MEASAT new technologies in education are now available. The EDUNet open possibilities for universities to offer higher education cheaper and to more people through distant learning. The EN project will help to produce a set of people who will be able to contribute in the future construction of a National Information Superhighway linked to the global network so that we can become part of the global community and capable of exploiting the most advanced information technologies and help make Malaysia a regional IT hub. With these developments Malaysia will be ready to meet the challenges of the Vision 2020 and the 21st century.

PREPARED BY

EDUCATIONAL PLANNING AND RESEARCH DIVISION
EDUCATIONAL TECHNOLOGY EDUCATION & INFORMATION SYSTEM DIVISION
MINISTRY OF EDUCATION

NATIONAL REPORT OF MEXICO

INFORMATICS IN EDUCATION IN MEXICO

According to Mexican Laws (Constitution, article 26, and Law on planning, article 5), President as Federal executive power is to work out the Plan of National Development and to submit it to the Congress for approval.

The present government came into action in December 1994, so the plan, which has already been approved, spans the period from 1995 through 2000. To carry this plan out, programs in various sectors, the educational sector included, were developed.

Education in Mexico is public, as provided by article 30 of our Constitution. The number of students in this country has reached 30 million on all levels, and 80% of them learn in state-supported institutions.

It is pointed out in the plan that "technologies are changing very rapidly, which leads to the necessity of drawing up all the resources so as not to fall behind in the global competition of nations". It is said also that "realizing these tendencies, development of education, raising of qualification, and creating an adequate technological infrastructure are the main factors that will allow this country to make use of the ever growing world scientific potential for the benefit of our economical growth and for raising the standard of living of our people.

In the Plan of Development for 1995-2000 some priorities in the field of informatics are outlined. Some excerpts from this document follow.

"Using electronic devices, such as audio and video players, telecommunications, computers, in education plays a great role in distribution of knowledge and of information to the society. The rapid growth of the branches of science related to communication has enlarged the amount of information available to the society and gave strategic importance to the skills required for using information in various areas of social life.

"Even now many countries, Mexico included, have gained experience to the effect that electronic technologies have a great potential in education. On the on hand they facilitate and enhance teaching and learning, on the other hand they allow to provide the population of remote and diffusely populated areas with education.

"We have some experience in computerization both on the federal level and in separate states of the Republic, where the work was done in cooperation with Latin American Institute of Education and Communications (ILCE) from 1985 through 1992. It is then that the project known under the name "Computerization of primary education" was carried out. The aim of this project was to teach teachers to use the computer in class for didactic purposes. 16,000 ten-year primary schools took part in this project. As a result, 138,000 teachers learned to use the computer for didactic purposes and 26,750 computer systems were supplied to schools for optimization of the educational process.

"Although not all of the purposes of the project were fulfilled, it marked the start of introducing new technologies into schools and familiarizing teachers with computers.

Unfortunately, the economical situation prevented the works begun in 1985 from continuation, and in 1992 they were completely suspended. At present there is no possibility either to develop the software that meets the demands of the society, or to purchase it, because there are but a few programs intended for school education, and all of them are extremely expensive.

At present, only 5 of 32 subjects of federation continue to work systematically in this direction and can to some extent hope that the authorities will fund the purchase of computer equipment and educational software for their projects.

The remaining states practically do not have the resources for the purchase of computer equipment and software, let alone development and financing the research. Even the schools that received equipment and software between 1985 and 1992 years, do not receive enough finance to work with it.

However, "taking into account the progress in informatics and its introduction into the society in which the modern youth is being formed, installation of computers in classes seems possible in the nearest future".

This is why the state structures are planning the development of informatics in education in the coming year 1997, both in the primary school and in baccalaureate (thirteen-year school) by way of an experiment. To that end, it is necessary to purchase and/or develop educational software, to enhance and/or upgrade research equipment, to secure the assistance of experts in didactics and teachers, to create a system of networks on all levels of education (pre-school, elementary school, primary school, and baccalaureate) which will meet the modern needs of Mexicans.

The above stated purposes can be also fulfilled with the restructuring of the telephone network, which began in Mexico in 1997 with a great success. This is related to the monopoly of the company Telmex in this field and with the activities of private companies, which laid optical cable and undertook to introduce most modern technologies.

"In view of all the above stated, the Mexican state is planning to introduce new technologies in communication and informatics, which will allow to raise the quality of education to the level it has never had, to make the educational system more flexible and adequate to the needs of the Mexican society. As a result of the efficient usage of electronic educational equipment, the prerequisites for creating the culture of continuous education will be provided for, which will allow people to widen the horizons of their personal and social development".

MEXICO CITY,
THE UNITED STATES OF MEXICO

NATIONAL COMMISSION OF MEXICO FOR UNESCO

NATIONAL REPORT OF THE NETHERLANDS

POLICIES ON COMPUTERS IN EDUCATION IN THE NETHERLANDS

By constitution, all schools in the Dutch education system (public and private) are funded by the Government provided that they meet the standards of quality set by the Ministry of Education and Sciences. Within the framework of these standards, schools are free to organize their teaching and learning processes. The introduction of new technologies in education began in 1982 with stimulation policies that launched several promotional programs over four time periods until 1992. Since 1993, the Dutch government has considered new technologies a regular part of educational practice.

STRUCTURE AND NATURE OF THE DUTCH EDUCATIONAL SYSTEM

FREEDOM OF EDUCATION

The Dutch Constitution, dating from 1848, establishes a principle of educational freedom in the Netherlands. Freedom of education means that groups of private individuals have the right to establish schools on the basis of their own particular philosophy of life or their own views of society and education and that these schools will be funded equally by the government. This produces a wide variety of types of schools which fall into two main categories. Publicly-run schools are controlled by the municipalities. Privately-run institutions fall into three groups, Roman Catholic, Protestant, and non-denominational private schools, which are not based on a religious belief, but have a private school board. In 1992, a total of around 6,300 school boards, existed in the Netherlands, and nearly two-thirds of them belonged to private schools (Krins, Plomp, & Scholtes, 1992).

All schools qualify for government subsidy provided that they meet the criteria for quality laid down in various statutes and regulations and provided that they are likely to meet the minimum standard for student numbers. The principle of financial equality between publicly-run and privately-run education has been established since 1921. This means that government expenditures for publicly-run education have to parallel the expenditures made on privately-run education. Until the age of 16 years, children have to attend an educational institution that meets statutory requirements and measures up to the standards of quality set by the Ministry of Education and Science. These standards define the subjects or areas of the curriculum that are compulsory under statute for various types of schools and specify examination requirements or attainment targets. Regulations regarding subject combinations, the time-tabling of lessons, and examination syllabi guarantee a degree of standardization in the intake and output of the different schools. Within the framework of these standards, schools may choose from a variety of methods to organize the teaching and learning processes they will use.

REGULATION OF EDUCATION

The central government controls the education system by means of legislation and regulation while the administration and management of Dutch schools are accomplished on a decentralized, municipal basis. Major central government responsibilities with regard to educational policy include ensuring that adequate facilities for education are properly spread around the country, providing funding and supervision, controlling the procedures and quality of examinations, and promoting innovations. The provinces play only a modest role. Their duties are mainly supervisory (to ensure that sufficient public provision of education is available at the primary and secondary level) and judicial (to settle appeals brought against decisions made by municipal authorities).

The municipalities are the de facto authorities with regard to managing publicly-run education. They are also charged with certain executive duties, such as supervising school compliance with the Compulsory Education Act and reimbursing the costs of school facilities, for which they in turn receive reimbursement from the central government. Municipalities reimburse the expenses of privately-run schools on the same basis as they reimburse publicly-run schools.

Funding

Education is funded by the Ministry of Education and Science. Excluding student grants and loans, the 1992 budget totaled 27 billion guilders (14.2 billion in U.S. dollars). This amount is equivalent to 5.8 % of the net national income and accounted for approximately 13 % of the total government expenditures. Money for the education budget comes from tax revenue and, to a limited extent, from the tuition fees charged by schools, evening-class institutions, universities, and polytechnics. Students beyond the age of compulsory education (above 16 years) are asked to contribute to the cost of tuition, but student financing schemes exist to ensure that these contribution requirements do not limit access to education.

The government distributes resources throughout the education system according to either a declaration-based model of funding or a norm-based system of funding. In the declaration-based model, schools declare their expenses (in accordance with various rules) and then actual costs are reimbursed on the basis of the declaration. In the norm-based system, schools receive funding according to a standard limit, so government control over the legitimacy of expenditures is less detailed and the schools have greater freedom to spend their money as they see fit. Recently, the government has gone over to the norm-based system for an increasing number of school sectors. Already established within higher education and senior secondary vocational education, the norm-based system is also expected to be applied to general secondary and primary schools over the course of the next few years.

LEVELS OF POLICY DECISION-MAKING

External bodies *advise* the Ministry of Education and Science with regard to policy-making. One permanent advisory body, the Education Council, was established by statute in 1919. It has 80 members and can advice the Minister at his request or on its own initiative. The Council takes a supervisory role in maintaining financial equality between the publicly-run and privately-run institutions, coordinating educational policy and regulations, and preserving the educational freedom that schools have to organize their teaching within the standards set by the government.

For new policy proposals, the Ministry of Education and Science *consults* with various bodies composed of representatives of the schools and institutions, staff, parents, and students. In consultation, these bodies are represented by four umbrella organizations, one for publicly-run education and one for each of the three ideological categories of privately-run education (Roman Catholic, Protestant and non-denominational). Such consultations precede any discussions of policy proposals that take place in parliament. Parliament then ratifies the main lines of approved policy proposals, by statute or otherwise.

As a consequence of its freedom of education principle, the Netherlands has no national curriculum. The substance of educational is regulated at the national level only through the specification of examination requirements and attainment targets. Based upon these, commercial educational publishers develop textbooks and compile sets of teaching and learning materials called "methods". The individual schools or teachers then decide which of these methods to use, always with the opportunity to choose among the products of several publishers.

The government subsidizes the design of new curricula via development projects carried out by the National Institute for curriculum Development of by one of three national educational support centers (one Roman Catholic, one Protestant and one non-denominational). Since no curricula can be prescribed by government, the products of these government-subsidized endeavors can only serve as than examples. However, development projects of this kind prompt educational publishers to modify their products.

VARIATION BY TYPE OF SCHOOL

Table 1 lists the different types of schools in the Dutch educational system while Figure 1 illustrates the structure of the system. A development of each educational sector follows below.

Table1.

Number of Students and Teachers (in Thousands)
In Dutch Educational System, 1990 - 1991

	Teachers	**Students**	
Type of Education	full-time	full-time	part-time
Primary education	71,8	1,441	---
Special education	17,9	109	---
General secondary	69,7	897 [1]	119 [2]
Mbo and adult education	31.7	432	157 [3]
Higher vocational	--- [4]	183	50
University education	--- [4]	160 [5]	

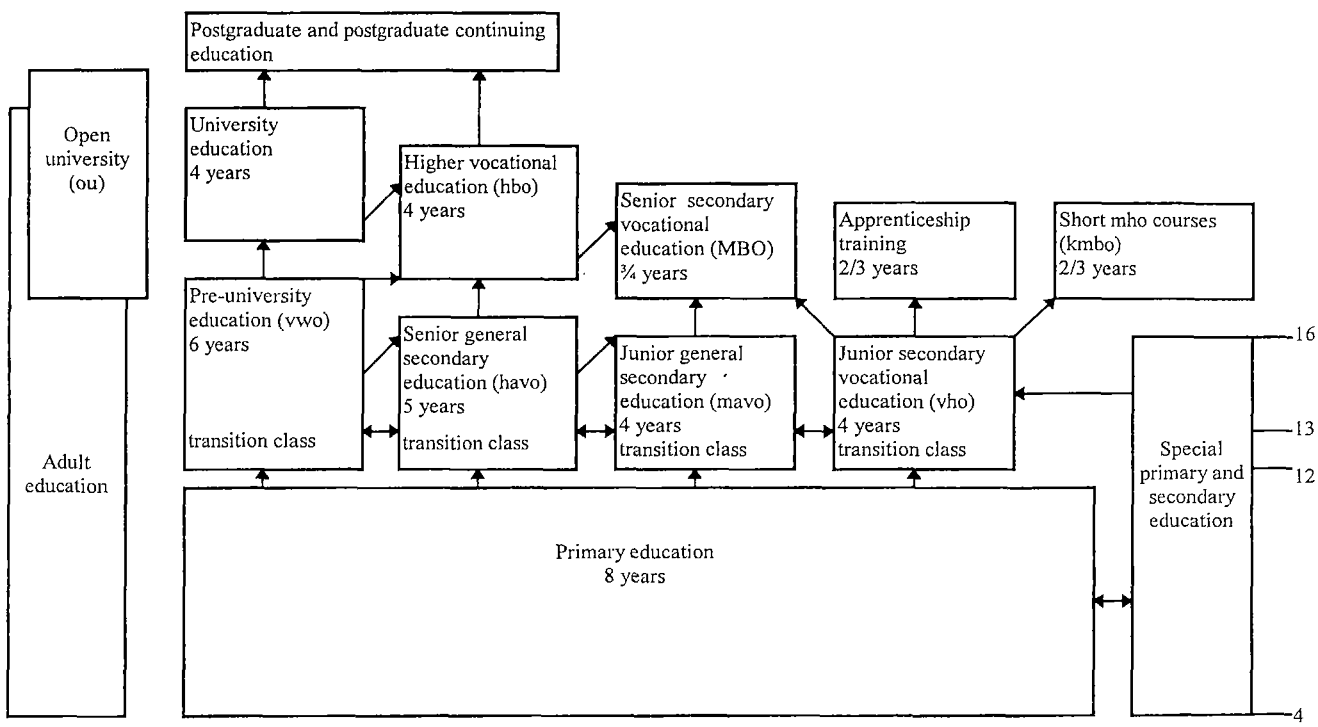
Notes:
1 = 75% of these are enrolled in vwo/have/mavo (general secondary).
2 = All part-time students are enrolled in general secondary (vwo/have/mavo)
3 = All part-time students are in vocational secondary (mbo)
4 = data not available
5 = This number includes part-time enrollees.
Source: Education budget 1992, Key educational statistics.

PRIMARY EDUCATION

The Primary Education Act took effect in 1985 and introduced a new-style primary school that integrated the old-style nursery and elementary schools. The new-style primary education offers children between 4 and 12 years of age an uninterrupted period of schooling geared to the progress and development of the individual child. Schools providing special education exist for children with handicaps or with learning or developmental difficulties who are unable to attend mainstream schools.

GENERAL SECONDARY EDUCATION

Within secondary education, a distinction is drawn between general and vocational education. The Secondary Education Act of 1968 sought to improve coordination between the different types of secondary schools, provide opportunities for horizontal and vertical transfers between the different types of schools, and offer a combined first year called the transition class. The intent of the transition class is to bridge the break (or transmission) between elementary and secondary schooling and between the different kinds of schools within secondary education. Two kinds of transition class eventually emerged: one for general secondary education and one for vocational education.



Source: Netherlands, Ministry of Education and Science.

Figure 1. The Dutch Education System Today.

Since 1968, debate on the structure of secondary education has continued. The most recent proposal, a new plant for Basic Education, was implemented in August 1993. Embracing the first three years of secondary education, it provides a basic comprehensive curriculum for all pupils aged between 12 and 15.

The objectives of the new basic Education are to allow the postponement of selection decisions, to encourage personal development, and to offer a more broadly-based education. The Basic Education Bill assumes that these objectives can be achieved without many statutory change in the existing education structure. Therefore, the different types of secondary schools (vbo, mavo, havo, and awo) will continue to exist and, following the period of Basic Education, pupils will be able to opt to complete their secondary education at any of these four types of schools.

VOCATIONAL EDUCATION

The four boxes in the upper corner of Figure 1 depict the alternate paths available for vocational education in the Dutch school system. Preparatory secondary vocational education (vbo) provides general pre-vocational education and it is not intended as terminal education. Its first three years are intended primarily for basic education while the fourth year is more vocationally-oriented. Schools in this group offer courses in technical subjects, commercial fields, and agriculture as well as in the personal and social services and health care. Senior secondary vocational education (mbo) is entirely vocationally-oriented. In a period of three to four years, it trains students for middle-management jobs in industry, the service sector, health care and government.

Short senior secondary vocational courses (kmbo) provide an alternative to pupils who are leaving either general or vocational schooling at the junior secondary level without having found their way into vocational courses at the mainstream senior secondary level. These short courses, which last two to three years on a full-time basis, lead to occupational qualifications. Finally, the apprenticeship system offers a form of vocational training that combines one or two days of classroom education a week with on-the-job training for the remainder of the week. Trainees in the apprenticeship system are paid for their on-the =job time.

SOME FACTS AND FIGURES

Table 2 indicates the overall size of the Dutch educational system. Over the last few years, growth in special education has halted while the number of pupils in primary education has slightly increased. The number of students in higher education is also increasing. In general, as compared with a decade ago, young people are staying on longer at school before entering the labor market.

Table 2.

Number of Schools and School Size in 1991

	No. of Schools	Average No. of Pupils
Primary education	8,422	170
Special education	1,004	109
General secondary	1,228	588
Junior secondary vocational	420	388
Junior-senior secondary vocational (combined)	39	1,962
Senior secondary vocational	146	1,395
Higher vocational	73	2,507
University education	12	13,879

Source: Education budget 1992, Key educational statistics

In addition to expansion in the size of the system, there is a continuing expansion in the scale of educational establishments as Table 2 indicates. It began with higher vocational education in 1987, continued with senior secondary vocational education in 1990 and is now occurring within all of secondary education. Primary education is likely to experience the same trend. This expansion in scale was prompted by government measures that defined minimum school sizes provided extra financial considerations for bigger schools. Expansion is motivated by the goal of greater efficiency.

COMPUTER-RELATED POLICIES

Beginning in 1982, the Dutch government applied a series of stimulation policies to promote the use of new technologies in education. The stimulation took place via group of promotion programs that can most easily be described in terms of four separate time periods. Figure 2 summarizes the goals, budget, and scope of each of these promotion programs in turn. Only a limited number of issues have been settled by statue-namely that new technologies should be used in physics in upper secondary school, in informatics in vocational administrative (upper secondary) schools, and in informatics and computer literacy (as a small course of 20 lesson periods) in lower secondary education.

Exploration, 1982 - 1983

The first steps were taken with the so-called "100 Schools Project". The aims of this project were broad: "Let a thousand flowers bloom". At that time, the possibilities of information technology (IT) for education were too little understood to be able to formulate clear objectives. The 100 School Project focused on creating computer awareness and improving computer and information literacy. It included the provision of computer hardware, inservice training, and assistance with curriculum development.

PROVISION AND INTRODUCTION, 1984 - 1988

The INSP (Information Technology Stimulation Plan) project embodied a developing national policy to promote the use of information technology (IT) in education. Policy proposals and their companion budgets were organized either according to educational sector or according to

Figure 2. Comparision of Promotional Program for New Technologies in the Netherlands

project	100-school	insp	nivo	poco	na-bont	opstap	print	comenius	presto	enter	new media
Period	82-84	84-88	86-90	87-91	87-92	89-92	89-92	90-94	91-93	93-96	87-92
Budget (in millions Dfl.)	6	270	100	26	95	50	100	105	45	450	14
Sectors											
Primary education		x		x		x	x	x		x	x
General secondary education	x	x	x	x		x	x			x	x
Junior and senior sec., voc. Education		x		x	x	x	x		x	x	x
Higher vocational education		x			x						
University education											
Adult education		x				x	x			x	
Infrastructure*		x				x	x			x	x
(in service) Training		x			x	x	x			x	x
Aims											
Training for citizenship**	x	x	x			x	x	x			
Human capital***		x			x	x	x		x	x	
CAI		x	x	x		x	x	x		x	
Computerization of administration											
Expenditure											
Hardware acquisition	x	x	x			x		x		x	
Courseware development	x	x	x	x			x		x	x	
Courseware acquisition			x			x		x	x	x	
Application software acquisition		x							x	x	
In service training	x	x	x		x		x	x		x	
Curriculum development		x	x				x		x	x	
Support for implementation							x			x	
Information			x			x	x	x	x	x	

<u>Notes:</u> ** = measures to stimulate production of educational software; ** = preparation for the information society; *** = preparation for satisfactory performance at work*

Source: Krins, Plomp, & Scholtes (1992)

function (for example, to facilitate inservice training or software development). INSP put forth two primary objectives: (a) to promote information and computer literacy as an essential element of preparation for life in society, and (b) to improve the quality of vocational education ("human capital") by preparing skilled workers. The use of IT to enhance the learning process itself was mentioned only as a secondary possibility, although a significant proportion of the development activities focused on this aspect.

The INSP project led to a number of parallel projects. (See the four columns subsequent to INSP in Figure 2. The NIVO and POCO projects will be described in some detail below. The NaBoNT project created substantial opportunities for people in vocational education to receive inservice training from specialists in business and industry. The New Media project explored possibilities of technological innovations for education. All four projects are described in Krins, Plomp, and Scholtes (1992).

The NIVO (New Informational Technology for Secondary Education) project involved collaboration among government, business, and the educational umbrella organizations (see the section on 'Level of Policy Decision-Making") to provide hardware and in-service training on a large scale. It was financed jointly by the government and the companies who initiated the project, IMB-Netherlands, Tulip Computers, and Philips. Efforts to acquire sponsorships from other companies were disappointing. The NIVO project was organized into several subprojects. In the *hardware subproject*, at lower secondary schools (vbo, mavo, havo, vwo) received a configuration consisting of one file server and eight network-linked pupil workstations (16-bit; MS_DOS 3.1 or higher) plus two stand alone computers intended for specific use in the subject areas. In fact, this approach established a hardware standard.

In *the inservice training subproject*, a minimum of three teachers at each secondary school (of whom at least one was a woman) received 80 hours of initial training in educational computer use. To cover all schools and build a broad base of training within a short period of time, a cascade model was applied. Sixty lecturers from teacher training colleges were trained by specialists from computer manufacturers and software houses; these lecturers then trained three teachers per school; and the trainees themselves were asked to determinate further introductory training to their school colleagues. In addition to the introductory course, all teachers could receive in-service training in information and computer literacy and the use of IT for subject area teaching.

The *courseware subproject* (in combination with the curriculum development subproject) was directed at developing teaching materials for information and computer literacy as well as for use of the computer to teach other subjects. Each school received a "starter pack" of software consisting of an author language and word processing, spreadsheet, and data base programs. Schools are also received a software coupon of Dfl 200 (105 US dollars). Sometimes exemplary lessons were provided. The actual use of the software in the classrooms was, however, disappointing.

The POCO (Software Development for Computers in Education) project was intended to bring onto the market a critical mass of rapidly usable courseware. It began in response to the failures other projects were having in producing sufficient courseware capable of meaningful and easy use by teachers. The POCO project was distinctive for taking its ideals for courseware from a curriculum analysis and from the wishes of the educational world. As a result, a standard user interface was developed, and the courseware development took place according to a fixed pattern. The products developed were then offered to educational publishers in order to make them available to schools through the usual channels and at acceptable prices. (Schools could use their software coupons for buying software). Vendors were required to return to POCO a certain percent of their sales profits for starting new projects. A disadvantage of the POCO project was the separation of responsibility for courseware development on the one hand, which a specially established management team handled, from the responsibility on the other hand for converting the courseware into marketable products, which, according to Dutch rules, must remain in the hands of the publishers.

IMPLEMENTATION, 1989 - 1992

The OPSPAP period began when the government decided to provide a further boost for IT within education by making funds available for another period of four years. The Dutch word "opstap" means "going away" or "moving on". The government used the word to express its intention that, after this additional period of support, schools in principle should be able to implement and independently maintain the use of IT in their educational practices. The aims of OPSTAP were much like the aims of the INSP project, but the new project broke with the procedures of the INSP by ending the integrated approach. Thenceforth, hardware acquisition and infrastructure measures were brought under the control of the Ministry. (See the Comenius project below). Meanwhile, courseware development, inservice training, and the support of schools became the responsibility of the educational support organizations. (See PRINT project description given below).

The PRINT (Project Implementation New Technology) project derived from the OPSTAP idea that a single development project should promote and implement the use of IT in the schools. The PRINT project took up that task, originally encompassing the sectors of primary education, special education, general secondary education, and secondary vocational education. Its aim was to offer schools help with their own processes of introducing IT into their educational practices. More specifically, PRINT offered assistance through organizing courseware development (in conjunction with the POCO project), through organizing professional development activities, and by fulfilling a general "help" function (providing advice and information about the use of IT and IT-related products).

The PRINT project activities, however, were organized somewhat separately sector by sector. For the sector of primary and special education, PRINT operated in conjunction with the Comenius project. In the sector of general secondary education, PRINT continued with the lines set out in the INSP and NIVO projects. Activities new to the PRINT project included the development of a 20-hour course on "information and computer literacy" for the new Basic Education curriculum at the lower secondary level. Other PRINT activities concerned the use of IT in a subject areas such as Dutch language, mathematics, and general technique; curriculum development in the area of computer science for the middle years of secondary education; and the integration of IT in the examination syllabi of upper general secondary education subjects such as physics, social studies, mathematics, and business economics. In this period, a norm-based reimbursement level was introduced for hardware maintenance or replacement, software acquisition, and the costs of consumables. The guideline implied that a school with 1000 pupils could spend approximately Dfl 12,000 (6.300 in US dollars) a year.

The Comenius project paid new attention to primary education. Because the INSP project had given priority to vocational and general secondary education, only a few experiments had been carried out to explore the possibilities of IT for primary education. Nevertheless, many primary schools took the initiative to acquire hardware in the INSP period and started to get familiar with the new technology on their own. By 1988, the government concluded that the time was ripe for a hefty push to stimulate IT in primary schools and approved the Comenius project as a mechanism for doing so.

From the Comenius project, primary schools in 1990 began to receive MS-DOS AT computers (1 computer for every 60 pupils) for the purpose of exploring IT's possible uses in primary education. Based on experiences from the INSP period, schools were given a year to prepare themselves for working with IT. A the computer coordinator was trained in advance and hardware was supplied to the schools while the inservice training of teachers (on a school team basis) was still in progress. The schools also received a starter pack of Windows software, part if which could only be used by teachers.

The PRESTO project developed as an offshoot of the PRINT project. After PRINT had been in operation for more than a year, it was decided that vocational education differed too significantly from education in the other sectors to be managed in quite the same way. PRESTO was set up to organize PRINT activities separately for vocational education, paying special attention to the culture of vocational education and the kinds of IT applications it involved.

POLICY INTENTIONS, 1993 - 1996

"ENTER: The Future" was activated when the State Secretary for Education and Science published his intentions in February 1992 for the near future of information technology policy in education. Four principles direct the ENTER project. First, with schools having autonomy and control over their own affairs, any further implementation of IT in education would take place under the authority and responsibility of the schools themselves. Second, because a technology based had been established within the schools during the preceding 10 years, schools themselves were now in a position to direct the integration of IT into their educational practices. Third and also because a certain infrastructure had been established in each school, IT in education no longer needed to be as much of a policy theme in itself as it needs to become instead an aspect of other policy themes. (For example, an aspect of the policy to introduce Basic Education in lower secondary education in the degree to which IT can function in relation to accomplishing those goals) Finally, central government would take a more selective role toward IT in education. Its work would be restricted to monitoring technical developments and translating them into curricula or examination syllabi and to encouraging courseware development for small target groups.

When it became clear that only a relative small number of teachers used computers as medium for teaching and learning in lower secondary schools, a new project started in 1993: Project on Information Technology (PIT). About 200 schools were selected for participation in this two-year project in which groups of about 25-30 teachers form a network for mutual support, exchange of experience and lesson ideas. Participating schools were financially facilitated and made a commitment to stimulate ICT use in at least three curriculum areas.

Because of the unique potentials of ICT for new teaching and learning practices, teachers have to be prepared for these developments. Therefore the Dutch ministry have planned to set up seven regional centers for information technology. These centers will be related to teacher training institutes and offer teachers the opportunity to learn about and to deal with the teaching and learning conditions of the future.

ISSUES

EQUAL OPPORTUNITIES FOR GIRLS AND BOYS

Of the Education Department's total expenditures on the promotion of information technology since 1986, 0.1 % (some 0.5 million Dfl, or approximately one-quarter million U.S. dollars) was spent on promoting the equal participation of boys and girls with IT in schools. In addition to this, emancipation budgets within the Education

Department and the Ministry of Social Affairs have enabled other measures to be taken to stimulate girls' participation in math and science courses and technical education.

In the beginning very few were aware of the danger that IT might become a male province in the schools. This risk was pinpointed when the National Center for Woman and Informational Technology, on its own initiative, presented the Minister with a report on the matter. The report successfully focused attention on the issue, at least in secondary education. (One of the most practical measures that followed was the NIVO project's rule to assign at least one woman among the three teachers sent to compulsory inservice training by each school.)

Since the time of their 1984 report, the National Center for Woman and Informational Technology has received increasing numbers of commissions from the Ministry of Education and Science to develop learning materials and promote equal participation. The first such commissions related to primary and secondary education. In 1991, efforts also began to provide extra encouragement for girls in vocational education to get involved in IT. Nevertheless, IT still continues to be a male preserve in most schools (Janssen Reinen & Plomp, 1993a, 1993b) and no prospects of further promotional measures to combat that fact are currently on the horizon.

OTHER AREAS FOR SPECIAL ATTENTION

Krins, Plomp, and Scholtes (1992) claimed that a number of additional issues are practically alive in the contemporary relationship of IT to education in the Netherlands. One question is whether IT is already deeply enough rooted in the schools for management to continue to ratify it as priority. Funds for IT promotion have been "changing color" in that the financial resources for stimulating IT in education are increasingly being concentrated within the ordinary reimbursement of running costs. In other words, instead of receiving funds that are earmarked for IT expenditures, schools are now expected to decide for themselves whether to devote such funds to the purchase of software, hardware, and IT courses or to new books, curtains, window-cleaning, and other things that might also appear as priorities. Likewise regarding vocational education, the main question is whether reforms can continue to be introduced at the same pace now that -- given the norm-based budget system -- the schools themselves have to take the initiative to make investment decisions to invest in favor of IT.

The extent of implementation within secondary education is a matter that concerns many minds. The number of school hours available for "information and computer literacy" is very limited, and integrating IT in other subject areas has proved to be an uphill struggle. Some people blame this lags on the belief that too few initiatives have yet been taken to supply hardware, software and teacher training to all the schools and all the teachers. Others blame the lack of a proper marketing approach, one which would be based on the principle of the teacher as the primary user. Yet a third category of observers believe that the benefits of IT to secondary education are either insufficient or too threatening for IT to have been embraced more fully by the schools.

In primary education, the issue is now mainly one of the acceptance of IT in the schools. As already noted, expectations are running high.

For a while, ways were being sought to induce greater activity on the part of the educational publishers. A study on the potential for public-private partnership with regard to courseware development produced some ideas, but these were rejected. The government is not currently undertaking any special action to stimulate publishers.

CURRENT TRENDS IN COMPUTERS IN EDUCATION

IT IN THE CURRICULUM

The integration of IT in the curriculum differs from one educational sector to the next. In primary schools, it is too soon after the introduction of an infrastructure to be able to speak of IT's integration in the work plans of the schools. Furthermore, it is not the intention of the government to prescribe "information and computer literacy" as a subject area for the youngest students. Within special education, IT has not so much affected the content of the curriculum as the types of aids that can be used to teach pupils with sensory handicaps.

In general secondary education, virtually all schools were already teaching "information and computer literacy". For that reason, introducing a compulsory 20 hours on the subject as part of the new Basic Education curriculum in 1993 was not expected to create many problems. In other school subjects such as physics, mathematics, and Dutch language, it is unclear how the integration of IT will progress. Recently, as part of the new Basic Education program, support was made available for 125 schools interested in integrating IT with the curriculum. Work to develop integration methods for social studies and business economics is still in hand.

Within the technical sector of vocational education, the curriculum now includes the use of IT in a degree parallel to where it occurs in the workplace. The same generally applies to commercial courses. The updating of the curriculum lags somewhat behind in the health care sectors, but IT use seems to be increasing in the more vocationally-oriented courses of the health care training programs. Many vocational schools are getting involved in contract education to professionals in business and industry.

All student teachers are now receiving training to prepare them for the use of computers in teaching. In addition they have the opportunity to attend a basic course in information and computer literacy if they have not already received one as part of their previous training.

AVAILABILITY AND USE OF HARDWARE AND SOFTWARE

In 1989 and 1992, information on the use of computers in education was collected from a representative sample of schools in the Netherlands within the context of the comparative international study on "Computers in Education" (Pelgrum, Jansen, Reinen & Plomp, 1993; Pelgrum & Plomp,1991). The survey was organized by the International Association for the Evaluation of Educational Achievement (IEA) and was carried out in the Netherlands by the Center for Applied Research in Education (OCTO) at the University of Twente.

NUMBER OF COMPUTERS

A main finding of the Computers in Education study is the degree to which hardware standardization has been achieved within Dutch schools. Secondary and vocational education establishments are gradually replacing or supplementing their XTs with ATs, which are already the standard within primary education. Table 3 summarizes the changes in computer availability that occurred between 1985 and 1992.

Table 3.

Increase in Percentage of Schools with Computers and the Average Available Numbers of Computers during the Period 1985 - 1992

	Primary		General Secondary		Senior Secondary Vocational	
Year	%	nr	%	nr	%	nr
1985	10	2	62	10	68	14
1986	20	2	76	11	82	18
1987	37	3	84	13	87	24
1988	48	3	88	17	91	31
1989	52	3	93	21	93	44
1990	68	3	100	22	na	na
1991	77	4	100	23	na	na
1992	89	5	100	24	na	na

Note: na =data not available
Sources: Ten Brummelhuis (1993); Ten Brummelhuis & Plomp (1993).

AVAILABILITY OF EDUCATIONAL SOFTWARE

All primary schools possess a word processing program while most of them have educational games programs and drill and practice software. Virtually all secondary schools and all senior secondary vocational schools have educational tool software such as spreadsheet, data base, and word processing programs. In addition, most secondary schools have drill and practice software, computer-assisted learning programs, and an author language. All the schools providing senior secondary technical education have cad/cam software.

SUBJECT AREA SOFTWARE

Most primary and secondary schools have programs for arithmetic, the Dutch language, and geography. Software for "information and computer literacy" is available in 90 % of the secondary schools, 80 % of the senior secondary vocational schools, and 47 % of the primary schools. Few schools in senior secondary general education have software available for general subjects like the Dutch language (17 %), mathematics (20 %), and foreign languages (21 %). In senior secondary vocational education, there is a little use of computers in relation to general school subjects; however, most of the schools (94 %) do have software available for the vocationally-oriented subjects. (For more data, see: Krins, Plomp, & Scholtes (1992); Pelgrum, Jansen, Reinen & Plomp, 1993; Pelgrum & Plomp,1991; Ten Brummelhuis (1993); Ten Brummelhuis & Plomp (1993a, 1993b).

CHANGES IN SCHOOL PRACTICE AND ORGANIZATION

No essential changes in school organization have resulted from the introduction of IT in the sense of shifting from traditional to individualized teaching or re-interpreting the role of the teacher. Yet a number of facts make it clear that IT has had impact on school functions and procedures, especially in secondary schools. Most schools now have a computer coordinater, and many schools have an IT working group. In some schools, experienced computer-using teachers are providing courses for their novice colleagues and a teacher or technical assistant acts as a system manager. Often schools have had to take some measures with regard to booking computer rooms or use of the network in order to avoid scheduling conflicts. Schools themselves now have to decide how to spend their IT budgets, which inservice training courses to use, and who should attend them. Moreover, in the vocational field, schools are using their hardware and software facilities to provide commercial courses on a contract basis for professionals in business and industry.

RESULTS OF THE STIMULATION POLICIES

Obviously, the stimulation policies of the Dutch government have resulted in a situation in which it is impossible to imagine Dutch schools today without computers. But the promotion programs brought some unanticipated disappointments as well as successes. Judging the status of IT in education in these terms, as Krins, Plomp, & Scholtes (1992) have done, is one way to consider what important lessons can be learned from the Dutch stimulation policies.

SUCCESSES AND DISAPPOINT MENTS

Primary education

Experience from earlier projects helped in developing a sound stimulation strategy for primary education. Furthermore, with many schools already pursuing IT on their own initiative—despite benign discouragement from the first INSP stimulation project, Comenius was frequently able to tap into a spontaneous process already underway. In the period 1990 - 1993, the Comenius project supported 85 % of the schools with inservise courses to familiarize teachers with potentials of computer hardware and software. (The remaining 15 % of the schools receive the same support in 1994.) By 1993, 98 % of the primary schools had begun implementing IT in the classroom and in their administrative systems, hardware standardization had been achieved, and an average of two out of every three teachers were making use of computers for educational purposes.

Nevertheless, initial signals from the Educational Inspectorate suggest that? For many of the primary schools, a single year's preparation preceding introduction of computers is too short a period to prepare for their sound educational use. One reason for this was that both the new hardware and software standards were different from what the schools were used to. The choice of a modern software standard (Windows user interface) is producing delays in the availability of courseware and development of software. Another reason the year's preparation time seemed too short was that the implementation of IT in elementary schools followed the strategy of a team decision, and takes time to introduce all members of a school team to IT and to motivate them and convince them of its usefulness.

General secondary education

Even though the Basic Education curriculum now earmarks 20 hours for the teaching of "information and computer literacy", almost all the schools in this sector had been providing similar courses even before it was required by statute. The level of success in this sector is indicated by a number of observations. When new curriculum are in development, computer use is being integrated as a matter of course, and a variety of companies have emerged to market properly usable courseware. In the schools, hardware standardization has been achieved. In fact, the computerization of school administration has taken off in a big way. As for the teachers , to date some 16,000 have attended introductory courses, 2200 have taken at least one course relating IT-use to their subject areas, and approximately 1500 have been retrained to teach "information and computer literacy".

It is important to point out though that some general secondary schools were spontaneously offering as much as 80 hours in "information and computer literacy" before the 20 compulsory hours of the Basic Education plan took effect. Also, no decision had been made to introduce "computer science" as a course in the senior general secondary schools, and no strategy has been established with regard to qualifying teachers for the Basic education course. The use of computer-assisted instruction (CAI) in secondary education occurs only on a very limited scale, among a select group of teachers. Systems management facilities, too, are extremely limited. Moreover, since the ending of subsidies to the schools, the contribution of educational publishers have been disappointing.

One critical success factor, the support of principals for IT, was recognized too late. Another recognized success factor, offering personal computers to teachers at reduced prices, was not possible for the government to undertake given the structure of the Dutch educational system. School boards could have arranged to provide such opportunities, but they rarely took up the recommendations to do so. Finally, to accomplish implementation, too little attention has been and is still being paid to the teacher as the main focus for change and acceptance. A related difficulty is the speed with which the training base in the schools can be eroded. Many of the three teachers per schools who attend the obligatory NIVO inservice training are no longer employed in the schools. Of the woman given training, no more than a third are still active in the field of information and computer literacy.

Vocational education (mbo and apprenticeship)

The initial results of the demand-driven approach are encouraging. In terms of hardware, software, and modifications in the curriculum, most key elements of IT have now found a place in vocational education. Schools have themselves purchased extra computer equipment, and teachers have been given the chance to attend professional courses on a large scale. (Course enrollments have totalled approximately 40,000.) In addition, regional centers have been set up where students can go to become familiar with some of the more advanced systems that are used in the workplace. In general, the contacts between vocational schools and local businesses are well established, so the increase in contact courses provided to business and industry is not much of a surprise.

Initially, motivated by the then current realization of their lack of equipment, the vocational schools were really only interested in obtaining hardware. A current question is whether senior secondary vocational schools will fall by the wayside with regard to future innovation now that adopting new strategies primarily depends on the schools taking the initiative to do so on their own. Then, too, it was at first difficult to establish in consultation with the labor market what skills the education system should be producing. The potentials for IT have prompted many schools to adopt yet further specializations and options, even through the business world's main requirement is for the thorough teaching of basic skills.

Software development and inservice training. It took a long time to get an infrastructure for software development in place and to make good inservice training available for teachers. Subsidies for inservice training could only be gotten when the training was provided by teacher training organizations. In other words, no financial support or encouragement existed for peer-group training in the schools, even though this form of training proves effective where it is used. Increasingly, too, the importance became clear of having users participate in courseware development. The attempt to organize software development along the lines of models used in industry not only created products too expensive for the schools to purchase, it also led to lines of development that offered the inexperienced educational world too little opportunity to adapt the original ideas of the developers. A successful effort in the software area was having one central organization evaluate and catalogue the available software. This information provided schools a means for preparing themselves to act as critical consumers.

THE FUTURE

The principles of 1993's ENTER policy work toward fulfilling the "opstap" goal set out in 1989 – that is, to "move on" to a time period wherein schools are taking nearly all the responsibilities for integrating and maintaining IT in their educational practices while government retains only a limited involvement in the relationship of IT to the Dutch educational system. Federal activity was so much limited by the ENTER policy that the Technological Coordination Unit established within the ministry in 1984 could be disbanded. Yet the ENTER policy still very much represents a period of transition between government and school responsibilities.

The IT budget for 1993 - 1996 totals Dfl 573 million (301 million in US dollars), of which Dfl 400 million (210 million in US dollars) will go straight to the schools via the reimbursement of running costs as dictated by the norm-based financing system. Because the schools can decide themselves how to use their budgets, this amount can be regarded as a "passive promotion" of IT. Of the remaining of Dfl 173 million (91 million in US dollars) in the budget, approximately 82 million is tied up for projects which were begun in previous periods such as Comenius and Presto. This leaves more than Dfl 90 million available for "active promotion" by the government. On appealing area for stimulation is courseware development. Finally, to assure that education keeps up to date with advanced applications of IT, a federal task force will be created of representatives from government, educational organizations, and computer experts to commission studies and support projects. For this purpose, a small budget of about Dfl 1 million (0.5 million in US dollars) per year is assigned.

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THIS ARTICLE DRAWS HEAVILY FROM A SUMMARY REPORT TO THE EUROPEAN COMMUNITY BY KRINS, PLOMP AND SCHOLTER (1992)

NATIONAL REPORT OF NEW ZEALAND

THE USE OF INFORMATION TECHNOLOGIES IN EDUCATION IN NEW ZEALAND

1. SUMMARY

This paper first discusses the New Zealand education system and recent reforms in education. It then provides information about the development of the technology curriculum of which information technology is an important aspect. The background to the development of the use of information technologies in education is described followed by information about the current use of information technologies in education settings in New Zealand. Comment is made about the use of information technologies in post compulsory education and the paper concludes by suggesting likely future directions.

2. THE NEW ZEALAND EDUCATION SYSTEM

Education is compulsory from ages 6 to 16, but almost all children start school on their fifth birthday. Education is free from age 5 to the end of secondary schooling. Most children spend eight years in primary school and up to five years at secondary school. More than half of the country's children receive the Final two years of their primary education in an intermediate school.

There are about 2500 primary schools and over 400 secondary schools, catering for about 500,000 and 250,000 students respectively. Many of the primary schools are small and in a rural setting with 1-3 teachers. About 4% of all schools are privately owned and operated.

Prior to 1989, the education system in New Zealand was centrally organised. Although school curricula and syllabuses were determined nationally, schools had flexibility to interpret the national requirements to suit their individual circumstances. Education was administered through ten Education Boards and a Department of Education. In 1989 substantial changes commenced as part of government social and economic re-forms.

3. REFORMS IN NEW ZEALAND EDUCATION

ADMINISTRATIVE

Over the last seven years, education in New Zealand has undergone fundamental and wide-ranging change. These reforms were part of wider Government social and economic reforms designed to strengthen the economy and enhance social cohesion. The purpose of the educational reforms was to make education more responsive to the needs of the community and to make schools more accountable for the way they used publicly owned resources.

The key common principles in the reform of all sectors included:

i Charters
ii Devolution
iii Bulk Funding
iv Review

KEY PRINCIPLES OF REFORM

i Charters

All education institutions receiving Government funds must have charters which indicate what they will seek to achieve. These charters are approved by the Minister of Education. In developing their charters, there is a clear requirement that institutions consult with their local community.

ii Devolution

Employer responsibilities and management are devolved to the individual institution level. This includes senior staff with managerial responsibilities being employed under individual contracts.

iiiBulk Funding

All government-funded education institutions are "bulk-funded," based on formula allocation systems, to provide for their salary and operating costs. The control of input expenditure is minimal.

iv Review

The performance of all chartered institutions is reviewed by the Education Review Office against their agreed charters and the requirements of the Public Finance Act.

The general themes and principles of Government education reform, in particular the devolution of administrative responsibility and management to institutional boards of trustees, required the establishment of a number of new agencies and new mechanisms for accountability, review and management. These included a Ministry of Education, replacing the former Department of Education; an Education Review Office; a New Zealand Qualifications Authority; a Special Education Service; an Early Childhood Development Unit; and a Teacher Registration Board.

The overall aim of the administrative reforms was to improve the quality of education for all New Zealand children. There was a major underlying commitment to greater equity. To achieve this aim, the reforms aimed to improve administration of education by providing more effective management and greater community participation in schools. It is also important, however, to view the reforms as part of the general movement for greater accountability in education.

CURRICULUM

As part of the reforms in education in 1989 the rather large and bureaucratic Department of Education, including the Curriculum Development Division, was dissolved and a leaner Ministry of Education was established. Curriculum development is now undertaken in a different way - by contractual arrangements. The Ministry of Education has a Learning and Evaluation Policy section responsible for developing policies for the development of the New Zealand Curriculum, and a Curriculum Implementation Division responsible for the letting and monitoring of curriculum contracts.

THE DEVELOPMENT OF THE NEW ZEALAND CURRICULUM FRAMEWORK

During the late 1980's there were calls for a more coherent curriculum policy. Following its inception in 1989, the Ministry of Education began developing a comprehensive framework for a new New Zealand Curriculum.

In May 1991 a draft document *The National Curriculum of New Zealand* was issued to schools for comment. After widespread consultation this draft document was revised and published in May 1993 as *The New Zealand Curriculum Framework.*

The New Zealand Curriculum Framework is the policy statement for teaching, learning and assessment in New Zealand schools. This statement and the associated national curriculum statements [1] set national directions in education and provide a basis for clearly indicating to parents, students, teachers and the wider community what should be taught and learned during the compulsory period of schooling. The framework has the following elements:

- *Principles - the broad curriculum fundamentals*
- *Essential Learning Areas - the broad aspects of knowledge and understandings for all students*
- *Essential Skills - the skills and qualities for all students* [2]
- *Attitudes and Values*
- *Assessment*

One of the seven essential areas of learning described in *the New Zealand Curriculum Framework,* and a new area of learning for New Zealand schools, is technology.

4. THE DEVELOPMENT OF THE TECHNOLOGY EDUCATION CURRICULUM

BACKGROUND RESEARCH

In 1989 a research project was set up to study students' concepts of technology and attitudes to technology. The research instruments used were those developed at the Eindhoven University of Technology (as part of the PATT project) in The Netherlands and used in many countries. The PATT tests, together with an open-ended question, were administered to a national sample of year 8 students.

It was found that New Zealand students had poor concepts of technology but positive attitudes, to technology. Many students perceived technology to be the physical products of recent developments such as computers and high technology equipment, and of overall benefit to human beings. Concepts were positively related to attitudes. Boys had generally better concepts than girls, though girls were less likely to gender-stereotype technology. Concepts and attitudes were generally better among higher ability than lower ability students, European students than Maori students, students taking technical studies than students not doing so, and boys in single-sex schools than boys in co-educational schools.

It was decided in 1991 that further developments in technology education needed to be based on research about how students develop technological skills and understandings. A survey of overseas literature revealed that there had been little research in this area. As a result a three year research project, *Learning in Technology Education (LITE),* funded by the Ministry of Education, was let to the Science and Mathematics research Centre at the University of Waikato. The research questions investigated were:

- What are the technological capabilities of students?

- What are appropriate teaching strategies for developing the technological capabilities of students?

- What are the appropriate curriculum models for the teaching and learning of technological capability?

Information from this project provided information and direction to the Ministry of Education regarding the development of technology education and to teachers about learning in technology and appropriate strategies for the teaching of technology.

THE FRAMEWORK FOR THE TECHNOLOGY EDUCATION CURRICULUM

During 1991 a major literature search was undertaken by officers in the Ministry. Discussion papers arising from the literature search and review of overseas curriculum documents were made available on request and have been helpful to teachers and educators seeking further information.

In November 1991 the Learning Media section of the Ministry of Education distributed a video to schools showing some current technology initiatives in schools and in March 1992 a discussion booklet *So this is technology* was issued to schools based on teachers' suggestions and questions. Both of these items were designed to encourage discussion about technology education. A further discussion document *Technology in Schools* was issued in June 1993.

During 1992 a series of policy papers were prepared for the Minister of Education suggesting a framework for technology education. These papers formed the framework for the development of the draft curriculum statement for technology education. Over 200 teachers were involved in the preparation of the statement, as well as people from business and industry. The draft statement was distributed to schools for trial and comment in December 1993, and all teachers were invited to comment. The statement was revised in the light of the comments and the final statement was issued to schools in October 1995.

THE TECHNOLOGY CURRICULUM STATEMENT

The curriculum statement commences with a definition of technology and technology education:

Technology is a creative, purposeful activity aimed at meeting needs and opportunities through the development of products, systems and environments. Knowledge, skills, and resources are combined to help solve practical problems. Technological practice takes place within, and is influenced by, social contexts.

Technology education is a planned process designed to develop a student's competence and confidence in understanding and using existing technologies and in creating solutions to technological problems. It contributes to the practical development of students, as individuals and as informed members of a technological society.

And a rationale for technology being introduced as an essential learning area. The aim of including technology within the curriculum is the development of technological literacy through the development of:

- technological knowledge and understanding:
- awareness and understanding of the relationship between technology and society.

These three objectives lead directly to the three inter-related learning strands and their associated achievement objectives. The strands are:

- technological knowledge and understanding;
- technological capability;
- technology and society.

The curriculum statement specifies seven technological areas. The technological areas are as follows:

biotechnology involves the use of living systems and organisms to manipulate natural processes in order to develop processes and products to benefit people;

electronic technology and control technology includes knowledge and the use of electrical and electronic systems and their use in the design, construction, and production of systems and devices, from simple electrical circuits through to integrated circuits, robotics, and control systems:

food technology includes the understanding and use of safe and reliable processes for producing, preparing, presenting and storing food and the development, packaging and marketing of foods;

information and communications technology includes systems that enable the collection. structuring, manipulation, retrieval and communication of information in various forms This includes audio and graphical communications, the use of electronic networks, and interactive multimedia:

materials technology includes the investigation, use, and development of materials to achieve a desired result; knowledge of different types of materials; and the processing, preservation, and recycling of materials;

process and production technology includes both the manufacture and assembly of products from individual components; the processing of fluid-bulk raw materials; primary production of agricultural and forest products; transportation;

structures and mechanisms includes a wide variety of technologies, from simple to complex structures, from simple to complex mechanical device';

Most technological activities which students undertake will address all, or a number, of these strands. Some sample learning experiences and assessment examples are described for each technological area.

The curriculum statement has been supported by production of a television series *Know How* designed to inform parents, teachers and the community about the nature of technology education and what will happen in classrooms. Official implementation of the curriculum statement is from the beginning of 1997.

5 BACKGROUND TO THE USE OF INFORMATION TECHNOLOGY IN SCHOOLS

COMPUTERS IN EDUCATION DEVELOPMENT UNIT

Computing courses were introduced into New Zealand schools in the 1970's. With the availability of microcomputers in the late 1970's and early 1980s the potential for the use of computers in education was recognised. In 1982 the Department of Education set up the *Consultative Committee on the Use of Computers in Schools.* Following the release of the report of this Committee a Computer Courseware Unit was established within the Curriculum Development Unit of the Department of Education. This Unit later was renamed the Computers in Education Development Unit (CEDU). A major project involving the evaluation of educational computing in New Zealand was commenced by the CEDU in 1987. This project was known as the *Exploratory Studies in Educational Computing.* Schools in this project were given or loaned hardware and the research aspect of the studies was evaluated by the New Zealand Council for Educational Research.

These studies had enormous impact on the use of information technology in New Zealand schools. The case studies arising from the action-research provided, valuable models for schools on the potentially most useful classroom activities.

Many of the teachers who were involved in the exploratory studies are now in key positions as advisers and trainers of other teachers.

The restructuring of education in New Zealand in 1989 led to the closing down of the Computers in Education Development Unit. This ended the provision of any central co-ordinating agency for educational computing in New Zealand.

ADVISERS IN EDUCATIONAL COMPUTING

Six advisory positions entitled District Adviser in Educational Computing were established in 1990 and one adviser was linked to each of the six Colleges of Education. The advisers attempt to keep abreast of emerging technology and give advice to schools on both the administrative and educational use of computers.

All colleges of education also have specialist staff to co-ordinate information technology courses for pre-service teacher training. Today educational computing, as a separate study, is receiving less emphasis. It is now more common for colleges to incorporate the use of information technologies across subjects in the curriculum such as science, art, music, and social studies.

CONSULTATIVE COMMITTEE ON THE USE OF INFORMATION TECHNOLOGY IN EDUCATION (1990)

In 1990 the then Minister of Education established a Consultative Committee on the Use of Information Technology in Education. The Committee made three recommendations in their report (Sallis Report). They were:

that the government make a commitment to a major upgrading of the levels of teacher professional development and support and service for school communities and boards of trustees in the use of information technology across the school curriculum;

that the government immediately establish a contestable equity fund for the purchase of hardware and software;

that the New Zealand curriculum objectives assert the importance of appropriate applications of information technology in learning.

The recommendation relating to teacher development was immediately acted upon and contracts for teacher professional development have been offered each year subsequently. The proposed equity fund was not established, and the essential skills in *The New Zealand Curriculum Framework* assert the importance of information technology skills.

IEA STUDY (1991)

In 1991 the Research Division of the Ministry of Education published a report on computers in New Zealand schools based on the results of New Zealand's involvement in the International Association for the Evaluation of Educational Achievement (IEA) study on computers in education.

The information for this report was gathered during 1989 before changes of government and education policies. The report provided data which supported the recommendations of the Consultative Committee on the Use of Information Technology in Education. The report stated:

Data showed that there was a strong call for major training programmes for teachers to be implemented if computers were to be used successfully within education in subjects other than computer studies.

The study also noted that there was a need to look at teaching methods, and to give teaches confidence to accept, and capitalise on the fact that students often have more knowledge about computers than the teacher does.

THE CONSULTED REPORT (1992)

This report *The Use of Telecommunications Technologies for the Enhancement of Educational Services,* commissioned by the Department of Prime Minister and Cabinet, focussed on the uses of telecommunications technologies in school and tertiary education, particularly their use in distance education. It also discussed workplace based training. The report made a number of recommendations, many of which have since been implemented.

6. INFORMATION TECHNOLOGY IN NEW ZEALAND SCHOOLS

In common with the rest of the developed world, uses of information technology in education in New Zealand have focussed in three broad areas: educational administration; the "ordinary" classroom; and facilitation of distance/open learning opportunities. The most recent survey undertaken by New Zealand Telecom in late 1995 reported that there was one computer per 18 students in primary school and one computer per 10 students in secondary schools. Half of the computers in the schools were more than three years old. Statistics from a Ministry of Education survey show that there is a ratio of one computer per 15 students and that a high proportion of schools have one or more CD Rom drives.

EDUCATIONAL ADMINISTRATION

The most up-to-date information available suggests that all tertiary institutions and secondary schools, and almost all primary schools, are using computer technology to facilitate elements of their administrative or office procedures.

Observers in the field report that all schools routinely use word processing software and spreadsheets for administrative purposes. More than 97% make extensive use of facsimile and an increasing number make use of e-mail. Many use sophisticated software publishing programmes to develop news sheets for communication with their communities.

Primary schools are using a variety of data file-handling computer programmes to record and process roll, class, and pupil details. Various programmes are used to record and process financial and asset records.

Secondary schools use a variety of software applications (from fully integrated relational data bases to suites of separate packages) to record and process for example: timetable; roll; class; and pupil details; achievement profiles and records; and Financial and asset management information.

The Schools Electronic Network (see chapter 10) was originally established to improve information flows between schools and the Ministry of Education.

THE "ORDINARY" CLASSROOM CURRICULUM

Computers have been used in New Zealand schools for a variety of teaching and learning purposes since the 1970's. In primary schools most computers are located in individual classrooms while in secondary schools traditionally computers have been located together in computer labs. However, today there is. an increasing tendency to locate some of the computers in classrooms dedicated to particular subject areas, i.e. in the science area for data logging exercises; in the graphics area for computer-aided drawing. Information technology is considered important in the classroom for three fundamental (not necessarily exclusive) reasons:

- information technology as a tool for learning;
- as an aspect of modern life information technology needs to be learned about in its own right;
- information technology to enhance the delivery" or the learning of thetraditional curriculum.

A TOOL FOR LEARNING

The most widespread applications in classroom learning are productivity tools. Word processing and publication programmes are very commonly used in the learning and practising of written composition especially in primary schools; spreadsheets, and data analysis and presentation programmes are often used in numerically rich curriculum areas such as science and maths; data file programmes are often used in situations where students are developing classification skills such as in social sciences. Various kinds of computer aided drawing programmes are used in art, music and technical subjects.

Since the mid 1980s an increasing number of schools have been using e-mail to communicate with other schools and educational institutions. Some schools are also linked to the National Library and the New Zealand Bibliographic network. Today approximately 61% of secondary schools and 39% of primary schools report using on-line services. A small number of schools have full access to Internet and World Wide Web but costs of access are preventing other schools from making use of this service.

A number of educational computing applications that might be called "virtual learning environments" have proved useful in New Zealand classrooms and overseas. This genre of software includes simulations such as virtual laboratories and problem solving/decision making "games" which require students to apply thinking, communication, decision making, or mathematical skills relevant to their current area of learning,

LEARNING ABOUT INFORMATION TECHNOLOGIES

The need for students to become confident and competent users of information technology has been a motivation in most schools' decisions to introduce computers into classroom programmes. While in the 1980s computer awareness was an explicit rationale for computing courses today most schools have seen the development of computer awareness as an implicit rationale, that is a goal which will be achieved as a byproduct of achieving more directly curriculum related benefits.

While in earlier computing courses the teaching and learning of computer programming was an important aspect today most courses now concentrate on the use of application software for problem solving.

Some schools have also introduced students to the idea of computer control by interfacing computers to electromechanical (robotics) devices. Given a particular problem students design and then build appropriate devices and write computer programmes to control the devices in solving the specified problem.

COMPUTER AIDED LEARNING/COMPUTER MANAGED LEARNING

A number of educational institutions have used computer aided instruction and computer managed learning programmes. Some programmes are particularly engaging and students enjoy using them (particularly relative to "ordinary" classroom experiences). However, there is little evidence that the use of this kind of software produces better learning gains than "ordinary" classroom experience. The programmes have been most successful with students of lower ability or with students who have specific skills in need of remediation and which can be improved by repeated practice.

DISTANCE EDUCATION/OPEN LEARNING

New Zealand has a long history of successful provision of distance learning. Correspondence education was initially stimulated by difficulties of conventional school access for children in geographically remote locations. The clientele for distance education now spans primary, secondary and adult students with diverse reasons for not attending conventional institutions. Additionally many secondary school students who are enrolled in "ordinary" schools use distance education programmes delivered by The Correspondence School [3] to study subjects which are not available at their schools.

At the tertiary level two universities offer distance education courses and the polytechnics have been active in providing a wide range of distance education courses.

In 1985 more than 70,000 students were enrolled in distance education courses.

Distance education in New Zealand has embraced the use of broadcast radio, telephone services and the use of 0800 numbers, broadcast television and recently satellite television, desk top video, delivery of audio and videotape materials, and computer disk based materials, including CD Roms.

The use of electronic mail and bulletin boards and audiographic networks is now an important aspect of distance education, particularly in rural areas in New Zealand. This has resulted in an increasing number of telephone lines coming into schools. Most primary schools, except small primary schools, have two or more lines and secondary schools have three or more lines.

7. TEACHER DEVELOPMENT IN THE USE OF INFORMATION TECHNOLOGIES

A major emphasis in New Zealand over the last six years has been the training of teachers to use new information and communication technologies effectively in the classroom. Over that period the Government has committed over $5.0 million to teacher training in the use of IT and more than 8000 teachers have received school-based training. These teacher development courses have been evaluated by independent researchers who have provided feedback to the Ministry of Education on how successful the programmes were in providing effective training for teachers. These teachers are now confident and competent users of technology in their classrooms and are often involved with assisting other teachers to be more effective users of technology. In

[3] The Correspondence School is the sole provider of distance education for primary and secondary school students in New Zealand.

- addition most trainee teachers in Colleges of Education undertake training in the use of information and communication technologies.

The snowball effect of this group of teachers growing ever larger as they share their skills with others is leading to a leaching force who are, more and more, making effective use of technologies in the classroom. However technology is changing at a rapid rate and teachers are having difficulty in keeping up with the advances, e.g., use of Internet. A further problem is that teachers skilled in the use of information technologies are actively recruited by industry.

8. FUNDING OF INFORMATION TECHNOLOGY IN SCHOOLS

lip until the end of 1989 almost all computer equipment in schools had been financed by parent contributions or community fundraising schemes to the value of about $60 million. Although there is no conclusive evidence available it is reckoned that most of the further $55 million worth of computing equipment placed in schools since the review of educational administration in 1989 has also been financed directly by parents or local communities. Since 1989 schools have been bulk funded for operations and schools have been able to use funding from their Operations Grant [4] to purchase information technology equipment. Rural schools have also been able to obtain funding through a proposals pool for innovative curriculum delivery.

As a rule of thumb it is generally held that a sum equivalent to about 40% of initial capital cost should be budgeted annually for: costs of software and consumables such as paper or floppy disks, line usage, maintenance costs, and for provision for replacement. On this basis schools should be budgeting about $46 million annually to cover the ongoing costs generated by the currently installed equipment. No Figures are available about what schools actually budget for these costs. However over the last two years many schools have realised the need to budget in this area and an increasing number have information technology plans. Recently the Ministry of Education put out a planning kit to help individual schools develop an information technology plan for their school.

Government initiatives in the information technology area have been focussed mainly on teacher development and on providing seeding funding for pilot projects such as the use of audiographics, development of CD Roms, use of satellite television, desk top video conferencing, schools electronic network, and exploratory studies in educational computing.

9. INFORMATION TECHNOLOGIES IN POST COMPULSORY EDUCATION

Post compulsory education providers are bulk funded on a equivalent full time student (EFTS) basis. Within this funding they decide the proportion to be spent on information technologies. While no Figures are available observers report that all institutions use computers for administration and most make provision for extensive student and teaching staff use. Some institutions arrange for students to have e-mail addresses. Two universities and several of the polytechnics offer distance learning courses which, besides print based materials, also make use of a range of telecommunications technologies for course delivery.

[4] Calculation of the Operations Grant did not include resourcing for computing equipment.

10. CURRENT AND RECENT INFORMATION AND TELE-COMMUNICATION TECHNOLOGY PROJECTS

DEVELOPMENT OF INTERACTIVE CD ROMS

The Ministry of Education contracted The Correspondence School in 1993 to produce interactive CD ROM's - one in beginning Japanese and one in translation geometry. (This was at a time before there were any commercial developers of CD Roms in New Zealand.) These were trialed in schools and are being used in distance education courses. A more extensive CD Rom in Japanese is currently being developed.

ELECTRONIC NETWORK LINKING SCHOOLS

The Ministry of Education has a text-based network the *Schools Electronic Network* linking approximately 500 schools and with approximately 4000 active users. Over the next few years this network will be expanded to eventually link all primary and secondary schools. The network includes bulletin boards and electronic conferencing facilities. New Zealand Telecom also has an educational network. *New Zealand On Line,* to which about 500 schools are linked, and Massey University has a smaller educational network linking about 200 schools. In all nearly one half of New Zealand schools are connected to electronic networks.

AUDIOGRAPHICS FOR RURAL SCHOOLS

Over 60 schools are connected in various clusters via audiographic networks. This enables teachers in schools to have classes spanning several schools. Over 20 subjects are delivered in this way. Funding ha:, recently been made available to further rural schools to implement this technology and so be able to offer students a wider range of courses.

DESK TOP VIDEO

Two remote schools and one city school were linked to The Correspondence School for this project. Courses in languages and social sciences were delivered to students. Both teachers and students were enthusiastic about the potential of desk top video for delivery of teaching and learning to small groups. At the time of the trial it was considered that until costs of hardware and software became more reasonable this technology was beyond most schools budgets. Since this trial some schools have been using the See You See Me product (slow scan video) and report favourably on its use.

SATELLITE TV DELIVERY OF EDUCATIONAL PROGRAMMES

In 1995 the Ministry of Education contracted The Correspondence School to undertake a pilot study in the delivery of languages and technology education via satellite. There are 90 official trial schools and 30 other schools who receive the broadcasts. Programmes in three languages and technology are broadcast daily. This is the first use of satellite delivered TV in New Zealand by any institution or commercial organisation. To date the trial is going very well.

USE OF WORLD WIDE WEB (INTERNET) FOR THE DELIVERY OF EDUCATIONAL MATERIALS AND PROGRAMMES

The Ministry of Education has home pages on World Wide Web (http://www.govt.nz/ps/mi.n/edu/) where information about curriculum and administration is available. A trial is being undertaken with ten schools to determine the viability of using World Wide Web as a replacement for the text-based schools electronic network mentioned earlier. It is estimated that currently approximately 100 schools access World Wide Web through a commercial provider.

11. FUTURE DIRECTIONS

TECHNOLOGICALADVANCES

The rate of increase in the number of possible applications of computers has been as rapid as the change in computing technology itself. Developments in multimedia which enable users, in an interactive way, to access text. sound, still and video pictures, potentially provide a number of rich learning opportunities. The rapid growth of the Internet and the resulting access to vast amounts of information, to international discussion groups, and access to up-to-the minute research provides exciting learning opportunities for students. As "broad band" technologies become available these technologies have great potential for facilitating educational interactions between students and learning materials, and between students at physically remote locations. Technologies such as video conferencing and Internet provide an infrastructure for more open learning opportunities.

EDUCATIONAL OUTCOMES

A great deal of the literature on the use of information technology in education reports on: the enthusiasm and engagement of students; the changed but important role of the teacher; the apparently enhanced role of the teacher; greater productivity; and enhanced co-operation between students. These findings are important because the changes in learning behaviours which students exhibit when using computers appropriately, are strong indicators that enhanced achievement will result. Papert in *The Children's Machine,* explains that the extension to human capability conferred by modern information technology changes the nature of knowledge itself. The fundamental questions of learning are no longer "what?" but "how?" "why?" and "how do I know?" Access to information has the potential to change the role of the learner from just seeker of answers to asker of more questions. Recently schools have been set up whose curriculum is supported by an information technology-rich learning environment. While it is too soon to say what the long term effects of such schooling are interim conclusions are positive. It is important to observe such experiments.

A further issue is whether in fact developments in information technology will make schooling less relevant and students of the future may learn from home, or other community institutions such as the library, using information technologies. This perspective ignores some of the important outcomes of schooling including socialisation. While some students may prefer to learn in this way it is still considered in New Zealand that in the foreseeable future most students will still attend schools. However, advances in technology will change the role of the teacher and of the school. In some curriculum areas students will learn mainly through information technology and in other areas through more traditional teaching methods. Information technologies will generally support and enhance the work of teachers.

FUNDING

Two particular thrusts are being considered by Government in New Zealand: provision of one computer per five students in schools and secondly to ensure all schools have Internet access. The costs of providing a ratio of one computer per five students together with on going maintenance software and replacement cost have been provided to Government and are Still being considered by Government. With regard to Internet access some clusters of schools are organising joint purchasing arrangements with providers, but this is moving slowly because of the high costs of Internet access in New Zealand.

PRINCIPLES

Whatever possible roles are considered for government, whether that be intervention strategies, or support for research or development projects, it is proposed that the following principles be adapted as a basis for future decision making.

Information technologies should he considered for use in education only if {here is good reason to believe that they will

- *increase student choice; and/or*
- *increase access to learning opportunities; and/or*
- *provide enhanced learning opportunity, and/or*
- *increase the productivity of students: and/or*
- *provide unique opportunities to learn IT skills.*

12. SUMMARY

The past six years has been a time of great change in New Zealand education. A new administrative structure has been put in place and major curriculum reforms, involving the total curriculum, are now more than half completed.

The importance of including technology as an essential area in the curriculum has been recognised as has the need for students to be able to access and use information and communications technologies for a range of purposes. Government has accorded in-service professional development programmes for teachers a priority. A range of initiatives are underway for ensuring that teachers are confident and competent users of technology; in encouraging the use of new information technologies in the classroom, and for distance education and open learning. Some of the initiatives, it is hoped, will be a catalyst to encourage schools to undertake further initiatives. As evaluations of these initiatives are undertaken these will give an indication of where future funding is best directed in terms of the use of new technologies for enhancing teaching and learning.

Exciting developments are occurring in information and telecommunications technologies. The potential of these technologies to support and enhance teaching and to provide new and exciting approaches to learning for students is being recognised by Governments' worldwide, particularly as part of wider social and economic reforms designed to increase productivity and competitiveness.

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[1] There is a national curriculum statement for each of the seven essential learning areas.
[2] Two information technology skills specified in the essential skills are:
Students will:
- become competent in using new information and communication technologies, including augmented communication for people with disabilities (p 18);
- be able to use a range of information-retrieval and information processing technologies confidently and competently (p 18).

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NATIONAL REPORT OF NORWAY

NATIONAL REPORT ON NIT IN EDUCATION IN NORWAY

NTRODUCTION

The use of NIT (New information technology) in Norwegian schools, colleges and universities has developed gradually over any years. The number of computers in schools seems to have doubled every 2-3 years. Several national plans have been launched and carried out over the last 10-15 years, and the last one, for the period 1996-99, was presented in August 1995.

The 1996-99 plan is based on a white paper to the parliament, submitted in January 1994 and handled in the parliament (Stortinget) in May the same year. The parliament stated that a high educational level in the population is a prerequisite for the further development of the Norwegian society, and also for our contribution to development in poorer countries. Equal access to education and training for everybody, independent of residence, sex, social background, handicap or disabilities are basic and fundamental principles in the Norwegian educational system.

Therefore all educational institutions, from primary level to university are directed to show continuous attention to this area, to secure a good general knowledge in this field, and to avoid the development of new differences between those who master NIT and those who do not.

THE EDUCATIONAL SYSTEM IN NORWAY

Children in Norway start school at the age of seven, (from 1997 they will start at six) and the compulsory school lasts for 9 (10) years. However, more than 90% of the pupils also enter the upper school, either to study general subjects leading to higher education, or vocational subjects leading to a profession. And since all pupils now have got a right to three years of upper secondary education, soon 90-95% of the young people will have 12 years of formal education.

Name:	Grade	Age	Description		
Grunnskole	1 - 6	7 - 13	Primary school		compulsory
Ungdomsskole	7 - 9	14 - 16	Lower secondary school		
Videregående skole	10 - 12	17 - 19	Upper secondary school, General subjects	Upper secondary school, Vocational subjects	
HØgskole universitet			College, university	Apprenticeship	

SCHOOL OWNERS

In general terms the primary and lower secondary schools (compulsory) are owned by our 435 local municipalities (kommuner), the upper secondary schools are owned by the 19 countries (fylker), while most of the colleges and all universities are state-owned.

The national control of primary and secondary schools is secured through national syllabus, laws regulations, circulars and other documents.

On average, 40% of the local budgets are distributed on a national level to ensure that all units can afford a high quality school-system. Most of these money is not for specified use to ensure autonomy of expenditure.

According to the NIT action plan the school owners are responsible for the supply of computers, software, facilities and maintenance.

STATISTICS

In the beginning of 1995, Statistics Norway (SSB) carried out a survey on behalf of the Ministry of education to determine the state of NIT in different parts of the educational system. This survey had four parts:

1. To determine the situation regarding computers, software and other equipment, and how this equipment is being used in different subjects.
2. Asking selected students in primary and secondary schools about their experience regarding the NIT situation at the school, and their access to computers at home and at school.
3. Questioning students in higher education about their access and use of computers and software at home and at their institutions.
4. Questioning teachers in primary and secondary schools about their opinions regarding the NIT-situation in their school, and their access to computers both private and their teaching situation.

SOME FINDINGS

Gender Issues

There is a considerable difference between boys and girls in this field. Boys are much more interested in NIT than girls. Boys who have access to a computer at home are using it a lot more than girls in the same situation. the same difference appears at all levels of education.

Number of students who have access to PC (personal computer) at home

School level	Boys	Girls
Lower secondary level	62%	52%
Upper secondary level	66%	51%
Higher education	69%	56%

Parents education

In homes where one of the parents have higher education, many more students have access to computers at home than in families where the parents have the basic education only.

	Highest level of formal education	Pupils with access to PC at home
Father	Lower secondary school	40%
Father	Upper secondary school	51%
Father	Higher education	80%
Mother	Lower secondary school	48%
Mother	Upper secondary school	55%
Mother	Higher education	73%

Density of PC's at schools

Upper secondary school appear to have the highest density of computers. There is one modern (Windows) computer available per 11 students. In primary (PS) and lower secondary (LS) schools the situation has improved since 1992, but a lot of new computers were bought for administration, and hence not available for pupils.

Number of pupils/students per computer in schools

	PS	LS	US	HE
PCs for pupils:				
- Windows PCs	75	41	11	29
- All types	21	20	8	24
PCs in total:				
- Windows PCs	40	25	8	8
- All types	20	14	6	6

There are significant regional differences. The Oslo area (Capital) has the lowest density while the northern and western parts of Norway have the best situation.

Schools in rural areas have significantly higher computer density than the cities.

Small schools are better off than large schools.

Teachers

Teachers at all school-levels, both male and female, are generally interested in NIT and they are or want to become personal computer users.

Teachers have access to computers at home to the same extent at the population in general, but there are some interesting findings regarding teaching level, sex and age.

Teachers with access to PC at home

	male	**female**
Age less 45		
Primary school teachers	46%	60%
Lower secondary school teachers	48%	66%
Upper secondary school teachers	54%	78%
Age 45 and above		
Primary school teachers	53%	48%
Lower secondary school teachers	60%	56%
Upper secondary school teachers	76%	70%

A large part of teachers call themselves "personal computer users", 60-75% in secondary schools.

Access to computers at home

In all the main groups of pupils/students and teachers in the survey, more than 50% have access to a computer at home.

Number of persons with access to computer at home

	Have access to PC at home
Lower secondary school students	57%
Upper secondary school students	59%
Students in higher education	62%
Primary school teachers	53%
Lower secondary school teachers	57%
Upper secondary school teachers	70%

NATIONAL PLAN FOR 1996 - 99

The NIT plan is an element in the realisation of the general objectives in the sector of education. The parliament has stated some key objectives for NIT in education:

- improve the learning environment for each single pupil and student;
- create a ground for new ways of teaching and learning;
- enable each pupil/student to evolve their talents and to realise their own goals better than before;
- give equal opportunities independent of sex, age, residence area and ethic background;
- give persons living outside school facilities an option to study at their home;
- increase international contact and understanding;
- become and integrated aid where suitable, in all subjects and at all levels of the educational system;
- increase the level of knowledge and skill in society and at work;
- use of domestic and foreign databases.

INCREASE EFFORTS IN FIVE AREAS

The main activities on NIT in education can be subdivided into in five main areas as shown below:

Teacher education	Using NIT to learn	Organisation
	Learning to use NIT	
	Technical issues	

Using NIT to learn

This is the central activity and is about NIT being used as an aid for learning every subject, fro simple vocabulary learning and math learning aids, over to simulation in science, to collection of information from data bases and to making contacts and co-operation with schools and students everywhere in the world.

Learning to use NIT

Learning to master NIT, for example word-processing, spreadsheets, database tools and communication programs, tools that more and more people have to master in the future. "Learning to use" is also about achieving professional skills on NIT. Without a large group of competent NIT experts and competent teachers, Norway as a nation will not be able to utilise NIT to its full extent.

Technical issues

They are about the technological infrastructure which is needed for NIT, for example computers, communication lines and services, and information highways.

Teacher training

Without well trained teachers and personnel who are able to put NIT into practical use, any effort in this area would be useless. Because it is of such critical importance for success, teacher training has been set up as a separate main activity.

Organisation

Norway with its small population of 4.3 mill. cannot carry through the broad types of projects as can nations with large populations. the small group speaking Norwegian has certain consequences for publishers, market, funding and competence. To compensate for these disadvantages it is important to be well organised, to develop good co-operation, do the planning well and succeed to use the creatively and competence of existing organisations and institutions.

ACTIVITIES

In each of these five areas mentioned above, a number of activities are defined, each with a description and one or more bodies responsible for its progression. Totally, 31 activities are defined and described, a few of them will be mentioned here:

A: RESEARCH AND DEVELOPMENT ON PEDAGOGICAL USE OF NIT

The research in this area in Norway has been limited, so far, at the same time as the international market for educational programs has exploded.

Therefore we need to know more about how NIT best can be integrated in the classroom situation. Methods for use of NIT in education should be given priority in the ordinary R&D activities in the teacher education institutions and other educational research bodies

Besides using NIT in various subjects and topics, the possibilities for cross-curricular activities should be developed. It is also important to promote the use of NIT in different types of special education.

B: GIRLS USE OF NIT

All the information the NIT-plan is based on indicates a need to stimulate girls to be more aware of NIT from a very young age. There are reasons to ask if the ways NIT is being approached could be improved in order to adapt better girls and women way of learning.

C: THE STUDENTS AS A RESOURCE

Many teenagers have obtained a considerable knowledge of NIT, from within of from outside the school. The students may therefore constitute an important resource, and it is a challenge for the teachers to utilise these students knowledge, and to stimulate them to continue there development.

D: NIT FOR THE DISABLED

NIT opens many new opportunities for handicapped and disabled students. Through earlier programs, several activities have been carried out to utilise these opportunities. These efforts must be carried on. It is above everything from adapted keyboards and switches, through specialised software to the development of methods of education. Close contact and co-operation between all active units in this area is essential for the results. Special attention should be paid to training adults.

E: NIT IN ENVIRONMENTAL AWARENESS TEACHING

Hundreds of Norwegian schools already have experience over several years in the use of NIT as an aid in several national programs for environmental education. Use and analysis of satellite pictures is one of applications.

F: THE NORWEGIAN INTERNET BOOKSTORE (INFORMATION WELLS)

Most of information available on the Internet is English. Even books written by famous Norwegian authors are often available in English only. In this situation it is important, from a national point of view that also the Norwegian language texts are available.

The Norwegian Broadcasting Corporation are going to publish some of their material on WWW, and carry out a research-project where five Norwegian authors will be presented in a multimedia form.

the National Library has the responsibility to collect and keep all Norwegian literature. They are now in the process of producing digital copies of their archives and making the material available on Internet.

G: NEW ELECTRONIC AIDS FOR LEARNING

Piles of CD-ROM and other material for education are available today in English. Some of it may certainly be translated and adapted for the situation in Norway. At the same time, it is important to develop modern educational aids based on the Norwegian social and pedagogical traditions. Publishers should be encouraged to produce electronic aids for the Norwegian market.

H: CERTIFICATION OF NIT COMPETENCE OF "EUROPEAN COMPUTER DRIVING LICENSE (ECDL)"

Also the adult population need to develop and document their skills in NIT. Courses can be held at the workplace, through the national employment agency, through study or distant learning organisations and through ordinary schools at all levels.

The Norwegian Computer Society (DND) is developing a test and a certificate for general computer literacy, in co-operation with sister organisations in many European countries (CEPIS). The original idea comes from Finland where more than 10.000 persons already have passed the tests. The final test will probably contain several modules, covering subjects as word processing, spreadsheets, graphics, general NIT-knowledge and more.

A pilot set program has been carried out in Sweden, Denmark, Ireland, Netherlands and Norway, and the first certificates are supposed to be issued before the end of 1996.

I: NEW URRICULUM IN TEACHER EDUCATION

Up to now, many teachers have gone through a four year education without using a computer. NIT now has to be implemented in all teacher education as soon as possible. This is about integrating NIT in education of each subject. The Ministry of education is in the process of developing a new curriculum. In the meantime preliminary documents will be issued describing the goals and directions to go. This can be aid in educating the teachers of the teachers.

J: ACCESS TO GLOBAL NETWORKS

There will be established an infrastructure to allow all Norwegian schools to be connected to national and international computer networks (Internet). Several suppliers of services seem to become available as the telecom market will be opened for competition next year. It is important for education system to take advantage of this situation.

For security reasons it is recommended to keep networks and services for school administration separated from the education network.

All institutions in Norway for higher education are already tied together in an extensive network by Uninett A/S, a firm owned by the Ministry of education. The experience and competence of Uninett is an important asset in the process of connecting all schools.

K: THE LIBRARIES AS A MEETING POINT

Not all students will have access to computers and networks at home. And even if they have a computer they may not have access to all the software and services they need. The school-libraries and public libraries can contribute to solve this problem by giving access to computers, various software and network services.

ANNUAL WORKPLAN FOR 1996

On the 1996 budget the parliament has granted NOK 33 mill. in addition to the normal NIT-related programmes. A work plan has been made to define in more detail the distribution of these funds within the 31 activities in the main plan. There is an opening for schools, institutions and individuals to apply for a contribution to their projects, if it is within the framework of the NIT-plan.

OTHER FUNDING

These 33 mill. are only a small part of the funding that will be used for NIT in the Norwegian educational system.

For primary school NOK 5 mill. have been set aside fro special purposes.

Resources have been reserved to perform the necessary training of teachers in connection with introduction of a new curriculum in upper secondary school (Reform'96), and primary school (L'97). Part of it is familiarisation to NIT.

It is also understood that the state-owned and co-operative bodies, for example teacher education institutions will be using their own budgets to accomplish their part of NIT activities.

The largest part of the funding still comes from the schools and school owners. They are responsible for equipment, software, facilities, maintenance and so on.

NATIONAL REPORT OF PAKISTAN

EDUCATION POLICIES AND NEW TECHNOLOGIES IN PAKISTAN

THE CONTEXT

In recent years, remarkable development has taken place in information and communication technologies. Media combinations have emerged to shape the "Information Society". Similarly, education is challenged to re-examine its position critically, specially since technologies seem to develop faster than education has capacity to make use of them. In this paper the general structure and background of education system in Pakistan is documented before the initiatives of latest technologies have been listed. This is to make sure that the use of technologies may be taken in the right perspective keeping in view the challenges for improvement of both quantitative and qualitative issues regarding educating the masses

1. INTRODUCTION

Pakistan is an Islamic Republic with an estimated population of 128 million. The country has four provinces and four territories under federal administration. They are variations of topographic features, size and distribution of the population, status of social indicators, socio-cultural practices and languages. The economically has been growing but there is a dichotomy between economic and social indicators.

2. CONSTITUTIONAL RESPONSIBILITY

Education has been and continues to be primarily a provincial subject. However, under the 1973 Constitution, it has been placed on the Concurrent List and the Federal Government has been given the responsibility for policy, planning and promotion of educational facilities in the federating units to meet the needs and aspirations of the people. It also acts as the overall policy-making, coordinating and advisory authority.

3. EDUCATIONAL ACHIEVEMENTS AND LIMITATIONS

Pakistan inherited a weak educational set - up at the time of independence. Masses were illiterate and institutions insufficient to impart education to the children of the new state. Moreover, the system itself did not suit the aspirations and demands of an independent nation. Therefore, a National Education Conference was convened in 1947 which, interalia, recommended that universalization of primary education should be achieved within a period of twenty years. Since then, universalization of primary education has remained one of the cherished goals of all governments in Pakistan. New facilities and infrastructure have been created; cadres of trained manpower have been produced; various projects have been launched and attempts have been made to give the country an educational set-up becoming a free nation on march to progress.

When Pakistan came into being in 1947, there were only 8900 primary schools with an enrolment figure of 0.77 million. As against this, the number of primary schools in 1994-95, including mosque schools, are 123,119 with an enrolment of 16.7 million. The number of middle schools is about 13,615 in 1994-95 with an enrolment of 4.1 million, and about 12,513 high schools with 1.4 million students. The number of colleges (Arts, Science and Professional) is 802 with an enrolment of 706,656 while that of universities at 24 with 87,403 students. In addition, in 1994-95, there are 724 secondary vocational institutions with an enrolment figure of over 93,000. Participation rate at the primary stage is 71%, at the middle stage at 45% and at the secondary stage at 30%

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Levels of literacy between 35 and 40 percent result from low access to schools and a high dropout rate irrelevant curricula, un-stimulating teaching practices and unattractive environments do not offer incentive to poor families. Child labor, lack of sanitary facilities, and teacher absenteeism are other contributing factors.

The literacy rate among women is much lower than among men. Lack of participation in planning and management, as well as lack of support at home are key underlying causes - basis of which are social taboos, the feudal power structure and inequitable distribution of resources.

There is demotivation and apathy at the programme manager level while mechanisms for participation of communities are not fully developed. Participation of Non-Governmental Organizations (NGOs/Community-Based Organizations (CBOs) private sector, media, religious and political forces and extended families is limited. Little emphasis is given to coordination of efforts or impact assessment.

In terms of access to primary schools, of the estimated 20 million school-age population, 13 million, or approximately 70 per cent are enrolled in schools. Gross enrollment of girls is about 54 per cent. Half the number of children who enroll do not complete primary schooling. The implication is that input into the education system, i.e. school infrastructure, teachers and materials, whether provided by the government or donor and other development agencies, has not been matched by outcomes in terms of completion and student performance. This situation has raised serious concerns about such process parameters as quality of school administration and management, supervisory practices, teaching methods and the role of local communities in the education process. Introduction and implementation of Social Action Programme is a step forward to improve the situation, particularly in basic education.

Participation rate at the primary stage is estimated to he 71 percent, at the middle stage at 45 percent and at the secondary stage at 30 percent. Pakistan's literacy rate is only about 37 percent - 49 percent among male population and 24 percent among females. Literacy rate for both sexes in urban areas is 58% while in the rural areas it is 28 percent.

There is a large network of infrastructure and extensive system for delivery of the educational programmes. Education officials at district level are responsible to manage education delivery. However, only 40 percent of children complete primary education under this system. Reasons given include poor quality of services, non availability of basic supplies, inappropriate behaviour of service providers and cultural barriers.

The annual budget for education during 1993, 1994 and 1995 has been Rs.33.0 billion, Rs.44.0 billion and Rs.55.0 billion, respectively. The allocations represent an increase of almost 66 percent in two years. In terms of GNP, the allocations have registered an increase from 2.1 percent to 2.5 percent. The government has also introduced a Bill which, will ensure that minimum 3% of GNP is spent on education by the year 2000. The Eighth Five Year Plan has provided Rs.69.0 billion for education during 1993-98 which is three times higher than the provision of Rs.23.0 billion during the Seventh Plan period (1988-93).

4. EDUCATION POLICY

Pakistan is a developing country and struggling both for quantitative improvement as well as quality. The low literacy rate and the less-than-desired participation figures have been matters of grave concern for successive governments in Pakistan The present government has consequently given a New Education Policy in 1992. It set the following major targets to be achieved during the next ten years.

Keeping this situation in context and considering the challenges of the 21st century the following initiatives have been taken (which also include the use of modern technologies in education):

- Universal Primary Education (100 per cent participation);
- 106530 new Primary and Mosque Schools to be opened;
- 24,750 shelterless Primary Schools to be provided two-room buildings.
- 20,000 existing Primary Schools to be provided additional rooms.
- Major repairs to be carried out in 50,000 schools.
- 2,65,000 Primary School teachers to be trained.
- Predominant attention on girls education, both

in respect of enrollment and incentives.

- Employment of 265,400 Primary teachers.
- Adult/Functional literacy to be raised from 35 per cent to 70 per cent.
- Literacy programmes to be implemented by NGOs and the private sector.
- 50 per cent participation rate at secondary level.
- Almost 200 per cent increase in the number of vocational institutions.
- 500 Middle schools to provide technical education facilities.
- Polytechnic output to be doubled.
- More than 100 per cent increase in the enrolment of university education.
- High quality technical manpower produced by colleges of technologies to be doubled.
- Four universities in public sector and 16 universities in Private sector to be set up.
- Eminent role to be given to the private sector and NGOs in the implementation of the Policy.
- National Testing Service for Equitable Academic Reliability.
- Increased content of meaningful Islamic Education and improvement in the existing network, and
- Computer education at school level to be made part of curricula.
- The potential of electronic and print media will be fully utilized for motivating the public at large for supporting literacy effort, and for delivering the literacy programmes.

4.1. THE FOLLOWING CHANGES COULD BE SUMMARIZED AS THE INNOVATIONS OF 1992 POLICY (IN CONTEXT OF NEW TECHNOLOGIES INCLUDING TECHNICAL EDUCATION, USE OF COMPUTERS FOR EDUCATIONAL ADMINISTRATION AND STATISTICS AND VOCATIONAL ED UCATION

Implementation of the Policy during the next 10 years will cost Rs. 143 billion (Rs. 107 billion in Public sector and Rs. 36 billion in the Private sector). Recurring expenditure will be Rs.92.160 billion.

The present Government is reviewing the various programmes contained in the National Education Policy with a pragmatic approach and has initiated action to further improve them. An Advisory Council on Educational Reforms has already been set up.

In fact, the present Government has, from the very beginning, shown full realization of the need to revolutionize the education sector. This commitment is reflected in subsequent policy announcement and in resource allocations to primary education and the enrolment targets given in the 8th Plan. The allocation of the Plan for Primary Education is Rs.32669 million and the enrolment target at Primary Education level (classes I-V) is 15 779 million - 8.8 million for male and 6.97 million for females. Participation rate in percentage is projected to be 87.7 (95.5 for male and 81.6 for females).

4.2. TECHNICAL EDUCATION

The Government has also been actively working to encourage and promote technical education as it is fully conscious of the fact that a sound system of technical education and vocational training (TEVT), in line with the needs of the job market, is essential for the rapid economic development of the country. Over the years, there has been manifold increase in the number of technical/vocational education institutions with corresponding increase in enrolment.

In order to formulate long and short term strategies for the development of TEVT, a comprehensive study has recently been concluded and, based on its Findings, a project proposal has been drawn up, which aims at improving quality relevance and efficiency, equity, access to TEVT facilities and cost effectiveness. A project proposal costing USS 100 million, covering specific project areas - such as (i) development of TLVT facilities for boys; (ii) development of TEVT facilities for women: (iii) development of Commercial Education, and (iv) vocationalization of general education - has been conceptually cleared for loan organizations with the Asian Development Bank.

Like all other Fields of education, women are also receiving special attention in technical education. A Polytechnic Institute for Women has been established at Islamabad, which offers 3-years diploma programme in modern technologies, such as Computer, Architecture, Dress Designing and Electronics.

To back up the country's technical education programme, a National Technical 'readier Training College was established in 1987 to promote excellence in technical education. It regularly organizes long courses for in-service polytechnic teachers and short courses for the managers, administrators and planners of technical education. In addition, the College also undertakes industry-based and demand-oriented programmes. Beside the training facilities at NTTC, polytechnic teachers are also provided opportunities for training abroad. There also exists a programme to develop technical teaching/learning resource materials within the country.

4.3. TECHNICAL EDUCATION PROJECT

In pursuance of policy on technical education a project to be assisted by the Asian Development Bank will focus the rehabilitation and consolidation of the Polytechnic system in Pakistan. It will improve selected existing Polytechnic in the four provinces in terms of teachers competency, managerial and Financial sustainability, industry linkages and where appropriate, private sector's participation.

Under the project, two Polytechnic for Women, one for Quetta and the other for Sukikur will be set up, and 23 new technologies will be introduced in 30 institutions all over the country, in addition, 43 Polytechnic Institutes will be provided equipment and furniture, 610 teachers will be trained abroad and National Institute of Technical Education will be established to impart B.Ed (Technology) programme. It will be implemented during five years i.e. 1995-2001.

All the above projects are being generously funded by donor agencies. The total number of schools under these schemes comes to 35,000 catering to the needs of about 2.6 million children. However, this is not enough to make a real dent.

Much more needs to be done and is being done both to expand educational facilities and improve the quality of education.

4.4 COMPUTER LITERACY POLICY AND PROJECT

According to 1992 education policy the computer education has stressed:

Computer Literacy and computer education will be emphasized and made a part of education curricula at all levels. All training programmes for teachers, and educational administrators will include computer education as a compulsory component. Computer aided instruction will be used as an important tool for enriching teaching-learning process. Special funds will be provided for introducing computer hardware and software in schools. Science curricula will be designed so as to include computer-based creative educational activities.

As mentioned in the highlights of the 1992 education policy for including the computer education in school curriculum, the Ministry of Education, in collaboration with IBM, has launched a project for introduction of computer literacy for class VI-VIII in 150 selected schools throughout the country. Under this project, 2 computers and one printer is being provided with training of one teacher in each project school. Additionally in each of the project schools, one teacher will be trained for computer operation and use. The total cost of the project is Rs. 17.59 million including IBM donation of hardware for Rs. 13.4 million for a period of 3 years. The project initiated in 1993-94 has so far covered 90 schools throughout the country. This will be finally integrated with Prime Minister's Programme for Computer Literacy.

4.5. PRIME MINISTER'S VOCATIONAL EDUCATION AND TRAINING PROJECT

Based on the guidelines provided in an Inter-Ministerial meeting, the government has recently launched an innovative and productive Technical and Vocational Educational Programme. Costing approximately Rs. 1.00 billion. The programme aims to establish 70 Model Vocational Schools throughout the country with intake capacity of 12250. The project will impart demand oriented skills in order to provide jobs to the individuals and needed services to the society besides increasing the economic activity in the country and raise the living standard of the people.

4.6. USE OF COMPUTER FOR EDUCATIONAL DATA

For the proper development of the education sector, it is imperative that accurate and reliable information about all aspects of the system should be made available well in time to help enlightened decision making, pragmatic strategic planning and efficient administration on the one hand, and to ensure effective monitoring and evaluation on the other. Be it the targets set under SAP or be it the objectives of other on-going projects, development of the education sector can neither be objectively planned nor effectively monitored without the availability of scientifically collected authentic data about the existing facilities and future needs.

With this in view, a project called National Educational Management Information System (NEMIS) was launched in 1991 with the collaboration of UNDP, USAID and UNESCO. Under this programme, computerized EMIS centers were created throughout the country at district level and educational data under various indicators was collected and processed. By the time the project completed its life in 1993, its tremendous importance and relevance to the development of education had been fully realized and it was decided to extend its life with the World Bank assistance.

In its second phase, the project continues to work not only in all the four provinces as educational data collection mechanism but also at the federal level as a national data processing and analyzing center. It acts as a catalyst for the promotion and institutionalization of technical development of EMIS throughout the country.

Known as FedEMIS, the central unit receives data from the four provinces and, after consolidating with it the data collected by itself from the federally administered areas i.e. Federal Capital Territory, FATA, Northern Areas and Azad Jammu and Kashmir, present a comprehensive national picture of the country's educational scene. This data constitutes one of the most important components for the monitoring and evaluation of SAP and the various other programmes launched to promote education in the country.

4.7. USE OF TELEVISION/RADIO FOR EDUCATION

Pakistan television has established its second channel, which is exclusively used for educational programmes. These include both formal as well as non-formal programmes to promote literacy. This programme has its definite advantages as it does not require the infrastructure of school buildings, personnel and related facilities. In Pakistan, Allama Iqbal Open University (AIOU) has a mandate of educating people through its open packages. AIOU is also using, educational channel of PTV for its literacy massages and lessons. But there are certain in built short comings regarding the use of Television for educational purposes, particularly in developing country like Pakistan. Some of the difficulties in these initiatives can be the following. Literacy lessons are telecast at a particular time by the PTV, which may not suite all the illiterate population. There may be people who may not have electricity in their areas and still others who may have electricity but still not in a position to benefit from these telecasts due to technical constraints and limitations. There may be variations in the convenience and suitability of timings for illiterate population. For instance experimentation of literacy projects in various parts of the country revealed that female illiterates used to derive maximum advantage of literacy centers as they were located at convenient places closer to the houses of illiterate population. Timings of the Center were arranged with mutual consent of the teacher and the learners either in the morning or in the afternoon. This made the programme attractive for female illiterates. TV lessons on the contrary have fixed timings, which may not suit a sizeable number of people.

Radio also plays an important role in conveying and communicating important messages related to national development and well being of the society. Its main emphasis is on illiterate peasants and working community, which enjoys their leisure time listening to folk music and songs. But unfortunately, it does not provide the reading and writing skills, which are essential ingredients of literacy.

It is generally believed that computers and video games sharpen the memory and understanding of school going children. Their grasp of multimedia technology as compared to adults is sharper. They interact with computers through video games and easily develop mastery over electronic gadgets. On the basis of such assumptions certain schools have been provided computers but again it has to be seen how far the students have benefited from such facilities.

4.8. DIVERSIFICATION AND VOCATIONALIZATION

Side by side with the Universalization of primary education and eradication of illiteracy, emphasis is being laid on the diversification and vocationalization of education, particularly at the secondary level. The secondary level happens to be the terminal point for the majority of the country's youth, as they leave schooling after this stage and go out to join the world of work. Hence, the need for equipping them with relevant, knowledge, skills and work attitudes and enable them to contribute effectively to the development of the country as useful citizens. Moreover, the secondary stage is a preparatory stage for higher education and, therefore, it is necessary to impart at this stage a kind of education, which provides basic foundation relevant to the requirements of higher education. With this in view, stress is being laid on stronger diversification and vocationalizing of education to enable each individual to opt for the vocation of one's choice or prepare the persons adequately for higher studies. To achieve these targets, various programmes and projects have been launched to overcome the deficiencies and improve the overall quality of education at the secondary level. Science education obviously receives a very high priority.

In an effort to make qualitative improvement and quantitative expansion in the field of science education, a Science Education Project (cost Rs. 1.0 billion) for secondary schools was launched a few years ago. It is about to complete its life after attaining almost 95% of its targets. In addition to the construction of science rooms and laboratories in middle and high schools, development and provision of science kits and improvement of science teachers' capabilities and skills, the project also envisaged the establishment of an Institute for the Promotion of Science Education and Training (IPSET). This Institute has already been set up in Islamabad with a network of four regional Science Education Centers, one in each province.

In line with the new approach outlined above, steps have also been taken to provide facilities for creating computer awareness and promoting their applications in schools to prepare the youth to face the challenges of the 21st century. A project has been developed for introducing computer literacy in 150 secondary schools across the country. Phase-I and Phase-II of the project have already been completed, under which 40 schools have been covered. Rest of the schools will be covered during 1995-96.

5. SUMMARY AND CONCLUSION

Literacy is considered as an essential prerequisite for the acquisition and spread of knowledge. It provides building blocks for raising the quality and standard of life of the people and opens up avenues of access to knowledge. Those who are knowledgeable can benefit from new technologies and can lead the nation to progress and prosperity.

Use of new technologies in the school system will definitely enhance the comprehension level of students in their early phase of learning. Introduction of multi-media technologies like Internet, e-mail, etc. in the college and university libraries, will not only link them with each other but also with other such facilities abroad. This will further improve the knowledge base of young students enabling them to compete along with other students of the developed countries. These technologies need to be developed on a war footing and expanded so as to move ahead along with other notions of the world.

As far as the use of multimedia technology for low literacy area is concerned, it is inconceivable that the backward areas will be catching with the developed areas. The backward areas will be caught in the vicious' circle of perpetual backwardness unless efforts are made to develop proper infrastructure, which facilitate the growth and development of multi media and new technologies. Existing shortage of energy further restricts the growth and development of such technologies even in the developed areas what to speak of backward areas. However the establishment of institutes in various parts of the country for the growth and development of such technologies will he an important step in this direction.

Some efforts have been made in Pakistan in the field of educational technology, i.e. opening of

ETV (Educational Tele-Vision): FedMIS (Federal Educational Management Information Systems): and Educational Technology sections in Allama Iqbal Open University: Computers has also been included in school curriculum and also provided in DEOs Office for the effective educational management Pakistan's education system is paying proper attention to promotion of science education, technical and vocational education and computer literacy programmes.

NATIONAL REPORT OF THE PHILIPPINES

NEW INFORMATION TECHNOLOGIES AND EDUCATIONAL POLICIES: THE PHILIPPINES

I. STATE OF THE ART IN THE NEW INFORMATION TECHNOLOGY

Information Technology (IT) is considered as a strategic resource and vital tool for national development. It provides the necessary infrastructure and support systems that will enable nations to achieve the goals of economic stability and global competitiveness. Advancements In this field are changing the course of all other technologies. In addition, IT is revolutionizing lifestyles, workstyles and is changing the process of learning. President Fidel V. Ramos has underscored the importance of IT by declaring 1996 as Information Technology Year.

A. IT IN THE NATIONAL PLAN

In recognition of the important role of IT, President Ramos instructed the National Economic Development Authority (NEDA) to incorporate IT in the Medium Term Philippine Development (MTPDP, 1993-1998). The Plan mandates the enhancement of IT research and development (R&D) to support technology development in agri-industry and other areas; develop and upgrade science and technology (S&T) manpower capability by strengthening engineering and science education and providing relevant technical training, improving literacy in IT, and equalizing the participation of women and men in S&T activities, strengthen industry-academy linkage in the development of IT in different sectors.

The National Information Technology Plan (NITP 2000) was formulated to provide direction to IT strategies, programs, applications, and activities of both government and private sector towards national development. Moreover, the Science and Technology Agenda for National Development (STAND) 2000 identifies IT, specifically computersoftware and manpower development in IT that should receive massive S&T support to enable the country to take full advantage of its potential. Likewise, programs have been identified in the Science and Technology Education Plan (STEP), a companion plan of the Science and Technology Master Plan (STMP), which provides the framework for S&T development in the country. Moreover, support programs for the education sector in IT are provided under NITP 2000.

The education and training IT component of NITP 2000 has two major concerns: IT literacy and IT manpower development. IT literacy is a major concern of the educational system and IT Solution (hardware, software and consulting) providers with much help from the mass media. IT manpower development is a major responsibility of the educational system in strategic alliance with technology sources for the academic requirements and with various industries for the practical training requirements.

Among the targets and key result areas (KRAs) identified for the NITP 2000 education sector programs are:

Development of a critical mass (i.e. from 30,000 to 50,000) of competent IT workers for domestic requirements;

Offering of IT degree programs in universities and colleges (i.e. From 10% to 50%) ;

Increased IT literacy (to 50%).

The above targets are to be performed along with the other structural component programs of NITP 2000, aptly given the acronym T-I-G-E-R, which stand for Telecommunications, Industry, Government, Education and Research.

B. IT IN THE EDUCATIONAL SYSTEM

The Congressional Commission on Education (EDCOM) which conducted a study in 1990-92 with the goal of improving the quality and access to education recommended the restructuring of the present Department of Education, Culture and Sports (DECS), into the Commission on Higher Education (CHED). Technical Education and Skills Development Authority (TESDA), and the Department of Basic Education (DBE). Except for the latter which is still under deliberation in Congress, the first two agencies have already been established by law. All these agencies, however, recognize the need to integrate IT as a critical resource in making education more relevant and accessible.

The Philippine Educational system consists of government and private tertiary vocational, technical, secondary and primary schools. For developing the country's IT capability, the formal education system is tasked to develop a pool of computer competent professionals, which include scientists and engineers, while the non-formal education system is targeted to develop IT skilled workers for government, industry, and education sectors.

Among the broad policy actions adopted by the government's Cabinet IT Cluster Committee in support of the effort to accelerate IT in the education sector are: (a) the teaching of computer knowledge in universities and colleges and its integration with mathematics or science subjects in the primary and secondary schools, and (b) liberalization of computer entry in the country.

Technical Panels for various fields, which include IT and Teacher Education, have been created from a pool of Filipino experts by CHED. The Technical Panels give advice to Commission on academic matters relating to tertiary education. At present, CHED has authorized the integration of computer courses as part of the requirements for offering baccalaureate degrees. In particular, teacher educational institutions offer computer courses as part of their pre-service and in-service training programs.

There are four main sources of IT training and education in the Philippines, which are:
- educational institutions (private or state owned colleges and universities) which offer formal education leading to a professional certificate or formal degree;
- proprietary training centers which conduct short term training courses and seminars.
- computer vendors and suppliers who offer training programs as part of their marketing efforts, and
- in-house training programs conducted by user organizations for the development of their own employees.

The first two categories produce the largest numbers and constitute the main source of manpower for the country's IT software industry. As of 1992, there are five (5) different baccalaureate and seven (7) associate degrees offered in 103 curricular programs in various educational institutions in the country. Forty-eight (48) of these institutions offer baccalaureate degrees leading to B.S. in Computer Science. Recently, some schools have began to offer the 2-year Associate in Computer Data Processing programs.

Eleven Metro Manila-based schools produce about 1,500 IT graduates yearly. Nationwide, the number of graduates is estimated to be more than 2,500 per annum. More than 1.2 million students are enrolled in Philippine colleges and universities which constitute a large population from which the country's IT industry can draw on its manpower needs. Specifically, graduates in science and engineering courses (more than 40.000 in 1995) constitute another pool of future IT professionals. Enrolment in propriety training centers for short term courses reached more than 50,000 in 1992.

II. DEVELOPMENT EFFORTS ON IT FOR EDUCATION

A. PRESENT INITIATIVES

Several institutions have undertaken measures to introduce teachers to the world of IT and computer aided instruction. The Coordinating Council for Private Educational Associations (COCOPEA), the Philippine Association of State Universities and Colleges (PASUC), Association of Christian Schools and Colleges (ASCC), Catholic Educational Association of the Philippines (CEAP), PACU, Philippine Association of Private Schools, Colleges and Universities (PAPSCU), PAPTI, Fund for Assistance to Private Education (FAPE) and computer training institutions like AMA Computer College, Science and Technology Institute (STI),. I/ACT, Innodata, Metrodata, etc., conduct computer training programs for teachers and educational administrators.

Modularized lectures and hands-on computing skills, such as design techniques like flowcharting, software concepts, programming, concepts and computer languages, application softwares like word processing, spreadsheet, data processing, multimedia presentation and desk-top publishing are offered.

The University of the Philippines Institute for Science and Mathematics Education Development UP-ISMED), offers, along with its short-term courses on science and mathematics teaching, the courses on microcomputer-based chemistry and mathematics lessons: and a course on computer programming and mathematics. Among its resources are the 24 computer programs in BASIC Language for Mathematics, Physics, Chemistry and Biology for Teacher Education. In addition, INNOTECH has regular teacher training offerings on Computer-Aided Instruction (CAI) and authoring. Private institutions like the ASIA-PACIFIC College and Eduvision 2000 likewise have package programs in teacher training. DECS also conducts regional summer training on computer education.

Several initiatives like those undertaken by the Department of Science and Technology (DOST) through its Science Education Institute (SET), support the upgrading of science instruction by providing computer hardware and software, audio-visual facilities and instructional materials to a network of public and private schools. The Philippine Business for Social Progress (PBSP) and the Foundation of Audio-Visual Technology for Basic Education likewise provide for similar support to underserved schools in the country.

An education modernization program is also being launched by DECS to equip schools with facilities, equipment, materials and skills and to introduce new learning/delivery systems necessary to capitalize on recent technological developments. Specific areas of focus are S&T education, computer education, and language education. Distance learning through educational television and other delivery schemes are increasingly being used in the school system. Science laboratories, computer laboratories, language laboratories, eco-technology classrooms and supportive equipment are also provided. At the same time, a massive training program for teachers is being implemented to develop the skills for making effective use of modern school facilities.

The DOST was instrumental in the setting-up in 1994 of the PHNct, the Philippines' gateway to Internet. With PHNct, an efficient medium of information exchange and coordination among researchers and S&T workers was established. This government intervention program of putting-up the gateway has encouraged the private sector to invest in a number of Internet service providers. With 17 Internet service providers at present, the Philippines seems to have the biggest number for such within the ASEAN region. For W3 servers in the S&T community alone, the following are now in place:

Institutions/Sector	Number
Academe	11
Government	9
Philippine Related	7
Others	6

Eight institutions of higher learning in the country have been wired under the DOST's Engineering and Science Education Program (ESEP). The following universities at present have fully operational electronic facilities: University of the Philippines in Diliman, Manila and Los Bacos, De la Salle University, Ateneo de Manila University, University of San Carlos, Xavier University and Mindanao State University-Iligan Institute of Technology. The Mendiola Consortium of Universities is likewise in the process of wiring its member institutions.

B. CAPACITY BUILDING

The efforts to build the IT capability of the Philippines are focused, among others, on: (a) upgrading of IT training and educational institutions; (b) building a critical mass of IT workers of adequate number and quality, and (c) building a capacity for self-reliance in the country's educational institutions in the area of IT education and R&D.

Agencies of DOST composed of the Philippine Council for Advanced Science Research and Development (PCASTRD), Advance Science and Technology Institute (ASTI) and the Science Education Institute (SEI), are committed to programs on IT manpower development. Support for scholarships in various IT fields from B.S. to M.S. and Ph.D. levels including diploma and short-term training are available as part of their major programs. Scholarships are likewise provided by CHED for IT courses through its State Assistance Program and the Higher Education Find. Graduate level scholarships on IT will be made available through its designated Centers of Excellence.

PCASTRD provides assistance to local scientists and researchers, on R&D, which includes IT for education. Among the priority ID R&D areas are: human interface technologies (windowing software, expert systems, speech recognition, multimedia); communication technologies (LAN, WAN, EDI, wireless technologies); and system support technologies (parallel processing object oriented, data extraction and conversion software, on-line database searching computerized libraries, storage/retrieval technologies, client/server technologies. Among the on-going projects of ASTI in R&D on IT with applications for education are:

- RF/Microwave Communications;
- Radio Packet Telecommunications;
- Applications of Digital Sign Processing;
- Neural Networks and Fuzzy Logic.

In terms of services for providing accurate information on the country's land and water resources, periodic surveys are done through satellites facilities on remote sensing by the National Mapping and Resource Information Authority (NAMIRA) of the Department of Environment and Natural Resources (DENR), the central mapping agency of the government.

As part of building the capability of universities to offer quality IT education to teachers in science and mathematics, SEI is establishing model IT classrooms at the UP-College of Education and the Philippine Normal ~ University (PNU). In addition, SEI is developing a mobile IT classroom, a vehicle equipped with hardware and software units, as pilot project on IT at the elementary level in the sciences.

C. DATA BASES IN EDUCATION

The Fund for Assistance to Private Education's (FAPE's) Education Data Bank was established in 1979 for the purpose of gathering and processing information on private education and the entire educational system. It is tasked with the job of monitoring the condition on the educational system with the end in view of providing the proper context for the evaluation of its programs and projects. At present, other data bases include the DOST's HERDIN (Health Research and Development Information Network), and SCINet (Science Information Network), and form its line agencies. HERDIN was initiated with UNESCO support and is now highly organized on-line retrieval system. Data bases from the SCINet and from other DOST agencies provide for relevant information needed by researchers, students and policy makers. Current efforts of SEI are now underway on the development of data bases for science education which is being done in collaboration with universities and government educational institutions.

D. BROADCAST TECHNOLOGY IN EDUCATION

Early experiments on educational technology were done for programs on radio on the air of the Bureau of Public Schools through the Government's Public Broadcasting System and similar initiatives at the University of the Philippines in Dilinian and Los Bacos, University of Mindanao and a few other educational institutions. There was also a pilot project on educational TV, the Metropolitan Educational TV Association which delivered pilot courses in physics and social studies in over a hundred secondary schools in Metro Manila and nearby towns through commercial TV during specific hours. A closed circuit TV project at Ateneo de Manila University also started about the same time. At present TV programs in the sciences are made available for kids (Sineskuwela of Channel 2) and physics and chemistry teachers of secondary schools (CONSTEL of Channel 4).

Very recently, the concept of open or distance learning became acceptable especially with the enactment into law of the University of the Philippines (UP's) open University System. Early initiatives in the late 80s include the CAP College Open Learning Program, which started as a correspondence course and now utilizes multi-media in its undergraduate and graduate degree courses. The AIDE (Asian Institute of Distance Education) also started about the same time by offering continuing education courses primarily for workers in government and factories. The most ambitious program is that of UP-Open University which offers both degree and non-degree course for students in the country and overseas Filipino workers. The Polytechnic University of the Philippines (PUP) Distance Education Program also extends to its various campuses like that of UP. Other initiatives include that of the Philippine Women's University which has established a consortium with a network state and private universities and the Technological University of the Philippines. The Meralco Foundation Institute and the Don Bosco Technical College have also started their continuing education programs. The Asian Institute of Journalism and Communication complements these initiatives through teacher training in the development of learning modules. A new institute, the Wizard Academy has embarked in the projection of computer courseware. At least two networks, the ANTEP (Association of Non-Traditional Education) and Force (Foundation for Continuing Education) provide the catalyst in mobilizing and sustaining these initiatives.

E. TECHNOLOGICAL DEVELOPMENTS IN THE COMMUNICATION SECTOR

Media programming is becoming more specialized as media users or markets are segmented according to profession, interest, ethnic background, political affiliation, religion, etc. This is referred to as demassification of media.

Cable television has introduced specialized channels featuring exclusively news, sports, music, sports, public affairs, environment, education, etc. Radio stations are becoming even more differentiated.

There is a proliferation of specialized publications-magazines for sports, hobbies, agriculture, entrepreneurship, environment ad infinitum. One local publishing company has a distinct magazine for pre-schoolers, elementary kids and teeners.

The commercially-oriented Philippine (VHS) television stations are airing more diversified programs for specific audience groups. More educational or instructional programs are being aired such as Negosiyete (entrepreneurship). Agrisiyete (agribusiness). More than Export, Ating Alamin, Sineskuwela (Science Lessons for children), CONSTEL (Continuing Studies via Television in Science and English), etc. Lately, there has been a market increase in the number of educational children's program, some receiving international recognition such as BATIBOT (Channel 9) and FIVE and UP (Channel 5). HIRAYA MANAWARI (New Age Stories for Children) and BAYANI, a show focusing patriotism and love for country.

There are three educational cable TV stations. Ed TV 36 of the Sky Cable Network is the first educational TV channel in the Philippines. It offers educational, cultural, religious, information and public affairs programs. Discovery Channel Asia (available through Palapa B2P and Apsrar 1), offers programming in the areas of science and technology, nature, history, human adventure, and world culture. TV 101 or Youth Campus Network serves the educational TV of nine Manila schools.

III. POLICIES TOWARDS STANDARDIZATION

SEVERAL LEVELS OF STANDARDIZATION ARE BEING CONSIDERED HERE: STANDARDIZATION OF OPERATING SYSTEMS, SOFTWARE

The growing popularity of the Internet provides an enormous opportunity for IT service providers in tapping big market shares of IT users. Considering the importance given by the academe, private industries and government sectors to the wide utilization and need for exchange of IT services and products, it is but necessary for institutions to standardize their operational systems. Among the networks with standardized operating systems are the 17 existing IT service providers.

Although actual application programs used by different agencies are not at present standardized, there is dominance of Microsoft's Windows 95 in the local market. It may be noted that the network of universities and colleges like the DOST-Science and engineering Programme (JSEP), and the Mendiola Universities Consortium are committed to use standard operating systems and software. On the other hand, the Government Information Sharing Technology (GIST-NET) will provide for value added service to agencies of government consisting of several network hubs composed of the network and internetworking equipment. GIST-NET will be accessed by the general public through the Public Information Service Points called INFOKIOSK.

The broadcast technologies that are now in place, a relatively modern and standardized with few problems on interfacing. Telephone systems are, however, mixed. The cellular phone system is operated by various companies, each one pushing its own variations of analog and digital, and digital-analog technologies. Urban areas tend to have the advantage of using the latest fiber optic systems which allow for easy access to information databases.

STANDARTIZATION OF CONTENT

Standardization is a problem with the proliferation of many systems and types of hardware. However, computer packages sold in the Philippines are IBM clones; the Macintosh platform has captured only a small market and its use confined mainly to art and design applications. The rise of many chip manufacturers in Asia offering their own versions of standard platforms may however be an emerging technology.

A proposal during a meeting of information technologists in ASIA was to adopt Asian Standards of hardware that would be more realistic for Asian needs and culture.

The trend towards networking of information systems is expected to lead to standardization of hardware. Computers with telephones and televisions will eventually "converge" and be hired out instead of bought which will result in a high level of standardization of both hardware and software. Moreover, the National Telecommunications Act and NITP 2000 are now working on policies leading towards greater uniformity and standardization. What should concern ASEAN and worldwide policy makers is the inter-operability of the many systems and hardware now in existence. Development is taking place so fast on so many fronts that the end user does not have time to learn the nuances of their usage. On the other hand, policy makers are in the dark as to the implications of certain technology and software shifts.

Because DECS has set a minimum learning competencies that are to be learned by each grade level, there is little debate as to what and how much is to be learned. Values education is integrated in almost all subjects, something that is very apparent in all the programs aforementioned. What is lacking in many of the television and radio programs is the lack of opportunity for learners to interact with one another which is characteristic of information technology-based learning materials. The latter allows the student to explore by experimenting on various combinations and options - something that a one-way medium like television does not allow.

At the tertiary level, computer science has been made as a compulsory subject for students enrolled for baccalaureate degree programs. The inclusion of this subject in all degree programs would assure the development of IT literacy among potential members of the pool of professionals in the country.

IV. ISSUES/CONCERNS ON IT IN EDUCATION

Despite the perceived advantages and potential of the Philippines, a number of problems hamper the accelerated growth of IT in education. Among these are the following:

1. Brain Drain

Considering the recognition given to IT professionals by other countries, there is a marked exodus of such professionals to lucrative position abroad. Close to 1,000 highly skilled system programmers are lost per year to overseas employment.

2. Slow expansion of trained personnel, mismatch of expertise/manpower developed-ment and industry requirements

Skills of graduates coming out of the formal education stream diverge from the requirements of industry as shown by some local studies (Teodoro, 1990). This is due to tile fact that academic institutions have the long-term objective of preparing students for lifetime vocation. As a result, software houses and user organizations require new recruits to undergo a training regimen before job assignments are given. In addition, most private universities suffer from faculty shortage, poor access to computer facilities, and lack of quality standards and accreditation system.

3. Unreliable quality, low productivity of software services, slow diffusion of IT

Such are partly due to the lack of access to software engineering and productivity tools. Universities and R&D institutions play negligible roles in adoption a diffusion, despite the rapid changes and R&D intensity of IT.

4. Inadequate training and exposure of IT faculty members

While the faculty stock of degree-granting institutions are equipped with masters and doctoral degree-holders or some may be in the process of obtaining post-graduate degrees, the weight of their leaching, loads prevent them from undertaking continuous development. Further, a number have not had actual experience on IT, and are therefore more theoretical in their approach. For propriety training centers, their teaching staff was found to consist mainly of part-time lecturers whose academic preparation would generally be less focused and less intensive than in degree-granting institutions.

5. Undercapitalized software companies

Except for a few large software companies that were born out of large diversified corporations or joint ventures as subsidiaries of foreign companies, the Philippine software sector grew out of efforts of individual entrepreneurs with minimal capitalization. Government intervention may be needed as catalyst for developing educational software which is presently quite costly in the market.

6. Poor telecommunications/data communication infrastructure

The country suffers from pour communications infrastructure, which has a direct effect on access to IT by schools and households.

7. Poor access of IT in education

The inaccessibility of information technology at a mass level has made poor rural schools and developing countries more vulnerable and marginalized in the globalizing economy. While most private schools already have their computer laboratories, only 0.03% and 6.22% of Philippine public elementary and secondary schools, respectively, have computers. About two-thirds (65.72%) of public elementary schools and one-fifth (19.94%) of public secondary schools still do not have electricity. The structure of the national budget for education eats up 75% and 12%, respectively, for personnel and schoolbuilding, leaving little for quality improvement and modernization. Furthermore, teachers and school administrators need upgrading in instructional application of modern technology.

8. Abuse of IT

Practically, any material that can be digitized, such as pornography, abusive language, prostitution, pedophilia, and even organized crimes may find itself in the information superhighway, which makes IT prone to abuse. The Philippine Congress is now debating on possible legislative measures for regulating and preventing abuse of IT.

9. Software production, protection, property rights and copyrights

The existing policies on intellectual property and copyright are vague. This is shown by the relative ease by which software have been pirated. On one hand, software developers, including the content providers, have been deprived of billions of dollars in royalties due to the proliferation of piracy, especially in the developing countries.

On the other hand, millions of offices, educational institutions, small businesses, and individuals have benefited from affordable pirated information technologies and products tools such as CD-ROMs, diskettes reprinted textbooks, photocopied and digitized copies of program codes.

10. Educators' Perception of IT

Within the Philippine educational system generally remaining hierarchical, the introduction of innovation has been uphill climb. Many decisions are made at the top, with little preparation of school administration and teachers in both management and implementation levels. Teachers and education officials especially in the public sector have been quite cynical of information technology. They perceive IT as a threat to their job as educators. They fear that it may take over their functions so that they would hardly be needed in the classrooms. This has been a stumbling block in the introduction of information technology in the educational system.

In the area of conceptualization and production, and eventual use and implementation of learning materials for actual learning institutions, teachers are seldom consulted by software makers. Considering that NITP 2000 will establish a Philippine Software Development Institute which will involve both IT production and concept personnel, this problem, hopefully, will be looked into.

The utilization of information technology for education is dependent on up-to-date technology, a deregulated telecommunications industry, a receptive policy environment, and competent, sophisticated, and creative content providers. There has to be parallel growth and expansion among information technology, information technology tools, telecommunications facilities, and quality content providers to ensure the substantial impact of information technology on education. This underscores the need for: 1) a policy environment that motivates the private sector to make affordable, quality, and value-added computers and other form of interactive technology; 2) a telecommunication industry that is deregulated and expanded to include major industry players and independent enterprises and that provides for social clauses on public access for education as part of the franchising agreement: and 3) competent content provides with a working knowledge of how computer information technology tools can be integrated into the learning environment.

V. PARTICIPATION IN INTERNATIONAL PROGRAMS

The Philippines has participated in several international conferences such as those sponsored by UNESCO, the International Telecommunications Union and the Pacific Telecommunications Council and dozens of other global initiatives. It has participated in establishing regional information coordination mechanisms and networks such as ASTINFO (Regional Network for the Exchange of Information and Experience in Science and technology in Asia and the Pacific to contribute in the elaboration of regional strategies relating to access and use of specialized information. The Philippine Computer Society itself is active in ASEAN and international conferences on the use of IT. In all these conferences, the concerns have always been the need for guidelines on content of programs for airing on international satellites TV. The focus is how to take into account the diverse social, political, cultural, and economic needs of the nations involved in the open, borderless world of international broadcasting while preserving strengths found in traditions, values and family.

Other projects where the country participates include the SEAMEO Philippine Center On Innovation and Technology's (INNOTECH's) information and exchange program for the Regional Educational Information Network (REIN) with its databases on educational policies for use in teacher training institutions. In addition, DOST in cooperation with the Philippine Computer Society (PCS), annually send a youth delegation to the International Software competition.

As member of the Asia—Pacific Economic Conference (APEC), the Philippine is committed to the establishment of the Asian-Pacific Information infrastructure discussed in the Ministerial Meeting on Telecommunications and Information industry of the APEC held in Korea in 1995.

SUMMING UP: CHALLENGES AND THE FUTURE

There is a national consensus that the key to IT development rests in the development of human resources in this sector. The country is now recognized as one of the best sources of programming talents in the world mainly due to the efforts of Filipino computer training, schools, software companies and computer users in developing computer professionals. In addition, the Filipinos' competence in English is perceived to be an advantage in sustaining the country's IT software capability. However, due to migration, the sector is reeling from lack of trained IT professionals. Current efforts are now focused on looking into knowledge-based programs and effective teaching methodologies in the educational curriculum, allocation of scholarship programs as well as providing necessary incentives to IT learning institutions and training centers. The Commission on Higher Education (CHED) has created a Technical Panel on IT to recommend minimum curricular and other requirements for IT-related degree programs. Government investment in R&D for IT in education should be accelerated to sustain national capacity building efforts in the field. Moreover, the commitment to develop human resources cannot be overemphasized.

The role of information technology, for a country like the Philippines, is to identify knowledge brokers-institutions or people who can help the learners pursue information and knowledge by suggesting leads where the information could be found. In such a manner, teacher and students will revolutionize education by assuming a new role: that of navigators in a field of data, triggered by a research process beginning with curiosity and desire to learn.

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NATIONAL REPORT OF THE RUSSIAN FEDERATION

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES

If Russia is to become GREAT it is only through its culture. It is not existence that shapes consciousness, it is consciousness that shapes existence. We will live to the extent we are educated, cultured and moralistic.

D.LIKHACHEV

INTRODUCTION

Today Russia is probably going through one of the most dramatic periods in its quest for socio-economic, state and political transformation. In the near future, Russia's role in the world wide process will be determined by the resolution of its Government and its people to set a strategic objective of transforming Russia into a world power with intellect- and science - consuming production prioritised.

To make the state rank the world's first positions, with intellectual labour prevailing in the GNP, some necessary conditions are required. To start with, 40 to 60 per cent of adults should have higher education, and the number of scholars and scientists in the nation should be sufficient enough to amount to 2-5 % of the total population.

Feasibility of the above indices is based on the fact that Russia now has an adequate number of highly qualified and skilled personnel and has accumulated an enormous intellectual product.

Recent transformations in the sphere of science and education have bolstered the argument that, as long as knowledge is of a universal nature, its acquiring, in-depth learning and dissemination is basically achievable through assistance and stimulated collective efforts of the international scientific community. Accentuation of internationalisation of education's content along with its functional variety, on the one hand, and increase in mobility of both students and teachers - on the other, becomes ever more significant in the light of today's trends in the world commerce, economic and political integration and growing demands for intercultural mutual understanding. This positive trend is backed up by the increase in the number of students who study, work, live and communicate in the international environment being greatly assisted through new telecommunication technologies.

The system of education is the most reliable and civilised way of achieving progress and implementing reforms leading to the development of society. Realising this fact should result in ensuring the outstripping approach to education development against the background of other measures contributing to the process of Russia's revival.

V.KINELEV
DEPUTY CHAIRMAN OF THE GOVERNMENT OF THE RUSSIAN FEDERATION
CHAIRMAN OF GOSKOMVUZ OF RUSSIA

1. BRIEF CHARACTERISTIC OF RUSSIANS EDUCATIONAL SYSTEM

The right to education is one of the inalienable constitutional rights of Russian citizens. Education in the Russian Federation is carried out in accordance with the national legislation and international law (Appendix 1).

According to the Law on Education, the RF, the system of education in Russia is defined as an entity of:

• the system of successive educational programs and standards for various levels and purposes;
• the network of educational institutions of various organisational and legal forms, kinds and types that realise the above curricula;
• the system of educational management, including the bodies within the jurisdiction of the above.

The educational programs and curricula implemented in the Russian Federation are subdivided into:

• general educational: basic and supplementary;
• vocational (professional): basic and supplementary.

General educational programs and curricula include:

• those pertaining to pre-school education;
• primary general education;
• basic general education;
• secondary (complete) general education.

General educational programs are designed to settle the Tasks of forming general culture, intellectual, moral, emotional and physical development of the personality; working - out scientific world-outlook; adapting individuals to life in a society creating the basis for a thought-over choice and mastery of vocational training programs (Appendix 2).

Vocational educational programs include:

• Those of primary vocational education;
• Those of secondary vocational education;
• Those of higher-school professional education;
• Those of post-graduate professional education and corresponding supplementary training.

Vocational educational programs are oriented toward further development of the personality in the process of acquiring a profession, speciality and qualification by students in conformity with their interests, abilities as well as the social order of the society and state.

The mandatory minimum of the content for each basic general-education and vocational program (for a specific profession or speciality) is determined by the corresponding state educational standard.

Interconnection between basic and supplementary educational programs are realised through the system of educational institutions (chart 1.).

According to their organisational and legal forms educational institutions may be state, municipal (community), non-State (private) ones, as well as those run by various public and religious organisations (movements).

According to their designation and objectives pre-school establishments in Russia fall into general child-developing ones, health-compensating (for children in need of certain correction of their psychological or physical development), those for child care, physical conditioning, and combined types.

The system of general secondary education in Russia includes:

• General secondary schools;
• Schools with in-depth studies of separate subjects;
• Gymnasia;
• Lycees;
• Educational institutions of the boarding school type;
• Special schools for physically or mentally handicapped children;
• Educational institutions for supplementary education;

The Russian Federation is populated by around 130 nations and nationalities. The Non-Russian population share is about 19 %. To avail that category of students of an opportunity to upgrade their knowledge of native languages, special native language schools are organised.

Primary and Secondary vocational education is provided through the network of professional technical and secondary special schools, including technical ("technicums"), humanities, medical, art and other establishments. These establishments ensure students every opportunity for acquiring general (complete) secondary education.

The higher-school professional education system includes:

• Universities
• Academies
• Institutes
• Colleges

Higher educational institutions (VUZ) train specialists and provide upgrading (refresher) courses for the like of them on the professional curricula leading to B.A. or M.A., along with a traditional higher education diploma as well as training the highest qualification scholars and scientists earning such degrees as a candidate of sciences or doctor of sciences.

Supplementary educational programs are realised in general educational or vocational institutions and in specialised supplementary institutions: at upgrading (refresher) institutes and courses, professional orientation centres, musical and art schools, at palaces and centres of child and youth creative activities and the like. The major objective of adult supplementary education is to provide a continuous upgrading of qualifications for workers, employees and specialists. The system of continuous education boasts the participation of 40 % of the nation's adult population.

Russia's system of education is one of the world's biggest. Nearly 20 million children of Russia go to school. Most of them (about 70 %) attend pre-school establishments before school. In 1994 they numbered about 73,000 such establishments with over 500,000 teachers and instructors.

The general educational schools of Russia (in 1994 - 69,000, including 2,000 national, native language schools) employ over 1,6 million teachers (75 % of them with higher school diplomas).

The primary vocational training (in 1994 - 4200 schools) employs about 160000 teachers and instructors, there are about I million students mastering the skills of 250 specialities and trades. Today, higher school professional education in Russia comprises 568 state and 211 non-state (licensed) higher educational institutions with a 3 million student body and 240,000 professors and teachers, including 18,300 DSc and 114,600 candidates of science. In addition, there are 1051 institutions providing upgrading courses, where 2 million people study annually, there are also over 100 military higher educational institutions.

The student body of 2600 state and 70 non-state secondary specialised schools amounts to over 2 million.

The higher school of Russia has a highly-developed academic, research and production infrastructure which includes over 600 libraries, about 700 scientific bodies, with 92 scientific-research institutes, 57 experimental design centres, 84 experimental production shops.

All in all, the secondary and higher professional school in Russia has about 6 million teachers, staff workers, postgraduates and students. The total number of people in the system of education in Russia amounts to 40 million, which determines its exceptionally important role in cultural, social and economic development of the nation.

No economic or social reforms are destined to triumph without an accelerating development of the system of education. Priority consideration to the problem of producing specialists that understand the gist of economic and social reforms and are capable to realise them through new economic mechanisms of management, through creating new progressive technologies and forming new social relations - will help Russia to preserve the role of the World's leading power and to successfully overcome difficulties on the road of grandiose socio-economic and political transformations.

2. PRINCIPLES, STRATEGY AND REALISATION OF RUSSIA'S NATIONAL POLICY IN EDUCATION

The territory and army can be sacrificed but the literati cannot.
(From Confucius' address to Ancient China's rulers)

The main principles of Russia's national education policy are set forth in the federal law «On Education» (Appendix 3).

The strategic aims of Russia's national education policy are consequently as follows:

- effort is to be made to provide citizens with the necessary facilities to exercise their constitutional right to education, with more self-determination, self-development and possibility for every individual to find a place for himself in life;
- Russian mentality is to develop on the basis of universal values, with respect for the rights of the individual as well as for public, territorial and ethical interests promoted in Russia's public consciousness;
- a system of education is to be formed, adaptable to men's conditions and standards and also to the new theory/practice interaction;
- principles of developing education and activity-oriented techniques are to be introduced, with education becoming a field for mastering thinking and acting procedure;
- Russia's educational system is to be integrated into the world system of general education.

Russia's national education policy is organisationally based on the Federal education program adopted by the country's supreme legislative body. The Program specifies particular ways and means to achieve the strategic aims set.

The main mechanisms of the major educational reform in Russia are diversification and regionalisation of education ensuring its continuity, overhaul of its administration system, as well as raising the quality of educational programs by basing them on a thorough scientific knowledge, and making them comprehensive and individual-oriented. One of the major mechanisms having to do with all the main trends in Russia's educational reform is informatisation viewed as a sine qua non and, at the same time, as an important stage in the informatisation of Russia as a whole. The basis for transition from the industrial society to the informational one lies in new information technologies (NIT).

Informatisation of education will ultimately make it possible to enjoy the essential NIT advantages, which are as follows:

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- an open education system can be devised, with every individual choosing an education route of his own.
- the process of cognition can be radically altered by adopting system thinking on a larger scale.
- the students' cognitive activity during instruction can be better organised.
- certain specific computer characteristics can be used. The most important of these are:
  - The process of cognition can be so organised that an activity approach is maintained throughout;
  - instruction involving need, motives, goals, conditions, means, actions, and operations. Instruction can be individual and, at the same time, comprehensive, with automated teaching programs programmed and dynamically adapted. Finally, radically new cognitive means can be used and organised.

Informatisation of education is looked upon as an important means of realising a new national educational paradigm designed to change the existing orientation. Generalised knowledge is to have preference over pragmatic highly specialised aims. Likewise, primacy of knowledge will make way for general culture and scientific thinking, while focus will be on the up-to-date concept of the structure and all-round content of science rather than the historic context of scientific knowledge.

The new educational paradigm will give preference to

- a thorough scientific knowledge, which implies emphasis on establishing deep-seated essential foundations and interconnection between all kinds of processes in the world around us;
- a comprehensive approach, which means introduction of comprehensive series of scientific subjects with a single aim in view and focus on links between them;
- the development of the individual.

It will help to enhance the social importance of education due to its enormously rich content as well as its cognitive and world outlook potential. But new educational tasks call for new technological solutions.

3. NEW INFORMATION TECHNOLOGIES IN EDUCATION - PECULIARITIES OF THE NATIONAL PRACTICE AND PROSPECTS

Bare hand and brain itself are of little if any power. Actions are performed with both instruments and auxiliaries, which are of more need to brain than to hand.
Francis Bacon

3.1 .BRIEF HISTORY

Development of computer technologies in education in the USSR started in the middle of the 70s and reached the peak of its mass application circa the 80s. At this stage informatisation of education developed mainly at higher school. Automated teaching systems, developed on the basis of common programming and methodological means, such as AOS VUZ, RAKURS and others, were then widely practised.

Within the framework of science and technological programs for the USSR and the other Warsaw Treaty countries from 1979 to 1990 a series of projects was carried out on developing and introducing computer technologies into the practice of educational institutions of all levels. As a result, there appeared:

- concepts of designing and applying computer teaching technologies;
- a complex of instrumental program facilities:
  - author languages, aimed at constructing dialogue teaching programs;
  - author systems (automated systems for constructing teaching programs);
  - experimental expert and consulting systems (program systems for instrumental and methodological support of knowledge bases for teaching purposes);
- sets of applied program and methodological means, aimed at studying different subjects.

The newly formed means became an effective instrument for accumulating, testing and specifying new teaching methods and forms at all the levels of the educational system.

Expansion of new information teaching technologies brought about some structural changes in the most frequently used professional terminology. The new term *NEW INFORMATION TECHNOLOGIES IN EDUCATION (NITE)* came into use.

In Russia, the so-called Technology of Education means realisation of educational contents, envisaged by educational programs and by a system of forms, methods and means of education to reach didactic goals.

Distinctive signs of new information technologies of education are specific environment, in which they are applied, and some components, such as:

- technical (technical facilities in use);
- program and technological (programming means to support the applied technology of the education);
- organisational and methodological (instructions to both teachers and students, organisation of the educational process);
- the problem area of knowledge.

In Russia, automated educational courses with computer program support, aiming at reaching one or more targets, are widely practised. Automated educational courses include programs, methodological and educational materials (slides, printed material, audio and videotapes etc.), necessary for teaching activities at any level.

In Russia, works in the sphere of didactic programming got considerable elaboration. In the pedagogical literature this term is used in connection with tasks and problems of selecting and structuring educational material, as well as optimal organisation of the educational process. One of the most important tasks of the didactic programming is synthesis of target systems for optimal monitoring of educational activities, when the level of knowledge and skills of any student reaches the required one.

At present, a new tendency comes to the surface. It is aimed at developing and using the author's integrated medium, supporting different informational components: texts, dialogues, schemes, patterns. It also includes analytical and simulation models of the objects and phenomena under study, data and expert knowledge banks, support systems for certain professional activities: scientific, engineering and technical calculations and studies, automatically controlled screen display and planning.

At present the system of education has accumulated some several thousand computer programs for educational purposes, developed at educational institutions of Russia. Certification, testing and distribution of these programs are carried out by branch foundations, being in close contacts with regional, higher institutional and other centres of new information technologies. These centres actively participate in realisation of state scientific and technical programs of informatisation in education, provide education and training for teachers, render all kinds of assistance to educational institutions in applying new information technologies of education.

3.2. INFORMATION TECHNOLOGIES IN EDUCATION - NEW PROSPECTS FOR STUDENTS AND TEACHERS

Modern information technologies provide students with an access to non-traditional sources of information, raise effectiveness of independent studies, lay the foundation for creative activities, gaining and securing all kinds of professional skills, and help put into life principally new forms and methods of education with the use of means for conceptual and mathematical modelling of different phenomena and processes.

Modelling in classes provides graphic or visual image of a studied object and stimulates students' interest to this type of education; as well as studying dynamic processes results in a more profound study of the teaching material.

Since modelling itself becomes a target for a number of subjects, they are developing new instrumental program means in Russia, enabling both teachers and students to work out and modify teaching models in the interactive regime without any further programming.

Additional didactic opportunities are provided by such kinds of models as playing tasks.

Communication as a result of playing comes here as one of the forms of a personality's self-expression in the process of information interaction with colleagues and a computer. According to Russian specialists the most effective playing games are those oriented to obtaining the best results in solving difficult typical tasks by competing student groups.

Information technologies in education provide any teacher with a possibility to apply both certain kinds of class work and their combinations, in other words to project teaching medium. Instrumental means, oriented to a teacher, allow him/her to quickly renovate the content of automated educational and control programs in conformity with knowledge and technologies.

The teacher gets more opportunities for supporting and developing the personality of any student, for creative efforts and organisation of their mutual work, development and choice of the best program-variants. The teacher becomes the main supplier of educational subject targets with the account of subjects diversity and importance - humanitarian, economic, natural science subjects, etc. - at a given educational institution. By providing a teacher with intellectual forms of labour, we give him/her a possibility to put aside and get free from routine teaching methods, typical for traditional education. Information technologies free a teacher from explaining to auditorium a considerable part of the studied material and routine operations, connected with acquiring skills and abilities.

Introduction of new hypertext technologies into a teaching process provided both students and teachers with principally new possibilities to work with text documents. Multimedia technologies turned the computer not only into a worthy interlocutor, but enabled students, without leaving classrooms or homes, to listen to the lectures of eminent scholars and professors, become witnesses of historic events of the past and present, visit the most famous museums and centres of world culture, most interesting and geographically remote places on the planet.

Completely new possibilities for students and teachers have been opened by telecommunication technologies. As studies of specialists showed, being involved in the computer network activises students' need to become a member of a social community. A considerable increase in children's literacy and development of their speech habits, growth of their interest toward studies and, consequently, growth of progress in studies have been noted. International telecommunication projects become more and more common. Inter-regional and international competitions using new information technologies are held regularly. Russian school children, participating in them, traditionally show high results.

Getting an access to professional data banks, Schoolchildren get acquainted with scientific problems that are yet under study, form and work in small research groups, share their results with other researchers in the same field. Use of well-structured information, stored in data banks, serves as an instrument of testing hypotheses of their own, helps learners to remember information, facilitates to form habits for executing logic operations of analysis, comparison etc.

With an access to the telecommunication network, teachers not only increase their informational competence, considerably but get a unique opportunity to communicate with their colleagues practically all over the world. This creates ideal conditions for professional communication, for carrying out joint teaching, methodological and scientific activities, and exchanging teaching aids, computer programs, data etc.

In recent years Russia is expanding the sphere of computer application pre-school educational establishments. Different methods, aimed at children's individual development with the account of their age and individual capabilities, at organisation of their communication, are under development. Special attention is given to the use of modern information technologies in solving problems of integrating children with limited capabilities into the nowadays society. For this group of children new information technologies are the only instrument to get a full-scale education, competitive profession and simple communication.

3.3. EFFECTIVENESS OF TEACHING PROCESSES INVOLVING NEW INFORMATION TECHNOLOGIES

Estimation of the effectiveness of any method or educational technology includes evaluation of reached results, material and time expenditure involved. Academic progress is measured either by test paper results in points or percent of solved testing problems. Usually two groups of students are compared: those with a computer support and those without it.

Effectiveness of computer teaching methods is usually estimated against that of the so-called traditional methods, with academic progress being the only parameter measured. Sometimes the time spent by students is also taken into consideration. Application of such an approach to estimation of information technologies implies that the latter bring nothing new to educational goals and tasks. In reality, introduction of such information technologies changes the education itself dramatically, transforming it in conformity with general principles of society informatisation developing an into informational society. And this is one of the most important aspects of introducing new information technologies into education.

Nevertheless, the question of comparing effectiveness of traditional and new educational technologies is of much interest to specialists. Russia constantly hosts scientific and pragmatic conferences on increasing effectiveness of new information technologies in education, this subject being actively discussed by specialists in scientific publications, methods for estimating the effectiveness of new information technologies in education are being developed and tested.

According to Russian specialists, new information technologies in education will increase effectiveness of practical and laboratory classes in natural science subjects not less than by 30 %, and objectivity in testing students' knowledge - by 20-25 %. Academic progress in test groups using new information technologies, as a rule, is 0,5 point (with a 5-point scale of evaluation) higher. The vocabulary accumulation rate in groups studying foreign languages with a computer support increases by 2-3 times.

New information technologies allow us to settle a number of principally new didactic tasks:

- study of phenomena and processes in micro and macro environment, inside complex technical and biological systems on the basis of modelling;
- use of a suitable for studies time-scale for representing different physical, chemical, biological and social processes that, in reality proceed with too high or too low speed.

This enables us to introduce into the teaching process classes and laboratory works using computer models of a very expensive, sometimes unique equipment, which many educational institutions can not afford to acquire. In such cases we can speak about direct economic effectiveness of NIT introduction, but, as a rule, it is an effectiveness of a hypothetical nature, since in reality there is nothing to compare with - without NIT applications it would be impossible implement laboratory works of that kind in the educational practice.

4. RUSSIA'S STATE POLICY IN THE FIELD OF INFORMATIZATION OF EDUCATION, MAIN PRIORITIES

There are rules to choose a decision but
there are no rules to choose these rules
Anon

It is common knowledge nowadays that information and knowledge, its ultimate form, create a decisive factor of development in a society as a whole. To effectively use gigantic volumes of information and knowledge brought up by the modem information revolution in order to solve real problems and overcome actual difficulties, Russia has to carry out intensive, co-ordinated and feasible informatisation of the society in practical terms:

• create legislative, economic, technical, social, professional and educational conditions to make available information, necessary to settle social and personal problems, anytime, anywhere, for any potential user;

• create technical conditions, hardware and software, telecommunication systems to ensure fulfilment of the previous item;

• provide an industrial and technical base for the production of competitive national information technologies and resources within the framework of the international labour division.

• ensure the primary development of structures, institutes and mechanisms, first of all in science and education, that guarantee an outdistanced (as compared to other spheres -political, economic and social) production of information and knowledge;

• train qualified personnel;

• implement a complex introduction of information technologies into the sphere of production, management, education, culture, transport, power engineering and etc.

Implementation of society informatisation requires a special information policy whose main principles with reference to Russia's educational system are conceptually recognised and formulated. A series of state, interbranch scientific and technical programs envisaging realisation of large-scale projects of education informatisation have been developed and are being implemented. They cover the following main directions:

• improvement of students' basic training in informatics and NIT;

• improvement of the system of teaching staff training and retraining in NIT;

• informatisation of the teaching and education process;

• equipping the system of education with technical means of informatisation;

• creation of a modern national information space and its integration of educational institutions;

• creation of a united system of distance education in Russia on the NIT basis;

• Russia's participation in international programs on NIT in education.

4.1 .BASIC TRAINING IN INFORMATICS AS A BASIS FOR INFORMATISATION OF THE SOCIETY AND A NEW QUALITY OF EDUCATION

Historically basic training in informatics in Russia underwent three periods: before 1985, 1985-1990 and 1991 till present.

Before 1985 training in basic informatics took place only in higher educational institutions, where future engineers, economists, physicists and mathematicians were taught the following topical subjects in: «Computing facilities in engineering and economic calculations», «Principles of computing technology and programming», "Algorithm languages and programming" etc. These programs were developed by methodical committees under the Ministry of Education. The programs were standard and obligatory for all higher educational institutions except several dozens considered to be of an advanced level and allowed to teach under non-standard programs.

Informatics classes in Russia's secondary schools were optional and were held in newly formed school education informatisation centres in Moscow, Novosibirsk, Ekaterinburg and Saint-Petersburg.

The first manual for the school course "Principles of informatics and computing" was prepared by a group of authors headed by academician A.P. Eshov in 1986.

To ensure proper informatics training at schools and universities sets of manuals on basic informatics, computer-aided control and design systems, microprocessing technology were published in 1985-1988. The best specialists and teaches of the professional education were involved in preparing these manuals.

Mass training of teachers and professors all over Russia in the field of computer knowledge was organised in 1986-1988.

The concept of teaching basic informatics covering all levels of education was developed in 1985. This helped to correlate contents of training and secure succession and continuity of studies at all levels of education. Training programs and plans oriented at specific level of education were substituted by new ones to achieve these key principles. The goal was to elaborate a content structure for continuous training in informatics, independent of institutions and levels of education: from methods of calculations with micro-calculators to the highest levels of computer application implying skills to program, develop microprocessors and insert them into equipment and electronic devices, develop systems of computer-aided design in one's professional field etc. The program of training in informatics was structured with reference to age stages that to be completely covered on finishing secondary school and other levels that were, as a rule, achieved on graduating from higher or secondary professional educational establishments. Figure 2 shows the structural composition and interaction of age stages and levels of training in computer science.

Computer science training was divided into basic and special-purpose training. The goal of **basic training** was to provide students with basic knowledge in computer science and computing facilities principles that will be needed to get **special training** in such fields of computer applications as design of information-processing and microprocessor systems, management and design automation, and etc.

One of the main elements of the system developed was a handbook of qualification requirements for computer science training of higher and special professional school students (fig. 3 gives a fragment of the handbook line). For each speciality of the professional education system, the handbook outlines the recommended levels of basic and special training in:

- microprocessor equipment (MPT);
- computer-aided design systems (CADS);
- computer-aided systems of industrial processes management (CASIPM);
- computer-aided research systems (CARS).

For each level of basic and special training, the following elements were developed:

- a fragment of activity description (a list of skills and abilities, and the level of knowledge the student should acquire in basic or special training at the relevant level);
- names and syllabuses of disciplines studied, the hours allocated to these disciplines, recommendations on the composition and volume of practical studies involving the use of computers and work in specialised laboratories;
- theoretical and practical teaching aids;
- recommendations on technical equipping of computer classes and specialised computing technology laboratories.

The scheme of formation of a program for computer training of students, using a developed complex of teaching and methodical documents is given in fig. 3.

The concept of outlining the content of computer training in Russia's educational system that was worked out and introduced in the late 1980s featured competence and adaptability to perspective requirements to students' skills and abilities, as well as completeness provided by teaching and methodical materials. The aforesaid makes it, in main aspects, relevant up to now.

The late 1980s saw significant changes in the content of courses in basic computer science for all levels of education. As a result, the number of hours allocated to studying programming decreases. More emphasis is made on studying new information technologies. When the new, modern, concept of teaching basic computer science in Russia's educational institutions was under development, the main principles embodied were as follows: priority to studying information technologies while taking basic computer science courses; and acknowledgement of high, ever-growing, computer science potential and its specific role in the formation of the modern informational society.

The distinguishing features of teaching computer science in Russian educational institutions are:

- acknowledgement of high ever- growing potential of computer science and granting it the status of fundamental natural-science discipline;
- modern- outlook comprehension of the computer science subject domain;
- modular presentation of the studied subject domain, instead of discipline one used before;
- use of modern information technologies for system modular formation of training content based on the activity approach. These technologies supported by state educational standards help to form a program with students' professional activity orientation and consideration of their personal interests and peculiarities;
- orientation to new information technologies of training.

Courses in computer science at schools are being modified substantially to follow the modem concept.

Training is split into three stages:

- general educational stage (I - VI grades) envisages introduction of schoolchildren to the computer world, formation of basic elements of the informational culture in the process of using educational game programs, the simplest computer simulators, etc.;
- the second stage (VII-IX grades), the main course is taught. Here students acquire methods and means of information technologies for solving problems, develop skills of conscious and rational use of computers for educational purposes;
- the third stage (grades X-XI) provides continuation of computer science studies, varying in the volume and content according to students' interests and their pre-professional training orientation.

To provide school computer science courses with teaching aids work is under way to prepare programming and methodical materials for the experimental course "Informational Culture" (running through all grades, X-XI). There were made such teaching aids as, "Algorithmics" (V -VII grades), "Computer Science" (XII-IX grades) and "Principles of computer science and computing facilities" (X-XI grades).

A specific feature of the modern concept is an upgrading mechanism that is being developed to update the content of training, for it to the catch up with rates of progress in informatisation means and technologies. Educational standards are revised every 5 years, which is too long a period for such a dynamic sphere of knowledge as information technologies. The solution is that standards regulate requirements to basic knowledge in computer science and determine only the list of information technologies students should master. At the same time, teaching modules providing the study and mastering of technologies can be chosen from a wide enough spectrum, with the account of institution technical bases and teaching staff proficiency. On the other hand, each recommended teaching module is characterised by its actuality. So, different curricula developed for these teaching modules can meet the requirements of the standard, but have different actuality ratings, which, in it's turn, will influence the rating of an educational institution.

4.2. INFORMATISATION OF THE EDUCATIONAL PROCESS

Development and introduction of educational information technologies into the teaching process are done in accordance with state research programs which are carried out by educational institutions, regional computer centres and research organisations dealing with educational problems and new information technologies.

Under conditions of sharp deficiency of resources and funds, scientific and technical programs for introducing new information technologies in education are being developed with the following priorities taken into consideration:

- development and introduction of information technologies of educational orientation;
- development of works widely used in the teaching process with their orientation to courses, taking a major part of time for studying: disciplines of base educational cycles, such as natural sciences, humanitarian, socio-economic, general technical cycles;
- projects envisaging creation of programming and methodical centres, which is of a particular importance for subjects enduring changes in scientific and methodical bases;
- research works aimed at scientific support and development of scientific and methodical bases of the process of education informatisation.

An extremely important component of Russia's information policy in education is development, as well as introduction, of complementary educational standards for state information technologies of testing acquired knowledge at all levels of the educational system.

4.3. NEW INFORMATION TECHNOLOGIES IN EDUCATION MANAGEMENT

Along with the reform of Russia's educational system, there goes a reform process in the system management. The aim of the reforms is to find the most rational and, in the perspective, the optimum correlation between centralisation and decentralisation principles of management that should justify strategic goals of education, on the one hand, and management democratisation with larger independence of regions and educational institutions, on the other hand.

Now in Russia many practical studies in the field of management automation are carried out, but , most of them are aimed at creating single automated working places for employees or, at best, at automating separate functions of administrative establishments. To ensure effective functioning of the administrative sector, it is necessary to develop an informational infrastructure for the organisational and administrative sphere on the NIT basis.

For this purpose, informational banks of data and knowledge are formed, they accumulate standard, instructive, and factual information. Means for analysing business and other information are created, and they are connected with educational institutions activities.

Within the directions mentioned interacted computer systems are being developed. They provide automation of control functions for the educational process, which allows us to reduce overhead costs in organising educational process control at educational institutions. In this field, they envisage the development of a computerised access to the library and inquiry information, calculation of the rating of every student and educational institution. To control the quality of the educational process, information systems for monitoring state educational standards including federal and national-regional aspects are being created.

In the field of the development of scientific principles for educational process control models of territorial and regional location of educational institutions and changes in their activities with the account of changes in the market are being developed.

The most important principles for providing informatisation of the educational system in Russia are: a system character, planning and conceptual bases and step-by-step realisation of work covering main directions of activities in the educational system:

- education and teaching;
- scientific research;
- system management.

Education informatisation can give the necessary social and economic effect in case the information technologies created and introduced into the traditional system of education will become its integral elements, combining with traditional methods in education.

Education informatisation requires great material and financial resources equal to the national annual income of the country. Therefore in Russia, the so called "Island" computerisation takes place, which means:

- singling out key organisational, educational, social and administrative structures in the educational system that lend themselves to informatisation. They are the "Islands", the basis for the beginning of global informatisation of the educational system;
- organising introduction and support for system integration of information technologies in these sub structures;
- creating and ensuring conditions necessary for «the chain reaction» expansion of developed and used information technologies from the "Islands" onto the entire system of education.

4.4. CREATION OF MODERN INFORMATION MEDIUM IS A CRUCIAL CONDITION FOR EDUCATION INFORMATISATION

It is impossible to create a modern information medium without Russia's integration into the world information system and an access to modern informational «thoroughfares», international data banks on education, science, industry, culture, health care and etc.

The quickest way to integrate into the world educational system is to give Russia's educational institutions an opportunity to use global computer network Internet.

At present Russia has the RELCOM network. It is linked to Internet and consists of about 100 regional stations connected with each other through the central station in Moscow. These stations use mainly commuted telephone lines and a specialised telephone network. Through RELCOM it is possible to exchange postal messages with such networks as Internet, UUNET, BITnet, COMPUSERVE and others.

About 3000 different organisations in more than 250 CIS countries have RELCOM user stations. The total number of the network users is over 10,000.

In addition to RELCOM, the RELARN subnet was created within the latter. This subnet is used for research and educational purposes (any commercial activities are prohibited) and is state-financed. The speed of information transmission through RELCOM is sufficiently high: within a few hours information reaches any part of the world. The created federal university computer network RUNNET is one of the greatest projects in education informatisation in Russia. Satellite communication was chosen as a transmission medium. This makes it possible to cover the entire territory of Russia, with receiving and transmitting stations set up in all federal centres. Moscow and St.-Petersburg form the RUNNET distributed centre. Moscow's centre is the centre of cooperation with other Russian networks, while St.-Petersburg's centre provides an exit into Internet through optic fibre cables and Scandinavian nets Funet/Nordunet.

Besides the above main types of networks. Russia creates and uses other networks. All of them are set up as parts of a single informational medium that unites information resources of different educational institutions and 150 centres of new information technologies underlying education informatisation. The centres are uniformly distributed over the country's territory.

Efforts aimed at economically acceptable variant of creating an informational medium showed that the most effective way is to allocate a part of information resources of a large network for educational purposes and to use it as a basis for setting up a virtual network of the educational system. With such an approach, the expenses of Russian educational structures will mainly boil down to expenses on buying and installing user stations.

And this, even with the account of the fact that Russian educational institutions are cash-strapped, is quite a feasible task.

The ground-based station Slavyanka developed at the design bureau of the Moscow Power Engineering Institute (a technical university) is used for these purposes. The main criterion for its development is a bottom low price combined with all operational characteristics necessary for the user.

At present, the information exchange in the interests of the educational system is executed through the two «Horizon» satellite-retransmitters that cover the territory of Europe and Asia, North Africa and North America, and with more efficient aerial facilities, the eastern part of the USA.

Thus, with present development activity results and the accumulated experience in exploitation of space information systems working through Russia geostationary satellite-transmitters, it is quite possible to start operating the Russian space network of distance education that is integrated into international educational networks. Even with current financing difficulties, this problem can, in general, be solved within 2 or 3 years.

4.5. A PROGRAM FOR A UNITED SYSTEM OF DISTANCE EDUCATION IN RUSSIA

The federal program for a united system of distance education (SDE) in Russia has been under development since 1995. SDE supplements the full-time and correspondence (existing since 1927) tuition, perfecting and improving these forms. SDE promotes the integration of various educational structures and the development of a truly democratic system of continuous education for Russia's population that covers the entire territory of the country. If the existing system, to a certain extent, limits the access to professional secondary and, especially, higher education, a united system of distance education in Russia that is under development has no borders. This system is a system of education for everyone at any age.

The demand for Distance Education in Russia is considered as an adequate one to the requirements of full - time tuition, i.e. it makes up approximately 1,5 million students a year. Besides, according to the Federal Bureau of employment 2 million specialists need to be retrained in Russia annually. They have to change their job profile because of closing down and activity changing of enterprises, a forced migrations of population and other reasons. The major users of the system of Distance Education can be Russian - speaking people abroad and those for whom the Russian language is the second one. The demand for services of Russian SDE from foreigners is considered to be significant.

In contrast to the traditional systems distance education allows each student to have an individual scheme of education, master it by applying to a special informational medium created for this purpose, it gives an opportunity to satisfy the requirements in educational services in the most convenient and comfortable regime.

The most attractive features of the educational process in the system of distance education are its flexibility, adaptability, modularity, economic benefits, user orientation, application of advanced communication and information technologies. The system of distance education in Russia is set up as an entity system, meaning:

• the unity of organisational, teaching and methodical and other principles for setting up a system of distance education with the view to more fully implement the state's and citizens' interests;

• the setting up of state's regional and branch centres of distance education, ensuring implementation of the state policy on the system of distance education in industries and regions;

• the setting up of the federal bank of educational courses for the entire system of distance education, having a unified certification, author's and methodical notes, that is accessible by telecommunication networks of educational resources, i.e. banks, bases of knowledge and educational-purpose data;

• the setting up of the Russian University of distance education pooling resources of a large number of educational institutions of all forms of properties, included into the distance education system.

After finishing studies at educational institutions within the Russian University of DE, students get a diploma approved and recognised by the state.

The united system of distance education created in Russia must provide for:

• large-scale training and retraining and refresher training of specialists for providing employers with specialists in conversion, educational, regional and other government and public programs;

• radically new levels of students' academic mobility, giving them an opportunity to transfer from one educational program to another, from one educational establishment to another to continue education, and to simultaneously study at different educational establishments including foreign ones.

• an opportunity to get education for disabled people who cannot study using the traditional system;

• a high quality of education due to realisation of complex educational programs based on the best traditions in the national education and international experience of using advanced information technologies.

• an expanded influence of Russian higher degree establishments entering new markets of educational services in this country and abroad;

• an accessible higher education for foreigners (from the CIS countries and developing countries), overcoming the isolation of the national educational system from the world one, at the linguistic level, as well;

• reduction of big cities' social tension caused by the youth migration (including the underaged) in order to obtain education in leading universities of the country;

• an opportunity to get education where one lives that can help to settle social problems connected with today's disproportion in geographical distribution of educational institutions over Russia's territory.

• a possibility to get advanced education for the most talented of children and teen-agers in spite of their place of residence and remoteness of traditional academical and university centres.

The program for the creation of the DE system in Russia must be implemented by the year of 2000 it envisages the solution of the following priority problems:

• formation of organisational and administrative structures for the system of Distance education;

• working out of the scientific and methodical support of the system;

• development of the material and technical base;

• training of specialists;

• development of information technologies, media and communication infrastructure for realising educational technologies;

• working out of legal support;

• development of international ties in the sphere of Distance Education System.

The development of national DE systems will promote integration of educational systems into the world one that is an important sign of the world community evolution. The DE system will allow us to use education as an instrument to settle geopolitical problems and, first of all, the problems of the Russian population living outside Russia. The process of interaction with foreign educational institutions and associations (such as open University UK, ICDE (International council for Distance Education), EDEN (European Distance Education Net-work), EADTU (European Association of Distance Teaching Universities) is intensified. In this case, there appears an opportunity of fruitful co-operation in working out program and methodical materials and the joint use of the sophisticated technical facilities of didactical communication.

The united system of distance education in Russia is created as an open system. Russia presents its industrial, technical and educational potential to the entire world community and invites all countries to equal-right co-operation, one of the most interesting results of which will be accumulation of mankind's knowledge.

4.6. PARTICIPATION OF RUSSIA IN INTERNATIONAL PROGRAMS ON NEW INFORMATION TECHNOLOGIES IN EDUCATION

Today Russia maintains international educational ties with 126 countries. The Russian higher school works out and takes part in realisation of numerous joint projects. And the significant part of these is carried out with the participation of UNESCO and UNIDO and is oriented to the integration of national DE systems. The global international program «An open educational system of the 21" century» is aimed at this.

This program includes 2 basic projects: «UNESCO-UNIDO-Russia: World Technological University» and «DESCOP» («Distance Education in New Informational Medium»). A memorandum on mutual understanding between UNESCO, UNIDO and GOSKOMVUZ of Russia, envisaging realisation of this program, was signed in Paris in November, 1995. All countries, organisations and establishments interested in forming new educational systems and having relative projects, can join this program.

The World Technological University UNESCO - UNIDO-RUSSIA will become an innovative educational institution to promote the principles of creating "world culture", a centre of business activity and joint efforts of technological universities, scientific and industrial organisations of world community countries in order to solve urgent problems of science, industry and education.

The World Technological University is a university of a "composite type", whose members will be classical technical and technological universities, academies, institutes, branch scientific-research institutes, cultural and scientific centres, international and regional associations and bodies providing engineering education, as well as governmental and public educational, scientific and industrial organisations.

One of the most significant activities of the World Technological University will be the working-out and putting into effect novel information technologies used in education. At the same time the University teaching staff will efficiently use some modern information technologies in the teaching process.

The aim of realisation of the international project «Distance Education in New Informational Medium»(DESCOP) is to create a common educational

- informational and space providing an access to computer information sources, as well as traditional and electronic libraries, video- and audiotheques for both learners and teachers who will communicate with each other through systems based on space technologies and other modern communication systems.

Both projects mentioned above and constituting the basis of the program "Open Educational System of the XXI Century" were adopted at the 28th session of the UNESCO General conference (Paris, Oct.-Nov., 1995) and approved by the 6th session of General conference of UNIDO (Vienna, Dec., 1995). The UNESCO 28th General Conference supported Russia's initiative and adopted a research project «Multimedia Technology and Personality Development». Realisation of the project will bring together Russia's research learns and their foreign colleagues in solving the most important problem, that of determining adequate psychological and ecological conditions for using novel means of information technologies in education and formation of students' world-outlook.

Russia intends to extend its participation in joint UNESCO-UNIDO programs on information and information technology exchange, necessary for creating a global educational system that can ensure any person a real access to any form or level of education, including professional training.

Optimism toward the future of these and other similar projects is based on real results reached in the course of Russia's implementation of a number of joint educational projects.

For example, vigorous efforts by Russia's Higher School in the field of "Distance Education" were backed up by a pilot project *TACIS* "Training managers in Russia on the basis of distance teaching methods".

In accordance with an agreement between Russia and the International Institute for Planning Higher Education (UNESCO/IIPHE), in 1995 they actively probed the possibility of using the Russian system of distance education for training students and teachers of 10 Russian Universities in the course «Higher Educational Institution Management».

Those universities were so selected as to represent different regions all over Russia: from Moscow and St.-Petersburg to Yakut Republic and the Far East. The course program was worked out by IIPHE - GOSKOMVUZ experts. The course is composed of 10 interactive classes 80 minutes each. At an agreed time GOSKOMVUZ ensures the use of satellite communication for the teaching process.

International educational projects using NIT are widely implemented in Russia's secondary educational institutions. Some of the most successful projects are ecological telecommunication ones in which schoolchildren monitor the ecological situation and exchange results by electronic mail. One of these is the project of the US National Geography society «Children's network KidNet». This project (telecommunication within its framework is carried out through the Sprint network) has been realised in Russia for 7 years, now it involves schools from 10 cities of Russia - Moscow, St.-Petersburg, Voronezh, Obninsk, N. Novgorod, Samara, Ekaterinburg, Novosibirsk, Yakutsk and Krasnoyarsk.

Another project - Global Lab, started jointly by Russian (INT) and American (TERC) scientists was used as a basis for the Glob project. An agreement on joint implementation of the project in both countries was signed by the commission Gore-Chernomyrdin.

The policy of the Russian Government aimed at integrating the Russian informational and - educational system into to the International informational medium will alleviate an access to the world's best educational programs and facilitate dissemination of Russian didactic materials through the international system of educational services.

The required conditions for integration of Russian education into the world informational medium include:

- creation of the communicational infrastructure core, ensuring effective exchange of information;
- use of international standards in informational networks;
- legalisation of the access to Western countries' computer networks for Russian users.

In its quest for effective ways of integrating into the world informational and educational medium, Russia actively participates in a variety of activities of international organisations, including:

- holding of conferences, seminars, schools, working meetings;
- exchange of information materials;
- working-out of international multi-language dictionaries and thesauruses;
- training of qualified personnel;
- working-out of international educational programs and systems;
- co-ordination of international projects.

* * *

Highly appreciating developing and effective use of new information technologies in education, Russia considers them not as per se, but rather as a means of forming the basis for the education of the 21th century which will prove to be education for everybody . It should be multivariant, adequate to cultural and ethnic diversity of the mankind and should satisfy various demands of socio-professional and confessional groups, as well as cultural demands of the individual.

APPENDIX I

THE STATE GUARANTY OF THE RIGHTS OF THE RUSSIAN FEDERATION CITIZENS IN THE FIELD OF EDUCATION

1. The citizens of the Russian Federation are guaranteed to get education irrespective of their sex, race, nationality, language, origin, residence, relation to religion, beliefs, belonging to public organisations (movements), age, health condition, social, property or position status, previous convictions. Infringements of the citizens rights to vocational training in relation to their sex, age, health condition and previous conviction may only be enforced on the basis of the law.

2. The state ensures its citizens the right to get

education through creation of an educational system and adequate socio-economic conditions.

3. The state guarantees its citizens accessible and free primary general, basic general, secondary (complete) general education; elementary vocational education. It also guarantees (on the competitive basis) free secondary vocational training along with higher educational vocational training, and post-graduate vocational training in state, municipal (community) colleges within the framework of state-approved standards provided that a citizen gets education of that level for the first time.

4. Citizens tuition fees in non-state paid state-accredited educational institutions using educational programs of general education are refunded in the amount determined on the basis of the State-approved standards for educating citizens in a state or municipal educational institution of the respective kind or type.

5. To ensure the right to education of the citizens who need social assistance, the state covers fully or in part their expenses for the period of studies. The categories of citizens entitled to the assistance, as well as the type, forms and sources of the latter are provided by the federal law.

6. The state creates conditions for getting education to handicapped citizens, providing opportunities for correcting their aberration and assisting their social adaptation on the basis of special pedagogical approaches.

7. The state stimulates persons with unusual abilities («whiz kids») to get education through awarding them special state stipends, including grants for studies abroad. Requirements and procedures for awarding such stipends are established by the Government of the Russian Federation.

Source: The Law on Education of Federation, Art. 5, The Russian Federation

APPENDIX 2

REQUIREMENTS TO EDUCATION CONTENT

1. The content of education is one of the factors of economic and social progress of society and it should be centred

around:

- ensuring self-determination of the personality and creating conditions for its self-realisation;
- strengthening and upgrading a law-abiding state;

2. The content of education must ensure:

- a world-adequate level of general and professional culture of the society;
- forming in students a picture of the world adequate to the contemporary level of knowledge as well as the level of the general educational program (tuition stage);
- integration of the individual into national and world culture;
- forming a personality and a citizen integrated into a society of his/her time and motivated (in improving that society;
- reproduction and development of manpower potential of the society.

3. The vocational (professional) education of any level should provide the student with acquiring professional skills and adequate qualifications.

4. The content of education should facilitate mutual understanding and co-operation between people irrespective of their race, nationality, ethnic, religious and social belonging; and take into account diversity of world-outlooks; enable realisation of the right of the student to freedom of opinions and beliefs.

5. The content of education in a given educational institution is determined by the educational program (curricula) worked out, approved and carried out on their own by this particular institution. The state educational management bodies ensure the working out of exemplary educational programs on the basis of state-approved educational standards.

6. In line with its charter's aims, an educational institution may implement supplementary educational programs and offer educational extras (on contractual basis) beyond the scope of its educational curricula, determining its status.

7. Military training in civilian educational institutions may be carried out only optionally with students' and/or their parents (legitimate representatives') consent at the expense of the interested Department and through the means of the latter.

8. While implementing educational programs, educational institutions make good use of cultural institution opportunities.

Source; Law on Education, RF, Art. 14.

APPENDIX 3

PRINCIPLES OF NATIONAL POLICY IN EDUCATION

1. Education is humanistic, with priority given to universal values, man's life and health and free development of the individual. One is to be brought up to respect one's civic duties and human rights, be diligent and love nature, one's country and family.

2. Federal cultural and educational space is indivisible. The educational system is to protect and foster ethical and regional cultures, cultural traditions and peculiarities under the existing multinational state conditions.

3. Education is to be available to all, with the system adaptable to the student's level and background.

4. State-owned and municipal educational institutions are to be secular.

5. Education is free of unnecessary restrictions and pluralistic.

6. Education in democratically governed both by the state and society, with educational institutions being autonomous.

Source: Russia's Federal Law «On Education», Article 2

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Fig. 1. The structure of Russia's system of education

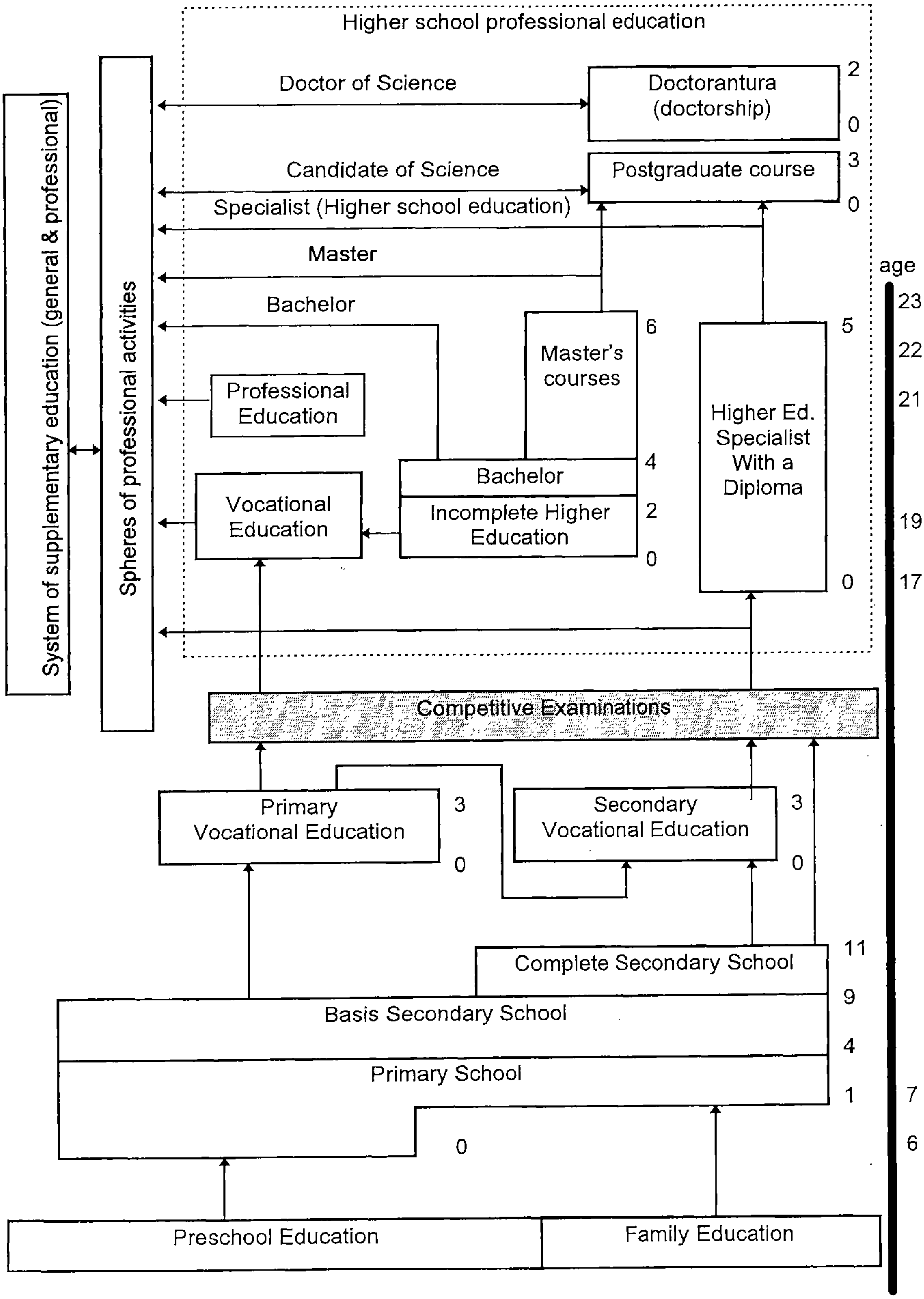

Fig. 2. A system of continuous training in informatics in education.

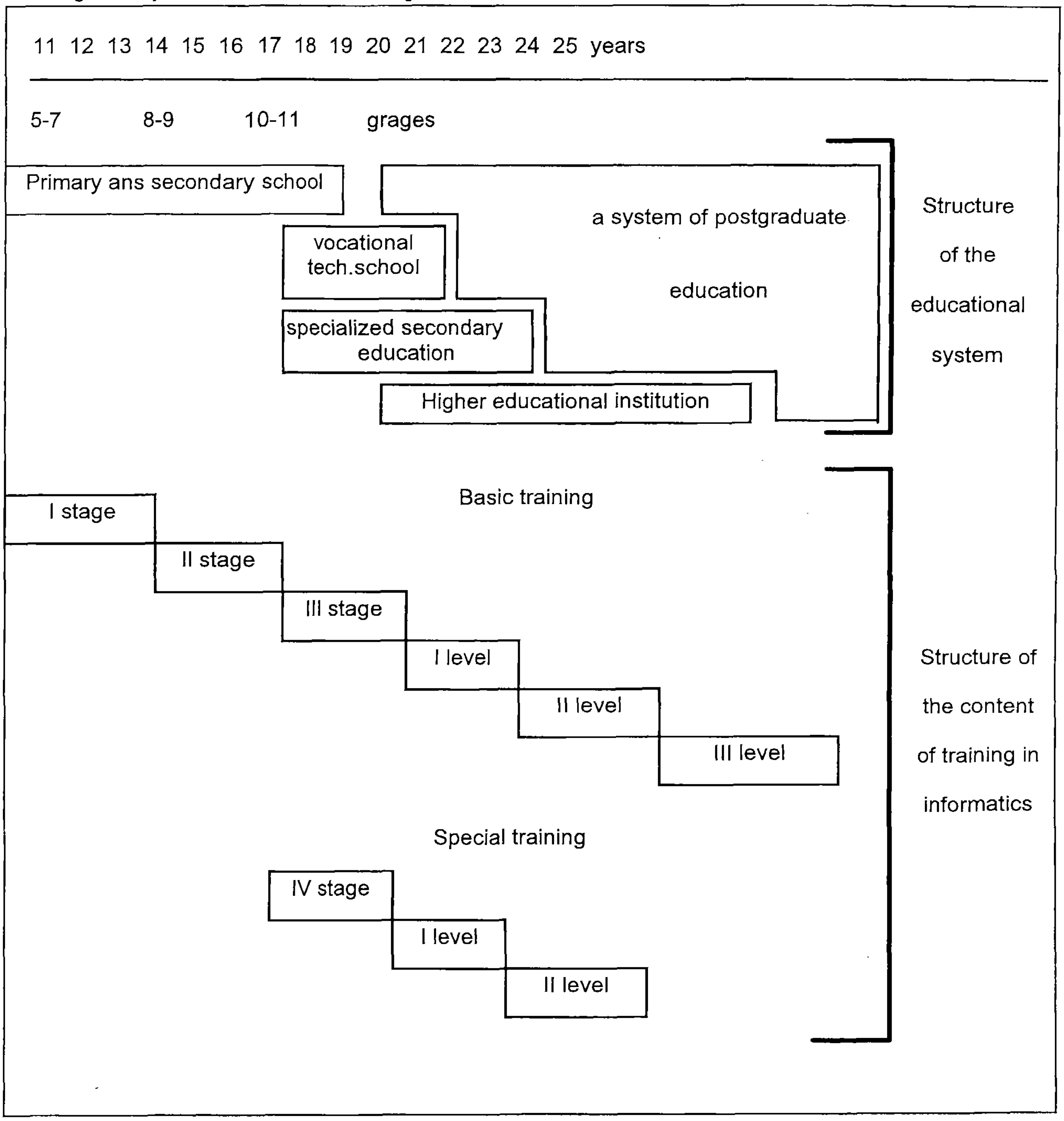

Fig. 3. Scheme of forming a program in informtics for students of the professional educational system.

Specialty code			Recommended levels of training				
№ group.	№ special.	Speciality name	Basic training	MPT	CADS	CASIPM	CARS
1	2	3	4	5	6	7	8
12	02	metal-cutting machines and tools	2	1	2	1	

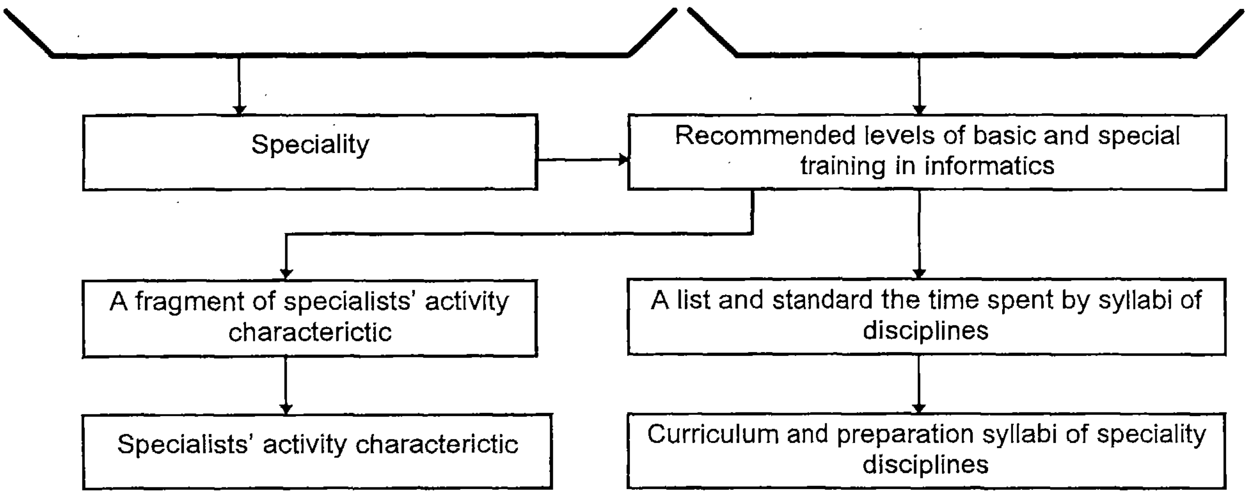

Fig.4. Structure of the subject area of informatics - a modern concept

Fundamentals of informatics

Theoretical informatics	Information as matter's semantic property. Information and evolution in living and non-living nature. Principles of general theory of information. Methods of information measuring. Macro- and microinformation. Mathematical and informational models. The Algorithm theory. Stochastic methods of knowledge. Semantic aspects of intellectual process and information systems. information systems of the artificial intellect. Methods of knowledge presentation. Cognition and creation as information processes. The theory and methods of developing and designing information systems and technologies.

MEANS OF INFORMATIZATION			
hardware	**for data processing, presentation and transmission**		Personal computers. Working stations. Input/output unity and information display units. Audio- and videosystems, multimedia systems. Computer networks. Communication means and computer telecommunication systems.
software	**system means**		Operating systems and media. Programming systems and languages. Service shells users' interface systems. Programming means of intercomputer communication (teleaccess systems), calculative and information media.
	for technologies realization	**versatile**	Word and graphic processors. Systems of data bases control. Electronic table processors. Means of simulating objects, processes and systems. Information languages and formats of presentation of data and knowledge, vocabularies, classifiers, thesauri. Means of information protection against destruction and unauthorized access.
		profession-oriented	Publishing systems. Systems of realizing technologies of computer-aided calculations, design and data processing in the sphere of accounting, planning, management, analysis, statistics, etc. Systems of artificial intellect (knowledge bases, expert systems, diagnostic, and teaching systems, etc.)

Information Technologies of social informtics	Input/output, accumulation, storage, transmission and processing of data. Preparation and word and graphic documentation. Integration and collective use of heterogeneous information resources. Information protection. Programming, designing, modelling, training, diagnostics and control (of objects, processes and systems). Information resources as a factor of socio-economic and cultural development of the society. The information society - rules and problems of formation and development. Information infrastructure of the society. Problems of information security. New opportunities for the personality development in the informational society. Problems of democratization in the informational society and ways of their solution. Informational culture and information security of the personality.

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NATIONAL REPORT OF SWAZILAND

THE SWAZILAND EXPERIENCE

INTRODUCTION

This paper is a product of years of observations measured by different researchers on science and technology education in Swaziland. Some of the observation are measured objectively while some are subjective estimates. The paper is developed as a national paper to contribute to UNESCO's efforts to bring about awareness on informatics among member countries. The paper will be presented at the Second International Congress on Education and Informatics to be held in Moscow, in July 1 - 5, 1996. The paper is divided into seven broad but related topics aimed at pointing successes and failures experienced in the effort to introduce information technology in our education. The author is responsible for erroneous observations reflected in the paper and does not in any way hold any institution, including government responsible for those failures. The author is convinced, however, that every stakeholder is responsible to do everything to give the Swazi child a better chance to face the future with confidence before it is too late. The first section of the report gives an overview on the country's education and industry infrastructure. The second and subsequent sections touch on different perspectives of new information technology in our education.

1. EDUCATION AND INDUSTRY OVERVIEW

Our education is structured sectored into six or more levels. The levels include the adult and non-formal education, preschools, formal schooling - which is further divided into: primary, secondary and high schools, tertiary and vocational education - and commercial schools, which are vendor-driven. The commercial schools concentrate in offering short courses in management, secretarial, legal, computing and few others. Identifying these different levels in our education at this point is an important factor for consideration as we aim to determine the layers at which new information technology can play an important role to enhance education quality as well as prepare students to be ready for future responsibilities in the learning careers as well as participating in society development strategies.

1.1. ADULT AND NON-FORMAL SCHOOLS

Because of intensive campaign to reduce illiteracy rate in the country the adult education was introduced to teach adults the two formal languages of siSwati and English, to the level of seventh year of normal schooling. As a result of introduction of adult education literacy rate has improved from 40% at independence in 1968 to almost 70% in 1986[1]. The adult education, which is instituted by SEBENTA, is distributed through out the country. It is supplemented by non-formal or special schools, whose main objective is to train young Swazis, especially females in crafts/skills including knitting, sawing, vegetable gardens management, handicraft, woodwork and other skills which serve as way-out to employment opportunities for people with low formal schooling qualification. The other area of contribution derived from the adult education is numeracy. Participants learn basic skills of arithmetic.

1.2. PRESCHOOLS EDUCATION

In 1994 over 460 schools were reported under this category. These schools share between them over 500 teachers and attend to over 16 000 pupils in enrolment per annum. Children enter this form of education from the age of two years and exit at the age of six years, just before they enter primary education. Primary schools receive graduates from preschools at the age of seven years. It is now almost a known fact of education policy (not formalised though) that children who enter the primary schools education should have preschool education as a prerequisite.

Most pre-schools are part of a primary-cum-secondary/high school, thus, sharing the same school management facilities. But some of these are independently run and located at strategic areas in the community they are serving. Preschools are most welcome by working parents who cannot afford the services of a domestic servant - which are at times not consistent in the caring for the child.

1.3. PRIMARY, SECONDARY AND HIGH SCHOOLS

Primary schools education admits children of the age of 7-years and upward. As already mentioned above these children would have graduated from preschools education. In olden days it was possible and prevalent to admit children of 12-years of age and above to commence primary education. The delay in entering the primary education was due to a number of factors. One cause of the delay was lack of awareness on the part of the parent how important is education[2]. The situation changed considerably after independence in 1968. Other reasons included lack of funding for clothing and school requisites, distance away from school, and environment surrounding the family such as: urban, rural, or farm settler/squatter. These conditions would not only delay entry into the primary education and thus delay period of exit to higher education but would also prevent many school age children from ever attending education.

During the year 1991 there were 516 primary schools (excluding pre-primary), and 150 secondary or high schools[3]. These schools were in the hands of, respectively, 5 347 primary-, and 2 430 secondary teachers. The primary schools had 173 000 pupils whilst the secondary schools had 44 000 students. Of the primary schools 70 were government schools, 411 were government aided schools, and 35 private schools. Of the secondary or high schools 70 were government schools, and SO being aided by government. There were no privately owned schools reported at this level.

1.4. POST-HIGH SCHOOL EDUCATION

There are six formal post secondary or high schools institutions in the country. Included in these institutes there is one university divided into two campuses. The six institutes constitute what is known as colleges and the University of Swaziland (Uniswa). These institutions share among them over 4 000 students and over 400 academic staff. The institutes are:

- University of Swaziland (Uniswa);
- Swaziland College of Technology (SCOT);
- Gwamile Vocational and Commercial Training Institute (VOCTIM);
- Ngwane Teacher Training College;
- Nazarene Teacher Training College;
- William Pitcher Teacher Training College;

There are other training institutes, which demand different qualifications than high school certificate or even lesser qualification as entry requirement. These include:

- Co-operative Development Centre (C.O.D.E.C);
- Good Shepherd Nursing College;
- Mananga Agricultural Management Institute;
- Manzini Industrial Training Centre (M.I.T.C) - distributed in three regions;
- Nazarene Bible College;
- Nazarene Nursing College;
- Swaziland Institute of Health Sciences;
- Swaziland Institute of Management and Public Administration (SIMPA) ;
- Institute of Development Management (IDM),

and other smaller institutions. We must mention shat the "other" institutions include the Police College and Prisons rehabilitation unit, both of which are large in terms of attendance.

1.5. INDUSTRY BACKGROUND

The structures of employment and establishments of government on one hand are complex, while the other sectors of the economy are characterized by subsistence farming on traditional land, small and large agriculture estates on freehold land (forestry, sugar, citrus, pineapple, cotton and cattle ranching), limited mining of asbestos, coal and diamonds; few agro industries, and manufacturing. The urban areas have diverse activities including wholesales, services, small industries, and a number of informal undertakings. The formal sector accounts for over 1 500 establishments (excluding the government sector), and employ over 93 000 persons (including the government sector).

In the next sections we focus on education technologies with special reference to the education and industry structures defined above.

2. NEW INFORMATION TECHNOLOGIES (NITS IN SWAZILAND EDUCATION SYSTEM)

The economy of Swaziland demands liar services, distribution, production and communications be efficient for ease of source and marketing raw materials internally and abroad. The volume of international trade, for an example, amounted to approximately E6.2 billion in 1994[4], of this trade export accounted for about E2.6 billion while import accounted for the rest. In addition to the external trade figures, local trade, including construction amounted to over E400 million[5].

These trade trends are clear indication that information and information processing are vital both to the traders and to the government. We have already indicated that the number of employees, from both public and the private sector is about 93 500 in 1993 statistical figures. The employees fall under the following closes: professionals, administrators, clerical, skilled, semi-skilled and unskilled labourers. Moreover Swaziland is part of the Southern African Development Community (SADC) region which is driving towards inter-country trade and development. Matters under discussion for the region include the sharing of transport, telecommunications and other facilities across the border lines for betterment of lives of the communities. These trade and strategic development issues depend highly, right now, on the regions capability to produce timely information for rationalisation and optimisation purposes. Each country will depend and rely on information concerning a set of select issues on social, economic, scientific and cultural competitiveness. A country's competitiveness will be achieved if the country advances itself competitively in technologies, including information technology. The countries which delay in advancing in the field of IT stand to loose in the race to compete for the scarce resources, and even experience higher deficits in their balance of trade.

2.1. DEVELOPMENTS IN INFORMATION TECHNOLOGY EDUCATION

It is a well-known ancient fact that man slaved off his development and advancement by hunting in the wilderness and in jungles for his daily needs. The hunt is still going on up to this very moment. There is a hunt for food, for clothing, for knowledge and for the unknown such as hunting for elements and friends in outer space. All countries participate in the hunt. In the developing countries such as Swaziland the hunt is concentrated mainly on acquisition of food, health, clothing, wealth and knowledge. The hunt for knowledge is urgent and a priority for boosting efficiency and effectiveness in the management and distribution of scarce resources. Because of the high level[6] of unemployment, (over 66%) which contributes to present dissatisfaction among the work force in general, there is an urgent need to explore areas which have not yet been developed and at the same time strive to increase production capacities on already existing production institutions. The type of education responsible for the supply of well-trained workers is under criticism from both government and society. The curriculum in particular, is viewed to having a greater room for improvement in order to produce the workforce capable of fitting in different work demands including, especially, versatile teachers. The observed deficiency in the curriculum is probably due to a slower growth curve and a weaker curriculum institution within the Teaching Services Commission. This fact will be discussed in detail in section 6.

THE CURRENT STATUS OF INFORMATION TECHNOLOGY IN EDUCATION IS AS FOLLOWS:

In tertiary education

The qualitative situation in tertiary education displays the following global characteristics:

Table 1.

Qualitative Computing Situation in Institutions

TERTIARY INSTITUTION	WITH COMPUTERS FOR TRAINING		
	TRAINING	ADMINISTRATION	RESEARCH
NAZ. TEACHER T.C.	NO	YES	NO
VOCTIM	YES	YES	NO
NGWANE TEACHER T. COLLEGE	NO	YES	NO
SCOT	YES	YES	NO
UNISWA	YES	YES	NO
WILLIAM PITCHER TEACHER T. C.	NO	YES	YES

SOURCE: Telephone interviews

For the moment we look at tertiary education how information technology education is conducted. Of the six institutions of higher learning listed above, three report the presence of at least one computer lab used for training. SCOT has three computer laboratories each of about 10 personal computers, while UNISWA has four computer laboratories each averaging over fifteen personal computers. In both institutions the computer labs are undergoing upgrading of the PCs from 80286 processors to 386 and even better processors. While the labs at SCOT are of stand alone PCs, all the labs at the university are connected on local area networks (LANs).

One of the university LANs is situated in a campus which is over 20 kilometers away from the main campus. The other three LAN's are linked together via a fibre optic backbone controlled from the university Computer Centre. There are about seven other related institutions, which report the presence of computing facility used for administration purposes. These were interviewed separately, and are listed below in Table 2. While most of the institutes make use of IT in administration reports, letters, and simple records, there is less effort made towards writing programmes dedicated mainly to word processing. The university has specialised systems for students record keeping, accounts, and other support systems, though. Some of the systems are built in house while others are acquired off-shelf.

Both the university and the technical college SCOT are in a process of linking to international highways to make it possible to research from shareable bibliographic databases through electronic data transfers. There are few other smaller institutions which exist whose details of performance and possession of computing facilities are not known. Of the major institutions, SCOT and Uniswa are the only ones engaged in formal and structured computing studies. SCOT offers computing literacy to the college students in general, and a 3-year diploma programme in computer science. Uniswa, on the other hand, offers a computer foundation course to three faculties: Science, Agriculture, and Commerce. The course is expected to reach all faculties in due time. In addition to the computer foundation course, the university Faculty of Science is also offering a degree programme in computer science as one of the majors, while the Faculty of Commerce offers Information Systems courses to first-, third-, and fifth-year students.

The least reported utilisation of computing in the institutions is research. The Social Science Research Unit (SSRU) of the university did report the utilisation of computing for its research activities, but this unit has since been dismantled in the process of restructuring of research activities at the university. Hopefully some form of research will immerge.

Table 2.

Other Related Institutions

TERTIARY INSTITUTION	WITH COMPUTERS FOR		
	TRAINING	**ADMINISTRATION**	**RESEARCH**
COOP DEV CENTRE	NO	NO	NO
GOOD SHEPHERD	NO	NO	NO
NURSING			
MANANGA MNG	YES	YES	NO
N.A.S.C.	NO	YES	NO
MITC	NO	YES	NO
NAZ. BIBLE C.	NO	YES	NO
S.I. HEALTH SC.	NO	YES	NO
SIMPA	YES	NO	NO
IDM	YES	YES	NO

In the Primary, Secondary and High schools

Private schools are the ones reporting the presence of computers more than public or government related schools. But as already alluded, even in these schools, the use of computers by students can be explained as being for the enthusiastic student - it is not universal. It is encouraging to note that the Cambridge Syndicate O-level, overseas education which sets end-of-year examination papers and issues Form V or high school certificate, has already included the subject of Computer Science as one of its examining subjects. Students do already have an option to choose computing as examination subject. But we shall see there are too few schools with computer facility to make computer education become significant.

In a study conducted in 1991 by V.L. Kelly and L.K. Manana[7] the following primary schools were found to possess computer laboratories. The laboratories were found in different spaces of the schools including used libraries, offices, and other congested offices: Primary schools found with computer laboratories are:

- Mananga
- Simunye
- Ubombo
- Usuthu forest
- Sifundzani
- Enjabulweni

Only two secondary/high schools reported computer laboratories. These are Sisekelo, and Waterford. All these schools, primary and secondary, belong to private companies. They service staff members' children, but they are open to outsiders as well. Public or government run schools are being sensitised by the sciences campaign aimed at schools head teachers to start using computers in the administration. It is expected that before the end of1996, more than 48 schools will benefit from this campaign.

3. PRIORITIES AND POLICY IN NITS EDUCATION

It has been observed that the introduction of computing in the schools mentioned above is an idea which originates from the companies. It is also observed that the teaching of computer study of any form, e.g., computer aided instruction (CAI), computer based instruction (CBI), or computer managed instruction (CMI), or any form of computer education for that matter, is dependant on an individual teacher with or without computer skills who is just enthusiastic on the use of computers.

Currently the government is putting together a national development strategy for the different sectors of development. The strategy is a development plan which covers a longer period of up to twenty five years. The component of science and technology is delineated as well. It is hoped that the strategy will help the government to make appropriate decision for intervention in the development of the economy, especially in the development of human resources. The recommendations[8] made by the Science and Technology Committee are that the government will establish and support a National Research, Science and Technology Council (NRSTC) which is to be serviced by a permanent Secretariat. The secretariat will operate as an inferential engine for all realisable technology advisory committees (TACs).

Among these TACs there is a science and technology education or specifically an Informatics and Biotechnology Education Committee. The latter committee will liaise with the secretariat's appropriate representative in matters of S&T education. It is the duty of the NRSTC to popularize S&T through all structures of the society, especially education. On the other hand a shot in the arm is being provided by the Ministry of Education which is currently engaged in the process of restructuring and strengthening the Curriculum Unit of the Teaching Service's Commission.

As other researchers have observed, introduction of NITs in a school is a costly process. It is, however, the rightful duty of the experts in IT to explain in simple language to the lay education community that the use of computers and communication is not only for betterment of running the affairs of industry but it is also most appropriate for pedagogical purposes as well. The uses of computers in education include[9] the following:

- computation - simple data processing
- conceptualizing - helping children to grasp concepts quickly
- problem-solving - solve complex problems quickly
- simulation - instilling excitement and enthusiasm in learning
- skill and practice
- teacher utility
- information management
- tutorial

Each one of the areas of computer uses listed above is a subject of its own. It is capable of generating a full paper for presentation. These are the areas that education in developing countries should consider explicating and infusing into the education systems at appropriate levels. As already highlighted, the Ministry of Education is campaigning to introduce a computing use to few schools in the near-future for purposes of information management. The areas of conceptualizing and simulation can be introduced to preschools up to including high schools, whilst the areas of computation, problem-solving, skill and practice, and tutorial can start at the level where children can read and write. All these areas can be infused into our education through the curriculum according to the rationales and paradigms, which are considered to be national priority. We should also emphasise the benefits derived when using IT education to the disabled pupils. IT education is reported to be making great impact in interactive distance learning with the use of multimedia. There is greater economy derived from conferencing as different groups of students could be scattered all over the country but listening at and asking questions from the same teacher. Swaziland, as a country with fewer resources could explore this innovative area in education. Another sector of IT and telecommunication education to be synchronized in the country is streamlining of vendor-based computer schools to teach in a way that will quickly close the gap of IT illiteracy in the country. These commercial schools, as often referred to, have a potential to play an important role in helping students during holidays and spare times to come in and have hands-on practice. They can serve as student centres. Already there are university students who attend classes in these schools on voluntary bases. The main interest among these students is to be able to learn a wordprocessor for producing own school project documents.

In 1995, the University of Swaziland, under the auspices of UNESCO and the Ministry of Education, did organise and conduct the "Training the Trainers Course in Informatics" for Teacher Training Colleges participants. The course concentrated on five areas of computing; viz., the operating system, word processing, spreadsheet, databases, and programming languages. The programme[10], which ran for two full weeks, was designed to teach participants on the importance of the computer and how to use the computer in the classroom - especially to motivate students in the conceptualizing process.

4. PROVISION OF COMPUTER HARDWARE AND SOFTWARE IN SCHOOLS

Informal discussions show that the level of awareness on the use of computers is still low in the country. Computing is still regarded as a tool for big companies. It is considered costly to be introduced in the education system, especially when there are schools without desks and chairs, without classrooms, electricity or telephone lines. Some schools are built by communities at inaccessible areas even by means of a vehicle. Thus, talking computing to these communities is like talking prestige. Kelly and Manana point out that education software is expensive for the schools to obtain. By 1996 standard the computing equipment which includes Atari, Apple and other two-disk (floppy) machines are way out of fashion.

They no longer can run current flexible software which run under windows and requiring bigger working memories.

The computer laboratories at the university, for example, are being upgraded to accommodate software, which requires 16 or better megabytes working memory. A limited number of the machines are equipped with CD-ROM, speakers and sound blusters. Although the use of multi-media has not yet been fully demonstrated, their potentials are being conceived. Over 90 per cent of computing equipment at the university are based on DOS operating system. DOS is said to be fast running out of life especially with the introduction of Windows'95. Users are still happy with DOS-based systems developed with user-friendly menu lines. The antiquatedness of equipment comes different ways. At times the equipment in place runs out of spare parts. When manufacturers no longer support the model, repairs to the equipment becomes impossible. The other cause for concern is when an application software has been upgraded by the developers on a higher model development system or processor. Few examples associated with the latter constraint include the requirements to run WordPerfect 6.1 and *dBASE IV* version 2.0.

Both applications require a working memory size of minimum 4-million bytes (Mb). The wordprocessor requires this much memory size because it runs on windows and it incorporates more features such as graphics than its predecessors. The database management system developers on the other hand have upgraded some features of the system such as array manager to handle a larger matrix of over 300 rows by over 5 columns, say. These applications are popular and have tied many companies into their use. The upgrades, however, signal that future acquisitions of hardware should be way over 8-Mb. The applications running on Windows have even a larger memory requirements. The Windows'95 requires a memory size of at least 16-Mb. Windows'95 has another feature -Internet connection which is an advantage to have. While it sounds like the future is shaky in terms of hardware, the good news is that the new bigger and faster memory machines cost relatively cheaper than the older versions when comparing the price per performance. The University of Swaziland is currently experiencing these hardware-software changes. Both local area networks running the administration records face memory constrains as explained above.

5. POLICIES AND STANDARDIZATION

At UNISWA the select Coordinating Committee set in 1987 and clearly stated that all equipment purchased or donated towards the university should be DOS-based machines. This stipulation is most useful, as it has served the university community over the past ten years or more positively. There are exceptions, however. Lecturers coming from overseas with equipment of different operating systems, mostly AppleDOS, have found themselves without support from the majority users. The university has two UNIX-based file servers used for teaching and electronic mailing. These UNIX machines are operated and managed by not more than two Unix experts on campus.

One other area of careful thought is the network architecture or topology. After a careful study of possible network operating systems to be implemented, the university decided to implement a simple Ethernet architecture running Novell on copper or coaxial cables. These networks are reliable and work fine so far. The backbone or broadband (fibre optic) based network has a star module at the Computer Centre which manages all networks connected to the backbone or campus wide network. A test of linking the two campuses separated by at least 20 kilometres is going on right now. It is conducted by Post and Telecommunications technicians. The test is towards implementing a leased line to link the two campuses.

Recently an association of information technology professionals in the country has been formed and officially registered. Some of the objectives listed as commitments of the association include the following:

- to help in setting standards and code of ethics for practicing IT professionals
- to help in setting standards for training provided by computer schools ....
- to enhance the body of knowledge in the field ... and create public awareness on IT ...

Already the association has managed to run two forums; one on "systems implementation and the future" and the other on "Networking and Data Communication; Present and future Prospects in Swaziland". In both forums the Post and Telecommunications Corporation has featured prominently. The executive council of the association is currently on a campaign to bring together government, industry', and private practitioners of IT to a discussion of training in IT. It is expected that such efforts organised and managed by IT professionals, should yield forward looking results in the country's progress towards stimulating literacy as well as setting standards in computing.

6. FACTORS LIMITING PROGRESS IN THE ADOPTION OF NEW TECHNOLOGIES IN EDUCATION

Computing in education is lagging behind in the country because of several reasons. We shall list just few but very important factors which can make a difference. In section 3 of the report we have hinted already on what Kelly and Manana observed as obstacles in introducing IT education in schools. In another study conducted by a University research fellow[11] it is observed that constraints include:

- power supply coverage
- telecommunication infrastructure
- trained IT teachers
- hardware and software availability
- IT in education curricula
- use of local IT professionals both in government and industry

6.1. POWER SUPPLY COVERAGE

The supply of electricity is generally good in Swaziland, but because of resettlement nature of homesteads being scattered over the surface of the country instead of forming compact villages, it is costly to lay powerlines to individual families. At present moment the Swaziland Electricity Board, the sole supplier of electricity in the country, would charge anything up to E16.000[12] per transformer. If one homestead is interested in connecting to the power line, then the homestead must foot the bill alone. In addition to the connection charges, the homestead must pay monthly utilisation bills in excess of E200 if not using the power for cooking or double this amount if cooking and other heavier utilisation other than light is contemplated.

In some areas some homestead groups, relatively uniformly structured, have emerged and bought electricity. The Khanyisa Kukhanyeni Group Scheme, for example, applied for the supply of power and the charge was E30.000, for a group of 15 homesteads. Another scheme of Jabulane community, near Nhlangano was charged E13.000, for a group of 5 homesteads. Both schemes source the power via a nearby school connection. In 1994 the Ministry of Education Information System unit reported 89 secondary/high schools connected to the power line and 82 schools with science laboratories out of a total of 165 schools. No details were available about the other lower level schools. Commercial and tertiary education are all expected to be connected since they are all located in the bigger cities.

6.2. TELECOMMUNICATION INFRASTRUCTURE

The problems of scattered rural homesteads, costs and shortages of telephones lines at PTC are but few problems to be mentioned in connection with supply of telephones. Current voice carriers can transmit at the capacity of 9.6 kilobits per second for most parts of the cities. Improvement of capacity has been made in connecting from Mbabane, capital city, to nearest point in the Republic of South Africa. A broadband carrier has been installed which can transmit voice and data at 64 KB/s. It is expected that a similar facility will be in place between Manzini, the commercial town, and Mbabane. Incidentally, the university is situated in the Manzini area where the line can transmit packets of up to 9.6 KB/s.

6.3. TRAINED IT TEACHERS

There is a shortage of IT experts in the country in general, and in the teaching community in particular. Kelly and Manana point out that the teachers who take the initiatives to introduce computing to the pupils are themselves not computer literate, but they are driven by interest. Some of these teachers go out to attend short courses provided by the commercial schools in the city. The university has already experimented with special computer course to teacher training colleges lecturers. If the course can be formalised and run over in a three or five year period-project, the deficiency of IT teachers can decline, and schools can take off, assuming that hardware and software becomes available.

6.4. HARDWARE AND SOFTWARE

This is the most sensitive component of introducing IT education in schools. The sensitivity is in two ways. In one way the developers of software don't like the idea that their software be spread around like mushrooms without payment for them. In Africa, unlike in Europe, or North America, university or school packages are not available from software developers. No company offers such discounts as 45 per cent on a brand name bought for educational purposes, for instance. On the other side of the story, planners in education consider the delivery of IT hardware as waste of scare resources. These conflicting scenarios require international intervention to resolve. As we have indicated, private schools IT education is established through the generosity of the company the schools are located in. One possible option out of this problem is to bring regional universities, and even schools to a pool of thought so that they develop their own software, and assemble the hardware for the purpose of supplying to schools. Unless a major step of this nature is taken, there is no visible way out.

6.5. INCLUSION OF IT EDUCATION IN CURRICULA

We claim that the stiffest door to open for IT education to come in to schools is the curriculum. Initially it looks there is no way one can force into the timetable a course in computing and let every child in the school have hands-on practice session. Some teachers may think this is overloading when in fact there are other technical subjects which have not yet reached the entire population of students. Technical subjects such as woodwork or carpentry, metal work, agriculture and home economics already have the teachers hands full.

These are problems foreseen by a layman outside the Teaching Services Commission, it is possible there is a lot more problems. We have mentioned in section 3, however, that IT use in education enhances the quality of education in various ways. Each level of education benefits to a greater degree. Moreover our economy is not a close one, we are part of a global village. Exposing pupils to high technologies at an earlier age gives them an advantage when they grow up and enter into employment environment. Some of us entered university education at an late age. We enjoyed benefits of experience in some areas but suffered technology shock in new technology subjects. While we were undergoing shocks we soon discovered that those pupils who grew up under technology environment pursued learning with ease. These are hard facts but they are true.

6.6. USE OF LOCAL IT PROFESSIONALS

Local IT professionals have started to have a share in the labour market. The graduates from computer science at UNISWA have been absorbed by the Teaching Services Commission in teaching mathematics and other science subjects, but not informatics. It is encouraging to see companies coming forward to the university and scout IT graduates from the university during speech and careers day. It is hoped that with the coming to age of the IT association now formerly registered, IT popularisation will increase to a significant notice of potential employers. This demand in turn will stimulate the supply, which, in turn, will stimulate intensification of IT education.

7. PARTICIPATION IN INTERNATIONAL PROGRAMMES

Under the UNESCO thrust to encourage informatics in member countries, the University of Swaziland has been designated the National Node under the Regional Informatics Network for Africa (RINAF). As such the university has established a link to UNINET-ZA - a university network in South Africa, which has full access to the World Wide Web networks and Internet. The project started in 1990. the first test run was accomplished during 1995. There are still problems surrounding the connection, but it is almost clear that the connection will finally stabilise and enable the university to take over its rightful functions to deliver local and international links to other institutes of learning and individual professional.

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NATIONAL REPORT OF SWEDEN

THE USE OF COMMUNICATION AND INFORMATION SERVICES IN SWEDISH SCHOOLS

"Describing the use of NIT services in Swedish schools is like describing a thawing river. We see the water rushing by but we also get a picture of the spring flood to follow "

PREFACE

SCHOOLS ENTERING THE AGE OF INFORMATION AND NEW TECHNOLOGY

Access to electronic information services and contact networks means new possibilities for obtaining knowledge and information on working methods.

How is the increasing availability of new sources of information and knowledge affecting education? Databases and statistics, obtainable on CD ROM or via the Internet, for instance, multimedia packages and access to ongoing reports from research projects are just some examples of what is on offer.

The Swedish Agency for Administrative Development has completed research in areas such as access to electronic information, as well as whether and, if so, how it has managed to influence teaching and working methods in Swedish schools. Around 40 "school computer pioneers", 50 headmasters of upper secondary schools, 100 headmasters of junior schools and 20 directors of schools were interviewed for the study. The study has been compiled in cooperation with the Swedish Association of Local Authorities and the Swedish National Agency for Education. It forms part of an analysis of the Swedish market for electronic information services (the IMPACT programme), financed by the EU.

A FEW CONCLUSIONS

Almost half of Sweden's schools (46%) have the technical criteria to enable them to access databases and information services. However, few schools utilise these in their daily work or have sufficient knowledge about information supplies and information quality.

Expanding technology, purchasing computers and getting links to the Internet to work, etc., are still the greatest priorities at most schools. The discussion on teaching methods being updated and how this is going to become reality often takes second place, and there are also critics of these new concepts, of course.

Having commissioned the study, we feel that the result emphasises the fact that the age of information and new technology is based on so much more than technology and that it takes longer to understand than people think. Many players should be involved. Whilst technology is expanding, there is also time to make other preparations.

MAKING USE OF TIME

As far as the *local authority* is concerned, it is perhaps a matter of supporting "teaching strategies" within the framework of a local school plan. This is important, since the opportunity for updated teaching and working methods is central to development. In a *school,* one important step may be appointing people responsible for education/obtaining knowledge to the same extent as appointing those for technology. The individual *teacher* faces such challenges as developing new teaching material and developing methods for using the Internet during teaching - finding a way of learning from others and sharing your own experiences with others.

Teacher training and research are influenced by the development. This may involve aspects such as updating basic education or how the Internet and other sources can be used for spreading methodology, ideas and the results of research, for example. *Producers of information and teaching materials* can also contribute towards increasing competence with regard to existing services and information supplies.

These matters are not new, but discussions and activities must be broadened and deepened in order for educational preparation to be able to keep in line with access to technology, the introduction of the Internet/the School Computer Network, etc. Responses to questionnaires and interviews also reflect apprehension concerning greater rifts *within* schools and local authorities, as well as *between* those local authorities which are well-off and those which have poor resources.

Those at the Agency for Administrative Development responsible for the study were Sören

Lindh and Ĺsa Finnström. A contact group, consisting of Göran Isberg and Lage Ĺström of the National Agency for Education, Hans Ekholm and Gunnar Hedborg of the Association of Local Authorities, and Sture Ströqvist of the Agency for Administrative Development, has monitored the work.

THE USE OF COMMUNICATION AND INFORMATION SERVICES IN SWEDISH SCHOOLS

Describing the use of IT services in Swedish schools during September 1995 is like describing a thawing river. We see the water rushing by but we also get a picture of the spring flood to follow.

SUMMARY

Swedish schools are currently experiencing a paradigm shift. The use of computers in schools is changing, and computer teaching is now more a matter of information than of technology. In a situation where local authorities have poor funding, some of them are investing substantial resources into creating a "local intellectual infrastructure" where a school plays an important part. Most of those we interviewed spoke of currently witnessing a breakthrough in information technology. However, there are sceptics who see IT investment as a non-event of the same type as the "computer breakthrough" in the middle of the 1980s. There are also old hands who carefully warn of "the disappointment for those expecting too much".

The analysis we carried out during September - October 1995 should be seen as describing a situation which can rapidly change. A corresponding analysis in a year will give a completely different impression, but will probably show that the trends we have noted will still remain. The results of the analysis may be summarised thus:

- a considerable technical breakthrough is taking place in the education system of many local authorities, since local networks are being expanded and schools are being given the opportunity to establish communication with external databases through fixed links and with other schools in other places and in other countries,

- this technical breakthrough is being followed by an educational breakthrough where schools are integrating IT strategies into their local school plans and where teachers are being trained to use IT as one of several teaching methods,

but

- the response to the question of how the increase in communication and information is being used in practice in schools is still based more on expectations rather than experience.

Computerisation of Swedish schools may be described in three stages.

The first stage was introduced more than ten years ago, which meant that schools purchased computers and set up computer rooms for computer training (technical computer training, programming, Word Processing).

The stage that followed is still going on in the majority of schools. Computers are also being spread out and placed in group rooms and classrooms. Local networks facilitate communication from each computer work place using CD ROM drives or external databases. Many schools can be contacted via modem or are permanently linked to the Internet. Technical criteria are being created for IT to become an integrated investment in teaching in schools.

The third stage is characterised by schools actually utilising the new communication and information services provided by new technology. Increasing information is becoming a vital part of teaching. Computers are being integrated into most subjects as tools and for teachers in their lesson planning.

This analysis shows that a number of pioneer schools have already introduced the third stage and that many schools are on the way to doing so. Factors which indicate that this trend will increase are:

- directors of schools and headmasters understanding that their schools must keep up with technological developments,

- pressure from pupils and parents,

- the objectives of many local authorities to create an IT infrastructure which also includes schools,

- the National Agency for Education's investment in the School Computer Network and in other forms of user support,

- support and, in certain cases, subsidies from Internet suppliers such as Telia, Tele2, Celsius Information System and France Telecom, and

- the increasing access to school-oriented information services.

Factors which could slow the trend include:

- the financial situation for the local authorities,

- the traditional working methods of schools,

- disinterest from some teachers and teacher trainers, and

- insufficient resources for training teachers in IT teaching.

THE SWEDISH EDUCATION SYSTEM

National frameworks and objectives for local authority schools

The Swedish education system has undergone considerable change over the last few years. Responsibility for schools has been completely transferred to the local authorities. The freedom of pupils/parents to choose which school to attend has increased, and approximately 1% of the pupils at junior school level and 1.5% of pupils at upper secondary school attend Swedish independent schools. New curricula have been established for both obligatory and voluntary schools.

At the same time as the School Act obliges all children and young people to have access to equal education, irrespective of sex, geographical location, social or economic circumstances, the resources and priorities of the schools vary from one local authority to another. There are particularly significant differences in costs for teaching materials, equipment and libraries per pupil.

The curricula for both (for the pupils) obligatory and voluntary schools emphasise that schools *provide both knowledge, certain skills and a basis* for making evaluations. Statements within the curricula which are of particular interest in relation to IT development include:

- "The headmaster of a junior school is responsible for...ensuring that the pupils have access to instruction, teaching materials of good quality and other support in order to be able to search for and develop their knowledge themselves. Such support may constitute libraries, computers and other tools" (Curriculum for junior school level/Curriculum for upper secondary school level).

- Teachers of all subjects will endeavour to balance and integrate different forms of knowledge in their teaching.

-The *school will endeavour* to ensure that each pupil...develops curiosity and the desire to learn, develops his/her own way of learning....

- The teacher will ... be able to ensure that girls and boys receive equal attention during teaching and that they have equal influence on teaching". (Curriculum for junior schools)

- "Pupils will be able to familiarise themselves with a complex reality with an enormous flow of information and a rapid rate of change. Their ability to find, apply themselves to and use new knowledge will therefore be important....".

- International contacts, educational exchange and work experience in other countries will be promoted". (Curriculum for upper secondary schools).

Swedish junior schools work to the same curriculum, where every subject has a definite number of teaching hours, but where approximately seven per cent of the teaching time may be used for the pupils' optional subjects. The upper secondary schools run national post-16 programmes which specialise in various different areas such as natural science, caring and social science. There are also some specially-designed or individual programmes available.

Computer science is not a subject as such on the Swedish curricula. On the other hand, Computer Science may be included in a number of subjects/programmes, and can also be chosen by pupils at junior school level as a "separate option". A number of schools included in this study have developed IT as a "specialist subject".

IT Commisson and schools

The IT Commission, set up in 1994 by the Government to promote broad usage of IT in Sweden, has emphasised in various contexts the importance of the role played by schools to strengthen Sweden's future international competitiveness:

- "All pupils at school will learn to use IT. This will mean that the teaching environment improves, education develops and learning improves. The creativity in both teachers and pupils will also be released, providing more opportunities for personal development and success careerwise...".

- IT will be an integrated tool in education in all courses and subjects, whether they are natural science-based and technically-based, humanities and the arts....

- Each local authority will draw up a strategy for IT use and development in schools. Head teachers of *junior schools will have this same responsibility* for their own schools.

- A national campaign is being implemented to stimulate all local authorities and schools to broaden their use of IT. The State, developers and suppliers of IT and educational publishers, etc., should cooperate in this campaign....

- A national Internet-linked information network (the School Computer Network) will be established. High-quality services linking all schools to one another and also to universities and colleges will be offered by the network. These services will be accessible from every classroom, even at junior level. It will be easier to make contact with libraries and various cultural institutions." (SOU 1994:118, Vingar ít människans förmíga [roughly translated: Encouraging peoples' abilities].

Even before the IT Commission submitted its report, the National Education Agency had started work to develop a School Computer Network (see below). As a consequence of the Commission's report, the "Foundation for Knowledge and Skills Development" was also set up to support development projects in schools and colleges.

THE FOUNDATION FOR KNOWLEDGE AND SKILLS DEVELOPMENT

The Foundation for Knowledge and Skills Development is investing in several areas of the schools sector: Project support for local authorities and independent schools, where the local authority and the school try out new teaching methods using IT; Adult Education vouchers to teachers to support their skills development; support for universities and colleges which will meet a growing demand for suitable further teacher training, and project support to develop a new generation of IT-based teaching materials, where the Foundation will also attempt to work with journalists, directors and fictional authors - those who are experts on the media of young people.

Everybody benefits

Everybody can benefit from the Foundation's input. Those projects granted funds are given the opportunity to develop their ideas with support from the Foundation. Even those that have applied for funds but have not obtained them will be able to make use of the investment in schools. The Knowledge and Skills Foundation will invest substantial resources in spreading knowledge and exchanging experience - a project which will benefit everybody.

700 million

All in all, the investment in schools is worth approximately SEK 700 million (app. US 100 million) and will run over a period of three years.

In January 1995, a new IT Commission

received a renewed directive and will study aspects such as the way in which IT changes the role of the teacher, the development of IT-based teaching materials, the development/adjustment of teaching materials and tools for pupils with learning difficulties.

Among the proposals made in the Commission's interim report entitled "Communication without limits, the IT Commission's work programme 1995-96" (SOU 1995:68) is one for teaching materials to be supplemented in order to emphasise the possibilities of new technology helping to update working methods in schools. The IT Commission further emphasises the possibilities of IT to support pupils with learning difficulties and proposes that the National Agency for Education be commissioned to produce documentation for teachers in their work with pupils who have difficulties with reading, writing and communicating.

DEVELOPMENTS IN COMPUTER TECHNOLOGY IN SWEDISH SCHOOLS

The first decade

As early as the 1970s, a certain amount of development work was going on within what was then the Board of Education to produce official documents detailing a future strategy for computers as tools in education. In the middle of the 1980s, a Computer Program Group was formed at the Swedish Ministry of Education and Science, and computers were generally introduced throughout Swedish schools. A special Swedish school computer, "Kompis" [literally: Friend], was developed. As the current study shows, a large majority of upper secondary schools and higher education establishments have had computers for teaching purposes for more than five years.

Early computer teaching took place in specially-equipped computer rooms and included Computer Science, elementary programming and Word Processing.

The number of computers in schools increased dramatically between 1993 and 1995. This included computers used by teachers for their work and for teaching. The number of computers for use by teachers in junior schools, upper secondary schools and local authority adult education has more than doubled, and has increased by 70% in schools for mentally-handicapped children.

The number of computers for teaching in junior schools has also more than doubled. In upper secondary schools, the number has increased by approximately 50%, in schools for mentally-handicapped children by approximately 40%, and they have almost doubled in local authority adult education institutions.

Table I below shows how the number of computers and the number of pupils per computer varies between different types of school.

Table I.

Computers for teaching in different types of school

Computers for teaching	1993 No. of computers	No. of pupils per computer	1995 No. of computers	No. of pupils per computer
Local authority junior schools	21 143	38	45 013	19
Independent junior schools			1 526	12
Local authority upper secondary school	22 728*	10	38 053	8
County Council upper secondary schools	1 463	20	2 494	10
Independent upper secondary schools			974	6
Local authority adult education establishments	4 417	**	8 286	8
Local authority and County Council schools for mentally-handicapped children	1 294	8	1 821	6
Independent schools for mentally-handicapped children			48	5
Educational institutions for intellectually-handicapped adults			388	6
Special schools			196	4
Saami schools			16	8

* *Probably underestimated due to lack of response*
** *Could not be reported*

Since 1993, more and more computers have been placed in classrooms. A good half of the computers for teaching in junior schools and three quarters of computers in schools for mentally-handicapped children are now in classrooms. However, in upper secondary schools and local authority institutions for adult education, three quarters of the computers are still in computer rooms.

The number of schools that have access to a modem and external data communication varies considerably, depending on the type of school; those with the most are upper secondary schools and those with the least are schools for mentally-handicapped children. The same applies to access to CD ROMs.

ENTERING A NEW EPOCH

In 1993, the Nordic Council of Ministers decided to found a Nordic School Computer Network, and in April 1994, the Swedish Government commissioned the National Agency for Education to develop and run the Swedish section of the School Computer Network The objective of the School Computer Network is to:

- provide schools, pupils and teachers with better opportunities to communicate with one another,
- provide schools, pupils and teachers with increased access to information sources,
- develop as one of several educational tools,
- stimulate local IT development, and
- act as "the schools' guide to the Internet".

The School Computer Network is not a physical network, but a logical information network through which a user should be able to access information which is physically stored and updated in various places in Sweden and throughout the rest of the world. Being linked to the Internet provides a school with access to the School Computer Network's four permanent functions:

- address system for electronic mail addresses (preliminary study) and a directory of schools with their own WWW information,
- electronic conferences and an electronic bulletin board,
- WWW server with links to information on the Internet connected to schools, and
- descriptive examples - a forum for spreading ideas.

The School Computer Network (www.skolverket.se/skolnet/) is completely open and may be accessed by everyone everywhere, irrespective of the Internet supplier and user tools. The School Computer Network was commissioned to develop the network, but head teachers are to decide for themselves whether and how they use the service. However, a good forty schools have been earmarked as pilot schools that will form a reference group for the School Computer Network and participate in the evaluation of the services being developed. The School Computer Network will also provide other types of support such as information on IT for interested teachers and other users.

In order to make it easier for users to find material of interest to their schools, the School Computer Network has established links to information which is sorted into lists of subject groups, Swedish and international information suppliers, search tools, electronic newspapers, education, schools, choices of studies and career, etc. At the request of the School Computer Network, Lund University Library for example is creating a "virtual school library" ("Länkskafferiet" [literally: "Link Inventory"]) within the framework of the School Computer Network.

A number of Swedish authorities and organisations are already offering information via the Internet and many intend to do so within the year.

Four Internet suppliers are participating in this development work: Celsius Information System, France Telecom, Tele2 and Telia.

On behalf of Swedish schools, the School Computer System has also reached an agreement with some commercial databases that now can be accessed via the Internet for a very low annual cost. These databases include:

- the "AffärsData" newspaper database,
- article search in the Library Service Agency,
- the Swedish Institute for Building Documentation, and
- the "Rixlex" of the Swedish Parliament, i.e. the parliamentary information service, (including members, proposals, motions, parliamentary committee reports, subject index, speeches, interpetations and questions).

USE OF INFORMATION SERVICES IN SWEDISH SCHOOLS

"IT in schools" will mean the following educational services in the future:

- information services such as computer programs for tasks such as Word Processing and calculations, multi-media programs as teaching materials for particular subjects, information databases, etc., and
- communication services, i.e. methods of contacting information services either via disk/CD ROM or via computer and telephone networks.

Current studies on the use of information services in schools

A number of studies on the use of IT services in certain schools have been published during the last year. These studies generally show particular aspects of the use of IT or its use in certain types of school. Studies which are more than one year old are not referred to in this document because they describe a reality that has already been achieved.

"IT i skolan" [IT in schools], Teldok Report 100 by Lars Bolander is not a systematic analysis of the use of IT, but a broad description based on interviews and study visits. The author believes that IT opens up great opportunities for schools - particularly for high and low performance pupils. However, he also believes that IT will require changes to the organisation of schools and to the role of the teacher, and he expresses surprise at "how passively and unenthusiastically teacher training and further teacher training often approaches the area of IT in schools.".

In a report, "Internet i skolan [Internet in schools]", produced by the Institution of Information Technology at Umeĺ University in June 1995, David Hällgren describes aspects such as school and educational projects on the Internet: the School Computer Network, KidLink, the Learning Bridge, KidsNet, the Canadian schools network, K12Net and WWWEDU/SchoolWeb. Mr. Hällgren has also studied the use of IT at Kĺgeskolan, which has developed a number of projects including its own language project, English Around the World.

Mr. Hallgren summarises teachers'

experiences of the use of IT as follows:

- communication may promote language skills
- communication may create greater tolerance among pupils taking part
- the pupils may become more active and creative
- the teacher's role changes
- the project includes other types of teaching materials.

In a report, "Attityder till datorstödd undervisning hos högstadielärare" [Attitudes of higher education teachers to teaching with computer support"], produced at Kalmar Högskola (the Programme for Media Production), Isabella Łkerlund describes the attitudes of 12 higher education teachers of different subjects to teaching with computer support.

This study generally shows a positive attitude to computers (3 teachers described their view of computers as 5 out of 5 and the others as 4 out of 5 on a scale of 1-5. All teachers of theoretical subjects would like to use computers in their preparation work, such as most teachers of music and (principally) Art and Home Economics. Only teachers of handicrafts did not really wish to use computers. 10 teachers were really keen to use computers in their teaching. The only doubt was among art and handicrafts teachers (attitude 3 on a scale of 1-5). At the same time, teachers with a positive attitude also indicated a few problems, mainly those of finding "time when the computer rooms were not being used", that there were not many programs suited to teaching and those that were available took too long to get used to. As far as actual use of computers in teaching is concerned, the picture is becoming more differentiated.

Teachers of Swedish and teachers of special subjects regularly use computers in their teaching (each week), and believe that computers provide excellent support for the process of learning to write, particularly for pupils with difficulties. One of the mathematics/physics/technology teachers often uses computers for mathematical skills training. Among the teachers of practical subjects, the home economics teacher has regularly used a computer, stating that she has "finally obtained a program which is suitable for her teaching".

The study's illustration of the position in Swedish schools

A good half of the directors of schools and 26 per cent of the headmasters who responded to the questionnaire believe that the local authority is extremely interested in IT. Seven per cent of directors of schools and sixteen per cent of headmasters believe that interest is either quite or extremely small.

Almost one in two schools has an IT strategy and one third have a school strategy which is part of the local authority's comprehensive IT strategy. Upper secondary schools have their own strategies to a considerably greater extent (62%) than junior schools (35%). Most schools incorporate IT matters into their educational development plans (71%). Almost three-quarters of all schools stated that there is a person at each school who is responsible for IT, and two thirds of schools have someone in charge of teaching.

Computers have existed in upper secondary schools and higher education establishments for a relatively long time, and in lower level schools for a few years. Only two head teachers of junior schools have indicated that their schools have no computers. Schools have mostly been using their computers for teaching Computer Science, Word Processing, etc. The majority of schools also have CD ROM drives.

A good half of the schools (61%) have to finance IT development on top of the ordinary school grant. 27 per cent of schools state that their local authority allots special funds to technological equipment (networking, computer equipment), which is substantiated by the heads. IT costs are not usually entered as a special cost in the schools' finances, and most head teachers of junior schools therefore have not responded to the question on costs for purchasing information services. Where costs are entered separately, they amounted to between SEK 5 000 and SEK: 20 000 in 1995 and are expected to be higher for 1996.

Schools, which received computers early on usually, located them in special computer rooms. Such rooms are still to be found in many schools, but the clear trend is now also to locate computers in study areas and group rooms (for pupils' individual work or for group work), and, more importantly, in classrooms. CD ROMs can often be accessed via local networks.

The response shows that barely half (46%) of all schools have the opportunity to search for information from external databases (79% of upper secondary schools, 27% of junior schools). Since connection is normally completely new (it has taken place over the last year), schools still have very limited experience and they find it difficult to judge how they will use communication and information services in the future. However, many said that they would become permanently linked to the Internet during the autumn term, and that they expect this to lead to rapid development. It was generally agreed, though, that IT use is set to change teaching and school work in many ways: "We are facing a paradigm shift."

The situation as regards users as described by the schools is that, until now, IT has been used to a great extent by:

- special subject teachers in junior schools (58%),
- teachers in technical and natural science subjects (45%),
- teachers in social science subjects (37%).

According to the assessment of the headmasters, IT is used to a lesser extent by:

- teachers of Swedish and humanities subjects (26%),
- languages (26%).

On the basis of this information, it is perhaps natural for the headmasters to name relatively few specific services in their responses and generally instead refer to IT as being important in social science-oriented subjects, etc. The named services included:

- training for pupils with reading and writing difficulties,
- possibility of searching for information on refugee pupils' home countries,
- distance learning,

- "company school".

Both headmasters and directors of schools said that "all" teaching categories should make use of IT in the future.

The headmasters said that 57 per cent of those responsible for IT at schools know "very well" or "quite well" which information services, such as public databases, are on offer. Teachers are judged to have relatively little IT knowledge. Several headmasters who commented on information services used said:

- that the services were not sufficiently well-suited to school use, or

- that they were difficult to find or sort out.

The headmasters have been asked to assess the rate at which IT development will grow at their institutions during the next two years. 60 per cent believe that it will grow rapidly (70% of upper secondary schools against 54% of junior schools), and 34 per cent believe that it will grow slowly. However, directors of schools in general said that it would grow rapidly (80%), as did representatives of pioneer schools (88%).

Most of those who said it would grow "rapidly" referred to their local authority's central investments and to the pressure from pupils and parents, but principally they referred to the need to "keep up". Several said that they would be installing local networks during autumn 1995, and would become permanently linked to the Internet. In so doing, they would then satisfy technological criteria for more systematic IT-based teaching.

Those who said that it would grow "fairly slowly" generally referred to the lack of funds within their local authority and school. One headmaster said with regret that it would grow rapidly: "over-confidence in computer technology on the school's junior level curriculum". Quite a lot headmasters (47%) of reception and intermediate levels said that external communication and possibilities of searching for information "were no more important than basic skills".

The majority of headmasters (60%) believe that they will want to have access to external databases and reference material in several ways: the Internet in combination with on-line databases and CD ROMs. Headmasters of junior schools at reception and intermediate levels have CD ROM as their priority and are less interested in the Internet ("too difficult for our pupils"), while all headmasters of upper secondary schools want access to the Internet.

The main obstacle to increasing the use of information services is a lack of funds according to 76% of the headmasters, which in turn leads to a shortfall of computers (39%). The headmasters then pointed out the lack of IT skills among teachers (63%). Technical difficulties were not seen as a particularly great problem (12%). Directors of schools largely agree with this assessment. However, representatives of pioneer schools said to a far lesser extent that a lack of funds was a great problem. On the other hand, 64% said that teachers' work load was an obstacle (compared with 41% of the headmasters and 27% of the directors of schools). Many representatives of pioneer schools commented that investment in IT would and must be allowed to take time.

All of those interviewed said that IT will influence education and internal work in schools. The pioneers, who do have the most experience of IT, said to a greater degree than the headmasters that schools would be influenced in several respects, including the effect of pupils on teaching and their ability to cooperate. The opinions of directors of schools were more similar to those of the pioneers than those of the headmasters.

Influence to a great or fair degree	Headmasters	Pioneers	Directors of schools
teachers' cooperation, spontaneous or in law	44%	63%	54%
teachers' choice of teaching materials	71%	66%	87%
pupils' effect on teaching	46%	75%	60%
pupils' subject knowledge	79%	84%	100%
pupils' ability to search for factual information themselves	92%	97%	100%
pupils' ability to analyse and solve problems for themselves	72%	81%	100%
pupils' involvement in the age of information and new technology	62%	60%	80%
pupils' ability to cooperate	44%	66%	53%
pupils' ability to work independently	87%	97%	93%
pupils' preparation for working life	87%	84%	94%

Both directors of schools, headmasters and pioneers were asked about how IT would influence their schools' objectives of giving all children equal access to education. The majority said that the differences between children with various learning abilities may increase, as may those between children with different amounts of study support at home and between children in different local authorities. There is, however, a unanimous belief that it is up to schools to provide IT as a tool and develop IT education, thereby compensating for these differences.

The differences between children	Agree to a great or a fair extent		
	Headmasters	Pioneers	Directors of schools
will increase with different study criteria	59%	57%	53%
will increase with different amounts of study support at home	77%	66%	74%
will increase in well-off/under-financed local authorities	83%	73%	80%

Pioneers

The study includes 33 interviews with people at schools that we assessed to be pioneers with regard to IT. Pioneer schools exist at all levels, in all types of local authorities and it is reasonable to assume that the pattern of usage being developed at pioneer schools will also be developed for other schools.

There is the question as to whether the differences between the pioneer schools and the other schools are type or level differences. The interviews show that a pioneer school is characterised by having an old hand (usually a teacher) who has support from his/her junior school head teacher. The schools are usually (but not always) in a local authority that encourages IT development. Pioneer schools make use of IT services to a much greater extent than other schools. However, half of them are still not permanently linked to the Internet.

Contacts are teachers or other school staff who have broad professional experience, hardly "young enthusiasts". They are personally extremely interested in information technology and "early adopters", half of whom have access to the Internet at home. However, for this reason they are not always enthusiasts in the sense of "missionaries". At the same time as believing in the potential that IT will bring to schools and believing that it will develop rapidly, there are some who emphasise that teaching must be developed, not just technology, that there is too much rubbish on the Internet, and that people must learn to sort out the required and useful information. Despite the fact that many of those interviewed teach technical subjects, they emphasise that people must adopt a humanities perspective when developing IT.

The pioneer schools have broader experience than other schools of working with communication and searching for information. Appendix 4 shows services named by contacts. The responses show that contacts are often made with schools/classes in other countries. Databases have still not been increased to any great extent. IT is used as a teaching material and is taught as a constituent part of some subjects (e.g. Swedish and other languages), while teachers of other subjects (such as mathematics) have not found equally applicable material.

The pioneer schools do not allow themselves to be held back by technical limitations. Telephone interviews gave several examples of schools where teachers and pupils had been building up data communication with other schools within and outside of Sweden simply by contacting "BBS systems" via modem, long before the Internet became a practical alternative. Schools with limited financial resources said how a functioning system had been created by collecting or purchasing second-hand equipment, getting local companies to sponsor WWW pages and allowing pupils to extract information from local networks.

The role of school libraries

Extensive school libraries exist largely in upper secondary schools. At the lower levels, library tasks are often taken care of by a teacher who, in return, will have his/her teaching responsibilities reduced. Responses to the questionnaire also show that headmasters of upper secondary schools believe the librarian to be the person at the school who uses IT most often (aside from teachers in technical and natural science subjects).

School libraries offer a double resource. In many cases, there are opportunities here to communicate with external databases, and there are usually CD ROMs available, as well as staff specially trained to search for information. There is an ongoing discussion among school librarians on the professional role of the library when teaching in schools changes. On one hand, the librarian has an important role in the team of adults organising teaching. On the other hand, the role of the teacher is becoming more like that of the librarian - to guide young people who are looking for information.

FACTORS WHICH MAY AFFECT THE DEVELOPMENT OF IT USAGE IN SCHOOLS

It is not possible at present to predict with any certainty the IT development that may take place in Swedish schools. A number of factors may, however, speed up the rate of development:

1. Technology/communication is becoming cheaper and more user-friendly

A large number of representatives from pioneer schools, who have had the opportunity to use technology for a while, said that systems have definitely become more user-friendly.

2. Teachers are being offered training

80 per cent of head teachers of upper secondary schools indicated that local authorities had organised IT training for teachers. At pioneer schools, contacts described how they themselves organise training for their colleagues. Internet suppliers such as Telia are offering starter or school packages with introductory training of contact teachers and those responsible for IT at each school.

3. School Computer Network "being discovered" by more and more people

The School Computer Network is still relatively new and by no means all pioneer schools have yet had the chance to make use of its services to any great extent. However, the School Computer Network received good marks from those who had used it, and it may play an important role for teachers and pupils who find it difficult to familiarise themselves with the Internet.

4. Local authority IT strategies

Many local authorities/schools have already accepted or are devising IT strategies. The Swedish Association of Local Authorities' and the National Agency for Education's joint manual (October 1995) on how to devise an IT strategy for a school should allow acceptable strategies to develop and new ones to be drawn up.

5. Publishers of educational aids

Until now, the supply of Swedish CD ROM teaching materials has been fairly limited, but several publishers have now announced a number of new products.

6. Information on society and local information via IT

The Swedish Parliament is now extending its service to schools by offering CD ROM teaching material (the history of the Swedish Parliament, working methods, members, information sources, etc.) and Rixlex at a low price on the Internet. It is possible for history teachers to teach about parliamentary history with support from multi-media, and for social science teachers to allow their pupils to follow the actions of their local MPs in Parliament (motions, questions, participation in debates and voting).

Correspondingly, some local authorities are planning to make their official authorised documents and other local authority information available via IT.

A national museum project (the National Museum and the History Museum) is making comprehensive collections available via the Internet, and local museums are extending their Internet information. This information may be useful both in general history teaching and for supplementary knowledge gained at home.

7. IT in special teaching

One of the categories of teachers who have tried out IT in teaching to a particularly large extent is special teachers who have had access to programs for children with reading and writing difficulties. Teaching materials are being developed for schools for mentally-handicapped children, supported by the Swedish Institute for Disabled Persons and organisations for disabled persons. Such schools are now being integrated into local authority schools, which may mean that the special skills of schools for mentally-handicapped children will become diluted. However, since September 1995, there has been a special information centre (the LISEN project) at the Teacher Training College in Stockholm, which provides an overview of the supply of teaching materials for schools for mentally-handicapped children and for special needs classes, and which has the task of distributing this information

Responsibility for communication which takes place in and between schools

Head teachers are those principally responsible for the way in which information available on the Internet is used in schools, in the way that the individual is responsible for information which he/she uses. Some schools that still do not have practical experience of the Internet, have expressed apprehension about pupils gaining access to undesirable material such as pornography or graphic violence via the Internet. There is research taking place into various possibilities for limiting pupils' access to "undesirable" parts of the Internet. Schools that have already had practical experience of the Internet do not judge the problem to be particularly serious.

Several schools have laid down ethical rules for the use of their Internet subscription, or are reaching " an agreement" with each pupil authorised to use the network about how the subscription is to be used.

SUMMARY OF ANALYSIS

Teaching in schools will be substantially affected by the growth in information technology. How rapidly and to what extent this will happen at each school firstly depends on a number of interconnected factors: the attitude of the heads, availability of "old hands" and the financial resources of local authorities. Now that IT-based education is becoming a reality in a number of schools in Sweden, it is, however, probable that IT will he used increasingly. This study shows requirements expressed by parents and pupils.

In practice, much of the external communication and information searching will lie linked to the Internet. National investments being made by the School Computer Network are based on the Internet, as are many local authority IT plans.

However, it should still be noted that the pioneers have built up a number of interesting early projects by using BBS systems.

We are thus of the opinion that the demand for services connected with IT will increase substantially during the next few years. Two types of service ought to be especially in demand: assistance with technological expansion and teacher training. It is impossible to predict how - to what extent and in what direction - the demand for purely educational tools will develop.

It should be noted that a large number of authorities and organisations are now in the process of or are planning to develop special school-oriented materials that will be offered to schools as CD ROM and/or via the Internet and the School Computer Network. Several publishing companies have announced new series of CD teaching materials.

The greatest obstacle to IT development in schools is the lack of finances in local authorities, followed by the lack of teachers' IT skills. The technical problems that some head teachers of junior schools referred to are described as minor by schools which are permanently linked to the Internet. Orientational difficulties "out on the net" are reduced for those who make use of the School Computer Network. Unanimous statements from the pioneer schools and from schools that have not even had much chance to try out the service show that the School Computer Network is very important in the use of IT in schools.

Information technology is particularly important for some "specialised" subjects where teachers must normally develop their own teaching materials. Here, IT is used both as an educational tool and for teachers to exchange experience.

IT may have major consequences for work within schools. Representatives of pioneer schools said (to a greater extent than headmasters and directors of schools) that cooperation between teachers will increase. The descriptions of how work is done at pioneer schools also show this to be the case: a team of teachers, cooperation with the school library, and "hours" which are transferred from one subject to another. The representatives of pioneer schools also said that IT would increase pupils' influence on teaching.

IT projects often demand longer working periods than the traditional lecturing system has allowed. This means that at the intermediate level, teachers have found it easier to develop working methods to make more efficient use of IT than those at the upper secondary level have.

NATIONAL REPORT OF THE SYRIAN ARAB REPUBLIC

INFORMATICS AT THE MINISTRIES OF EDUCATION AND HIGHER EDUCATION IN THE SYRIAN ARAB REPUBLIC

I. INFORMATICS AT THE MINISTRY OF EDUCATION

INFORMATICS AS AN INNOVATING TREND IN THE FIELD OF EDUCATION

Education is a continuing and renewing building operation devoted to Man, the cornerstone of progress, comprehensive development, and advancement of society. Being an effective medium in the formation of knowledge, acquirement of values and practical experiences, education prepares qualified cadres that are capable of utilizing science and technology in the numerous domains of life.

The process of developing and upgrading the level of education is clearly stated in the directives of Mr. President of State - Hafez Al-Assad, but this process will fall short of achieving the intended objectives unless it becomes associated with well-organized efforts, in order to exploit its fruitful results and make them serviceable for the advantages of tourism, economy, defense and other spheres of life.

Modern Syria is witnessing the use of informatics based on solid foundation, in addition to extending the application of information science in various areas of constructional development and cultural advancement.

The Ministry of Education has endeavored to promote the introduction of informatics in the fields of education and related activities. Moreover, the Ministry's endeavor is designed in accordance with an exhaustive scheme founded on a scientific methodology in expansion, application and rehabilitation of skilled personnel.

TRENDS AND FIELDS OF INTRODUCING INFORMATICS IN EDUCATION.

1. Area of Informatics Teaching.

The experiment of teaching a course at the school experimental centers for the secondary stage (second secondary classes), started in the academic year 1991-1992 in all the provinces (Muhafazat), according to a ministerial plan. The Ministry publicized the plan, specified the method of implementing and supervising it and provided the required experimental, theoretical and practical textbooks.

The aforementioned Centers are increasing gradually, year after year, in the provincial capitals, cities and the countryside. Their number has so far amounted to 67 centers which are equipped with computers and their requirements.

These Centers are received with great encouragement and desire by the students and their parents. In this respect, a new book has been published this year in two respective volumes-theoretical and practical. The book deals with the bases of informatics and the use of computer to be taught in the centers. It will be assessed and evaluated in cooperation with the specialists of the Syrian Scientific Association of Informatics and Damascus University. Pursuant to the new teaching plan which was carried out in 1995-96 regarding the secondary commercial schools, a course in informatics was introduced to be taught theoretically and practically for the three secondary classes. Special halls were set up at the commercial secondary schools and equipped with the required computers according to a gradual plan which has been applied starting from the school year 1995-96 to the first commercial secondary class.

2. Field of Educational Administration:

The computer has been employed in the system of general examinations since 1991-1992, to carry out the operation results of all general certificates at two centers. One of these centers is situated in the main building of the Ministry and the second is in the city of Homs. This experiment was developed vocationally and technically during the last five years. It has become a base in the system of examination , and reflected positively with regard to accuracy, saving time, cost and work mechanism of general examination. Consequently, all the results of the general certificates and related documents have been computerized.

Moreover, the computer is used in the accounting operation and the affairs of employees working in the central administration of the Ministry and the educational directorates. At present, a program of statistics and collecting data is being planned at the Ministry, in addition to preparing statistical educational tables and specifying educational and statistical indicators, pursuant to the accredited development plan.

3. Personnel training and rehabilitation

The expansion of introducing informatics in education is accompanied by parallel and comprehensive plans with regard to personnel training and rehabilitation for teaching and using informatics in educational administration. The Ministry has taken serious steps towards preparing trained national personnel and improving their qualification as the first necessary practical steps in introducing and upgrading informatics in educational administration and teaching.

Teachers are trained to provide teaching staff for the Training Educational Centers of Martyr Bassel Al - Assad. These centers were established by the Ministry in cooperation with UNESCO in Damascus, Homs. Lattakia and Aleppo. These centers offer a nine-month-training-course for teachers who hold Bachelor Degrees in Mathematics, Physics, Natural,

Science, Economics, and Commerce. Seventy teachers representing all Syrian provinces (Muhafazat) are trained each year. This year, the number of teachers has increased up to 102 trainees. This is due to the fact that these Centers are equipped with developed computers and modern software using both Arabic and English languages in cooperation with UNESCO. thus, the number of trained teachers will reach 422 by the end of 1996.
Furthermore, training of the employees in using computers concerning educational administration takes place at training centers established by the Ministry. This involves training of leading personnel and other employees working at the Central Administration and Educational Directorates belonging to all provinces (Muhafazat), each according to his or her field of specialization.

4. Setting up the Directorate of Informatics

In order to promote the expansion and development of informatics on the educational level, the Ministry established the Directorate of Informatics in 1994. In addition, the Ministry founded departments of informatics at the educational directorates of all provinces (Muhafazat) to implement the Ministry's plans in the area of informatics.
Moreover, the Ministry gives priority to programming and maintenance in view of their importance in developing work mechanism, local and national experiences.
The Ministry tries its best to overcome the difficulties through the following courses of action:
A. Developing the Department of Programming in the Directorate of Informatics and giving six-week training courses for the employees of the Department in cooperation with UNESCO in the summer of current year. UNESCO experts will undertake the responsibility of training. A specialist from the Informatics Directorate was sent to the Netherlands to attend a long training course pursuant to the informatics project which was agreed upon between the Ministry and UNESCO.
B. The experiences of the Maintenance Section employees are developed at the Informatics Directorate. A number of maintenance workshops which have been established in some provinces (Muhafazat) pay periodical visits to the informatics centers in schools and the directorates of education to maintain the computer devices.

5. Setting up a National Strategy to Introduce Informatics at Pre-university Educational Level

As a national strategy, the Ministry has worked in cooperation with UNESCO to introduce informatics into pre-university education. Thus, The Ministry has cooperated with the Syrian Association for Informatics in assessing and evaluating the afore-mentioned strategy which was accepted by the Regional Command in 1995.
Pursuant to the educational policy of the Syrian Arab Republic, the Ministry of Education tries to achieve the integration of mental, national and educational aspects. Moreover, the Ministry attempts to develop the practical experiences of the youth through expanding the informatics plan in cooperation and coordination with the concerned sides, especially with the Syrian Scientific Association of Informatics and Scientific Research Center.
The Ministry's main objective is to keep a balanced preparation of the coming generations whose future and welfare are the basic aim of the Nation.

II. INFORMATICS AT THE MINISTRY OF HIGHER EDUCATION

At present, The Ministry of Higher Education makes use of the Computer Center of the Faculty of Engineering regarding the distribution of students among various faculties and institutes of the four Universities, taking into consideration the student's desire and the capacity of each faculty.
Realizing the vital importance of science and knowledge in changing and developing the structure of society, the Ministry of Higher Education has drawn a plan with the aim of computerizing the Ministry's work and related bodies, including the Four Universities with their hospitals.
In order to accomplish a comprehensive informatics system, the Ministry tries to develop a local informatics network through introducing modern software system. Furthermore, the Ministry has established computer sections which eventually will be developed to become a directorate.

Introducing Modern Technologies Of Information In Higher Education

In view of the great importance of informatics and its vital role in scientific research, the Ministry has established a number of departments of informatics engineering at the Faculty of Electrical Engineering in Aleppo University. The Ministry has, furthermore, established a department for mathematics and informatics at the Faculty of Sciences in Damascus University. A course in informatics is also taught to students of higher studies at the University. In addition, the Ministry has accomplished the teaching plans and introduced them into the program of informatics and computer engineering departments of the Four Syrian Universities.
An intermediate computer institute has been established in Damascus. At Aleppo University, a department for specializing in computers has also been set up. Finally, the subject of informatics has formally been introduced into the teaching programs of all intermediate institutes.

NATIONAL REPORT OF THAILAND

STRATEGIES FOR THE DEVELOPMENT OF EDUCATION AND INFORMATICS

BACKGROUND

The development of information system and the utilization of information technologies in Thailand began about two decades ago or during our Fourth National Education Development Plan (1977-1981).There were series of meetings and conferences to initiate information networks which would facilitate the exchange of information for educational planning and administration. It was proposed that the Office of National Education Commission should serve as coordinating center for data collection and the utilization of data. Nevertheless, each individual agency had its own mandate and functionality to perform, therefore, the progress in terms of system development was mainly based on individual's needs. This caused the problem of non-uniformity which implies the inability to exchange information between different agencies. In addition the rigidity in budgetary and personnel administration impeded the development of information systems. The over-centralized administrative system required schools, district, and provincial officers to report annually in statistical forms which would be processed by the central administration. This long process of data collection explains why educational planners and administrators did not have information in time during the process of educational planning and administration.

Another dimension of utilizing information technology is in the teaching and learning process. The current movements indicate that more and more educational institutions in Thailand are trying to make an appropriate application in information technology (IT) in education. A wide variety of IT application includes tele-education via satellite, multimedia and computer-assisted instruction, and learning through the computer networks. In general, these alternatives possess good potential for education, but on the other hand, they are not equally effective in every circumstance. Therefore, the government and responsible bodies have to research and make a right decision to invest in order to get the greatest benefit out of each technology. The problem of this undertaking, however, is due to the lack of unified direction and coordination. Previously, there was no coordinating agency to develop national goals in utilizing IT for education, to monitor the standard of media, and to evaluate its impact.

STATE OF THE ART OF NITs IN EDUCATION IN THAILAND

Regarding the application of IT in education, there are two dimensions, namely, educational administration and pedagogy.

In educational administration, most educational organizations are in the period of transforming into computerized system. Hence, it is common for organization to have a mix between manual data collection system and a computerized database management system. This means most data collection system will require form-filling by local agencies at various levels, then the data are processed at the district or provincial level before sending to the central administration. This depends on the provision of computers. However, it is observed that sharing of information between departments is still limited, because information flow is mainly on a vertical line of administration. The question is how to promote the exchange of information in a horizontal plane. The solution is not to simple and requires a lot of efforts to fulfill many preconditions, such as:

- uniform data code and definition;
- software protocol and compatibility;
- availability of tele-communication services.

In pedagogy, it is quite clear that many educational institutions are trying to apply the new information technologies (NITs) in their delivery systems. Many forms of media being experimented, such as, tele-education via satellite, multimedia for computer-assisted instruction (CAI), and learning through Internet. Most applications are in initial stage which provides feedback especially in quality and standard of multimedia. Up to present there is central body to set a direction and monitor the development of multimedia for education. In addition, there is a severe shortage in personnel for its prediction. Moreover, the state should specify criteria for provision of micro-computers, so each department could plan to distribute them to schools accordingly.

Insofar, every department in education has already utilized some forms of NITs. It is not possible to present a comprehensive list of applications. However, some details on state-of-the-art of NITs in selected departments will be explained to reflect the overall developments.

EDUCATIONAL MANAGEMENT INFORMATION CENTER - OFFICE OF PERMANENT SECRETARY FOR THE MINISTRY OF EDUCATION (MOE)

The center is responsible for data collection, data processing and development of databases in educational, religious, and cultural affairs. This includes data analysis and dissemination to members within the MOE information networks. In addition, the center is a core of the development of management information systems, and computer related training programs for the Ministry of Education.

At present, the center is making effort to connect every concerned department under the administration of Ministry of Education into MOENET (Ministry of Education Information Network). At the same time all parties within the network will be connected to Internet. With regard to the provision of computers, every provincial education office is already equipped with a computer, and more than 400 district education offices, representing more than 50 per cent of the total number of districts in Thailand, are already utilizing computers in their work routines. It is expected that by 1998, every district will be equipped with a computer. This means general information covering personnel administration, budget allocation, management of programs and projects, material and equipment inventory, as well as basic data with regard to education, religion and culture will be processed at the district level. The center is currently developing a software for statistical report which will facilitate district and provincial offices in data entry, data processing and reporting. It is expected that a computerized statistical report will soon replace the manual system.

OFFICE OF INFORMATION TECHNOLOGY - RAJAMANGALA INSTITUTE OF TECHNOLOGY

The office was established to search for appropriate IT which can be applied to teaching and learning activities. Besides, the office is responsible for policy formulation, research, administration, and technology and academic services. There are four major programs underway.

1) The application of IT in teaching and learning.
2) Management Information system.
3) Research and IT services.
4) Development of Internet networks.

These programs are aimed to meet the following objectives.

1) To increase the efficiency of database management system and the services.
2) To improve teaching and learning activities and to promote distance education in order to expand the standard education all over the country.
3) To produce component and capable graduates to fulfill the future labor market demand.
4) To promote research and development projects to invent and improve in the area of IT.
5) To develop connectivity of computer networks.

THE DEPARTMENT OF VOCATIONAL EDUCATION (DOVE)

The Department of Vocational Education has established an information center to serve as a focal point in data collection and information dissemination to students and general public.

With regard to teaching and learning, the department now requires every student at certificate level (Por Vor Chor) and diploma level (Por Vor Sor) to take a compulsory basic course in computer. DOVE is trying to provide adequate computer facilities for teaching and learning. The target is to provide one computer set for two to three students. In addition, DOVE is supporting the computer-assisted instruction programs by means of acquiring authoring software and organizing teacher training in CAI courseware development.

THE DEPARTMENT OF CURRICULUM AND INSTRUCTION DEVELOPMENT

In 1990, there was a significant change in curriculum for primary, lower-secondary, and upper secondary education in Thailand. One of the objectives was to promote the use of modern technology and teaching media, especially the use of computer at the school level. However, in practice, the equipment and personnel were not readily available. It was not possible to put computer courses as a requirement in curriculum. Nevertheless, at the secondary level, there were electives on computer subject. Later on in 1995, when computers were more widely available, the department introduced a basic computer course for grades 5 and 6 at the primary level. This course offered under the work-oriented subjects, or the preparation towards jobs.

In reality, only large secondary schools and schools that are supported by the private sector can manage to teach a computer course. Meanwhile, most primary schools are not equipped with a computer for either educational administration or teaching and learning. However, the Ministry of Education is planning to provide at least one computer to every school as soon as possible.

THE DEPARTMENT OF NON-FORMAL EDUCATION

The Department of Non-Formal Education is responsible for providing educational opportunity to people outside of schooling system. There are several types of courses, namely, functional literacy, general education, occupational certificate (Por Or-abbreviation in Thai), vocational certificate (Por Vor Chor-distance education), short-course occupational training, and interest group training. In 1995, 3.6 million people registered in the non-formal education courses. In addition, the department offers informal education by means of public library, radio and television broadcasting, and exhibition organized by National Scientific Center. All together, more than 15 million people benefited from the informal education programs.

The department has utilized computer in two respects, namely, educational administration, and pedagogy.

In educational administration, the applications are mainly for database management system covering:

- general education statistics;
- encyclopedia for life-long learning;
- local resource persons.

In pedagogy, there are two dimensions in utilizing NITs, namely, computer-assisted instructions, and distance education.

1. Computer-assisted instruction by national science center. The center develops CAI multimedia programs to display science exhibitions. The content is related to basic science, natural science, environment, science and technology, astronomy, aero-space, and meteorology. The target groups are primarily and secondary students and the general public. The exhibitions are designed to facilitate self-

learning through computer multimedia.

2. Distance education via satellite. In 1995, the department of non-formal Education in cooperation with THAICOM Foundation, launched an experimental project of distance education via satellite. This educational program was transmitted with two systems, MMDS and DTH (direct to home). The signals were directed to 236 learning sites. There were approximately 126,800 people who received distance education via satellite in 1995. In 1996, the department is already in the process to facilitate learning centers in every province all over the country. The full expansion target, however, will have to reach 40,000 sets of receptors for all learning centers.

Moreover, the department is undertaking a project on electronic library which is intended to store textbooks, guidebooks, as well as CAI courseware modules in electronic medium. This documentation collection could be search and transferred to public libraries at provincial and district levels. It is planned that each library will be equipped with three sets of computers. The pilot project has been kicked off this year and the expansions will be made in the following years.

INFORMATIONAL CENTER - OFFICE OF PERMANENT SECRETARY FOR THE MINISTRY OF UNIVERSITY AFFAIRS (MUA)

The information center is responsible for the development of information systems for higher education policy formulation and planning, as well as providing information services to universities. Major tasks of the center could be summarized as follows:

1) Conduct a computer system analysis and operate computer services for the Office of Permanent Secretary for the Ministry of University Affairs, as well as development of computer systems for other agencies.

2) Develop higher education database for educational development planning.

3) Disseminate and exchange information with higher education institutes for educational administration.

There are six categories of information, namely: a) student enrolment; b) university faculty; c) budget; d) curriculum; e) job placement of graduates; and f) student entrance examination results.

With regard to pedagogy, the Ministry of University Affairs has already launched a project on education network and tele-education between universities. This movement is related to the fact that potential of personnel and graduates in the area of science and technology is getting worse. The porential has accumulated for many years and affected national development. The Thai government, thus, declared a policy to speed up the production of personnel in the area of shortage.

Many efforts have been asserted to build the capacity of teaching personnel and to improve the curriculum and teaching-learning process which are appropriate to the modern word. And most of all, to expand educational opportunity to people in every region of the country. Referring to a conventional approach, campus must be expanded to receive more students particularly in different regions. However, the conventional method is not feasible, because the existing universities already lack teaching personnel. Therefore, it is important to recruit adequate staff for the new campuses.

In order to alleviate these shortfalls, the MUA decided to utilize information technology to expand educational opportunity quickly and efficiently. The combination usage of computer technology and communication devices, offers a solution to the problem. This means students in remote campuses can benefit from master teachers through modern technology. This approach helps bridging the gap in terms of quality between different universities.

However, before the utilization of technology, the Government must invest into the infrastructure to create the educational information highway. This is like the road to the source of learning. If the basic structure is provided to every university, it will be open a new channel for a two-way distance education.

This is not a new concept. Many countries in this region, such as, Singapore, Malaysia, Japan, Taiwan, and Australia have already taken this advantage. In the United States, the North Carolina Information Highway (NCIH), was a significant example. NCIN was introduced in 1986 to connect 50 universities in North Carolina along with community colleges, secondary schools, and etc. into the information highway. The essence of this concept was to build a virtual classroom in a rural school or any place affected by teacher shortage.

To create the information highway, there are four layers of information network that have to be developed, namely, campus network. In addition, the preparation for distance education networks comprises three components:

1) Organizing a standard classroom for two-way communication by utilizing video-conferencing system.

2) Develop computer networks within a university to obtain campus networks.

3) Create high-speed computer networks between universities.

With this frame of development, the MUA proposed a three years development plan as follows:

*Year One (*1996) - To build educational informational Highway between universities in Bangkok and in other provinces. This includes the installation of equipment for distance education, and the development of campus-networks. (US $ 36 million).

Year Two (1997)-To expand the number of studio classrooms to meet the increasing demand, and improve inter-university networks by switching the mode of communication to optic fiber. (US $ 42 million).

Year Three (1998) To install the systems for video-on-demand to allow every university to review any educational programs any time. This operation will eventually extend to schools and educational institutes at every level to minimize the utility of educational information Highway. (US $ 42 million).

NATIONAL IT POLICY

It is clear that information has become more and more instrumental for development in terms of production and distribution of wealth. The Thai government recognized that advancement of information technology (IT), such as, computer, telephone, television, multimedia, on-line database, and a wide range of other related technologies which will significantly shape the way we live. Thus, it is an opportune time to declare a national IT policy and set a direction as well as strategies for the next decade.

Since IT offers a good opportunity to improve effectiveness in business, and social development, the government must plan to utilize appropriate technology to spread economic activity, democratic principle, and social benefit provision such as education and healthcare across every region of the country.

It is foreseen that effective use of IT would be instrumental for - more equitable distribution and job opportunity to rural inhabitants;
- promotion of democratic principle and national heritage;
- reducing labor migration and alleviating urban slums and pollution in the capitals and major cities;
- more fairness in public services such as education, and healthcare to individuals in every sector of society;
- conservation of natural resources and environment.

Even though there are many positive features we could expect from the use of ITT, but we must be reminded that if properly developed and applied, IT could exaggerate the existing problems. Instead of bridging the gaps between the rich and the poor, the rural inhabitants, it could be a discriminating factor on who will get the social benefits and who will lack them. Therefore, it is likely that in this situation the rural population and city-poor residents will be left further behind.

In transforming from vision to realty, three fundamental conditions must be addressed and put into agenda as follows:
- National Information Infrastructure (NII);
- well-educated population and adequate IT manpower;
- genuine commitment from the government.

Agenda #1: Invest in equitable information infrastructure

At the most fundamental level, the Government must put investments to build the physical infrastructure. The most basic building block for a NII is the telephone service at high-speed telecommunication backbone linking the entire nation. Particular attention must be given to the distribution observes. A widely available and affordable basic telephone service is one important condition to effective rural development.

Agenda #2: Expand basic education for the entire population and produce adequate IT manpower.

In order to spread the benefits of using IT to all segments of society, there must be a liberate and well-educated population to become part of the beneficiaries. Without that, the society as a whole could not be expected to be active generator and consumer of new knowledge and information. On the other side of the spectrum, there is a critical shortage of almost all types of technical and managerial manpower. The greatest shortfall is in software and telecommunications engineers and technicians.

Agenda #3: Invest for the good governance.

Every member in society should be aware and involved in the undertaking to develop IT. However, most importantly, the state must provide the prime moving force to encourage, promote, support, and coordinate the development. The state must make every effort to remove critical obstacles, and provide a role model to society. This means investment in IT facilities and personnel is only pre-condition. The state must design and introduce innovative ways of working to achieve the full benefits from using IT. In this process, a society whose members can clearly perceive the benefits of IT will turn them into active users themselves.

These three fundamental issues set the scenario of what needs to be done to prepare our country to meet the challenge to next decade. To be more specific, each issue must generate more concrete strategies as guidelines for preparing program and projects.

1. Build an equitable national information infrastructure.

1.1. Embark on a five year rural communication expansion and modernization program.

1.2 .Ensure a reasonable share of the benefits be given to the rural region in all future major communication projects.

1.3. Establish an independent telecommunication regulatory body.

1.4. Review and reform the existing telecommunications and other related acts.

2. Invest in people to eliminate critical storage of IT manpower and raise basic education of all citizens.

2.1. Implement a National School-Informatization Action Program.

2.2. Establish a National Interactive Multimedia Institute to oversee the development of educational courseware and application software.

2.3. Intensify IT manpower production at all levels.

3. Enhance government services to make fuller use of IT by all public agencies trough government reengineering and to provide full supports to all sizes of entrepreneur in the information industry.

3.1. Launch a Nationwide Government Informatization Program.

3.2. Make IT planning an integral part of the annual government budgeting exercise and IT policy research an on-going effort.

3.3. Support the development of a short local information industry.

3.4. Promise and support electronic means for citizens and business to interact or trade with government, or among themselves, or with the world community.

MASTER PLAN OF INFORMATION SYSTEM FOR EDUCATION

From the scope and strategies generated by national IT Policy, education sub-sector has to delineate its own details. The prospect is quite clear that education can benefit a great deal from appropriate use of IT. However, there are numerous institutions involved in educational provision. It is necessary to develop a master plan of information system for education. The Office of the National Education Commission, which is attached to the office of Prime Minister, serves as coordinating body to develop the master plan.

The objective of developing information system for education is to achieve an efficient information system which supports educational planning and management. The information must be interchangeable and the system must be accessible to educational institution at all levels. This includes information services which fulfill the aspirations of all citizens for life-long learning and skills upgrading without regards to age, profession, distance, geography, or physical disability. The desirable information system for education comprises two major components:

1) Information system for education administration.

2) Information system for teaching and learning.

INFORMATION SYSTEM FOR EDUCATIONAL ADMINISTRATION

This component actually covers statistical information and documentation information.

The system of statistical information comprises a wide range of agencies, both information producers and information consumers, from institutional and departmental levels to ministerial and national levels. It is expected than by the year 2001 the linkages between departments and between ministries will be completed, and the line of data communication will also be available for international cooperation.

The system of documentation information comprises libraries, academic clearing-houses, private agencies, and international organizations. There are two types of network. First, a network which the ONEC serves as a node where members can have an access to available databases, such as, a collection of cabinet's resolution, on education, educational laws, educational development plants, and education research abstracts. Second, a network where ONEC is an affiliated member connecting to other existing networks, such as, a national library network, university libraries networks, etc.

INFORMATION SYSTEM FOR TEACHING AND LEARNING

According to the national IT policy with regard to investing in human resources, there will be a national project on "School Informatization" This means schools will be equipped to benefit from the advancement of IT. A wide range of IT applications will be organized. Schools will be connected into a network and have access to a variety source of learning. There are two organizations which will be responsible for the development of information system for teaching and learning.

(1) National Electronics and Computer Technology Center (NECTEC). NECTEC will provide services to schools and universities to get connection to the Internet and other international networks.

ThaiSarn, the Internet of Thailand, was founded in 1992. Initially, the institute's operation was purely academic and aimed to serve research communities. Later on its operation was expanded to meet demand for nation's economic growth. By the end of 1994, more than 40 sites would have been on-line with ThaiSarn-Internet. ThaiSarn is growing at the rate of approximately 120% annually.

ThaiSarn's major goal is to establish an information structure for the academic and research communities in Thailand by means of computer networking and the information service therein. The short-term mission is to bring all universities, their libraries, colleges and leading schools on-line to the global village in a professional manner. The medium-term mission is to build up solid information-exchange foundation for ultra-organization communications and cross-database access for all participating parties. In this endeavor, Thaisarn must seek new forms and technologies to make this ambition a realty.

(2) National Interactive Multimedia Institute (MIMI). This institution will be a central body in monitoring, supervising, and developing standards of multimedia for education. The tasks also includes purchase of software, development of software applications, and distribution of multimedia to schools.

The establishment of National Interactive Multimedia Institute will respond to the intention of the government with regarding the distribution of Knowledge and information to the people through electronic media. This is especially true for education. In the United States and Europe, for instance, there are over 10,000 titles of learning topics recorded in the CD-ROM annually. Thus, in order to mobilize resources to build capacity in multimedia production, the establishment of the multimedia institute is indispensable. It is expected that the institute will be able to serve the domestic demand by building the capacity of personnel and monitor the quality standard of the medium in terms of educational psychology and presentation technique.

STRATEGIES FOR DEVELOPMENT

In order to achieve the objective of the master plan of information system for education, certain strategies must be specified to ensure support from the government. These strategies cover the development of infrastructure system for educational administration and information system for teaching and learning.

1. STRENGTHENING COOPERATION FROM ALL PARTIES

The state should encourage and provide incentives for the private sector to be involved in the development projects. There should be at last two levels of the coordinating committee,

1.1. National level. A sub-committee on educational information system development should play a role in proposing development policy and master plan of action. This includes a plan for producing and upgrading IT personnel/manpower, the mechanisms to coordinate among governmental agencies, and between governmental organizations and the private sector.

1.2. Regional level. There must be a committee at the provincial level to ensure appropriate operations according to national policy. This committee will promote lateral cooperation between different organizations, so that the sharing of resources and exchanging of information would be maximized.

2. IDENTIFYING COORDINATING AGENCIES FOR EDUCATIONAL INFORMATION SYSTEM DEVELOPMENT IN BOTH AREAS OF EDUCATIONAL ADMINISTRATION, AND TEACHING-LEARNING ASPECT.

2.1. Coordinating agency for MIS. The Information Center for Education (ICE) located in the Office of the National Education Commission should be the coordinating agency for MIS. The scope of work includes developing information criteria and standard software for database management system which will make possible the sharing of information between different agencies, and eventually will extend information service to the general public.

2.2. Coordinating agency for teaching and learning. The National Interactive Multimedia Institute should be immediately established to oversee/monitor the quality standard of teaching-learning media, and promote research and development projects to improve the efficiency of using multimedia for education.

3. ENCOURAGING ALL EDUCATIONAL AGENCIES TO PUT INFORMATION FOR ADMINISTRATION AND TEACHING-LEARNING ASPECTS INTO MACHINE READABLE FORM

3.1. With regard to information for educational administration, all concerned agencies should plan to conduct a data collection to fulfill the agreed upon list of educational indicators by the end of the 8th National Education Development Plan of the year 2001.

3.2. With regard to the production of media for teaching and learning, the coordinating agency should be responsible for:

1) monitoring the quality standard of educational media;

2) identifying appropriate technologies for certain type of education, this includes distance education via satellite, multimedia for computer-assisted instructions (CAI), and learning through Internet;

3) providing financial support for the production of teaching-learning media to governmental and private institutions;

4) conducting research and development projects for innovation in education;

5) organizing training courses to develop teaching personnel from educational institute at all levels to be able to use IT for education.

4. CREATING EDUCATIONAL INFORMATION HIGHWAY FOR ALL TYPES OF EDUCATIONAL INSTITUTION

4.1. Regarding information for educational administration, the state should support the development of LAN within an institution and data communication lines between central and regional administration.

4.2. Regarding information for teaching and learning:

1) at the institutional level, a school network or campus network should be developed to facilitate the sharing of resources;

2) infrastructure for tele-education should be immediately developed to connect various educational institutions into tele-education networks;

3) all levels of educational institution should be connected to the Internet to get access to resources of learning worldwide.

5. BUILDING THE CAPACITY OF IT PERSONNEL TO RESPOND TO THE NEED FOR THE DEVELOPMENT OF INFORMATION SYSTEM FOR EDUCATION

5.1. For educational administration, the IT personnel must be trained for the MIS and be able to operate data communication between different agencies.

5.2. Regarding IT for teaching and learning, teachers at all levels must be trained to utilize multimedia technology for education. In each school there should be a good proportion of teachers who are able to write a script to produce a software for computer-assisted instruction which would be a key factor in educational expansion and quality improvement.

6. THE GOVERNMENT SHOULD PROVIDE ALL NECESSARY SUPPORT AND MAKE THE DEVELOPMENT OF INFORMATION SYSTEM FOR EDUCATION A HIGH PRIORITY

6.1. At the national level, all ministries will be connected into Governmental Information Network: GINet, where the educational information highway will be a part of the governmental information network.

6.2. For teaching and learning purpose, two modes of delivery system must be supported:

1) learning from a computer, either stand alone or LAN, a school should have an electronic classroom;

2) infrastructure must be developed to facilitate all types of educational institutions to apply a two-way tele-education to their delivery system.

NATIONAL REPORT OF TOGO

THE REPORT ON EDUCATION AND INFORMATICS IN COLLEGES OF TOGO

Like all developing countries, Togo is accused of a considerable lag behind in industrialization and of lack of attention paid to the information revolution.

Such situation is caused by non-adequate relationship between education and world's evolution, on the one hand, and between education and the real needs of the country, on the other.

In order to reach a high level of development in all spheres of life by constant analysis of factors, affecting productivity, Togo does everything possible to form professional staff in its education institutions, which will be able to use all the known information technologies for the wealth of the country.

The newest findings in the spheres of informatics and communication technologies are looked at as a solid base for the rational and effective modelling and control of education systems and of other social and economic systems.

And with the majority of systems being interested mainly in micro-informatics, the education system is in a great need of this science in the fields of inner-control and planning.

1. THE INTRODUCTION OF INFORMATION TECHNOLOGIES IN THE UNIVERSITY OF BENIN

Many countries have already worked out their national informatization plans, which determine a state policy on the further information systems' development and on spreading new technologies in the education system.

The program of the informatics introduction into the education system of Togo has been already drawn up. It is only the first step of the elaboration of the expanded plan of the informatisation of education system. This plan plays a considerable role in the general plan of the country's economic and social development because informatics is able to have a great impact on the productivity growth.

A. THE ROLE OF NEW INFORMATION TECHNOLOGIES IN THE SYSTEM OF HIGHER EDUCATION

The program of the informatics introduction into the education system is carried out on the basis of inmpoving already existing information technologies in the University of Benin. In higher, secondary and primary schools informatics is supposed to assume the role of :

- an instrument of control, planning and management of educational process ;
- a means of getting access to information;
- an independent school discipline;
- a research instrument.

In higher school the changes of the existing information technologies of the Benin University are effected in the following directions:

- Informatics as an instrument of planning and control of educational process
- Informatics seems to be the most suitable way of coping with the complicated structure of management, caused by the constantly growing volume of information that has to be adjusted.

We are talking, first of all, about the Personnel Department, managing all the personnel of the Benin University. Earlier, the personnel management was carried out only by hand but now this style gradually leaves its place to informatics. This service has part of the data distributed among different sections at its disposal. The information control of managerial and teaching personnel is effected quite easily. Payments have become another important procedure that uses informatics widely. It is worth mentioning that the majority of programs run by this service have been worked out by the Informatics And Computer Center (ICC). The system of personnel and payments management is based on the local network of mini-computers.

Another system that requires computer-aided management - The Administration of School and Higher Education Affairs (AEHEA) - also formed the information program of school education management in 1989. The original information system has undergone considerable changes and now consists of ten management departments. The development of this system is performed by the ICC of the Benin University. In a month it is likely to form a new department that will operate the AEHEA's network. Carrying out this project will be the one more step toward the Campus' information network. AEHEA publishes its annual Bulletin, reflecting all novelties of informatics, taking place in Benin.

Information technologies as an access to the information through telecommunications

In Campus one can get an inquiry by inner-telephone. In the nearest future it will be possible to receive necessary information about the University's management structure and about the University 's scientific research.

This system of providing information also includes mail service that will allow a customer to send different messages with the help of special mail-boxes of E- mail. At this moment, the University doesn't have such network.

Informatics as an independent discipline

Informatics courses are being studied at different faculties of the Benin University and at schools. The contents of these courses depend on the University's financial resources. The course opens with the introduction into informatics as a science (students learn about information network, scientific programming and automated control). The studying of informatics is also required for book-keeping (editing texts ang making tables). Particular attention to the informatics studies is paid during the last years of the University, especially at Technics faculties.

ICC furnishes the faculties with material and technical supplies: provides rooms, computer facilities and sometimes it offers help of its own specialists. The provided facilities help to eliminate extra costs and delays in computer equipment adjustment. Nevertheless, some faculties and schools can afford to organize their own computer structures.

The great interest in informatics showed by students and the necessity of creating a new society contribute to the active use of information technologies by the officials of education institutions. For example , from the year of 1990 the African Center of Training and Maintenance of Micro-Informatics (ACTMMICRO) prepares highly qualified specialists in micro-informatics. The training course lasts a year and the graduates possess knowledge that can be applied not only to the Togo's computer system but to the up-to-date computer systems of the other African French-Speaking countries.

In 1995 new 2- year program of informatics training was set in the Center. The Benin University has also suggested that the High National Engineering School should organize a course devoted to industrial informatics. This faculty will probably open in 1996/97.

The highly qualified specialists training is also available from private institutions. But only the Control System of the Benin University povides state examinations.

The University invests regularly in the programs of informatics application to book-keeping in order to facilitate the work of managerial and teaching personnel .

Informatics as an instrument of research

Today any scientific work can hardly be effective without informatics. For supporting scientific research ACTMMICRO gives the University's professors engaged in research an opportunity to purchase computers at a prime cost and in credit. This program is financed by PII/UNESCO and by the University Teachers Mutual Aid Society. At present the scientists look for the way of using informatics in the creation of new computer technologies.

The efficiency limit in informatics

ICC makes out special information programs for different services and University research works. They cover the following subjects: programmed control of schools, programmed control of personnel and payments allocatins, organization of an inquiry service (providing information about different University structures), control of faculties' documentation, etc.

Since 1992 ACTMMICRO distributes computer facilities among the universities and institutions at a prime price, thus cutting expenses on computers' purchasing.

B. THE PRIORITY OF INTRODUCTION OF THE NEWEST INFORMATION TECHNOLOGIES, GRANTED OF THE UNIVERSITY

For achieving the planned objectives, the strategy of introduction of new information technologies has to follow the real political concepts. In Togo this strategy is based on:

- taking into account the advanced experience of world's technologies;
- finding new ways of development.

The usage of the advanced experience of world's technologies

One of the first applied advanced technologies has become a system of training, based on the various versions of access to the heterogenous database (equipment, operation systems, different programs). This method has to identify the institution's systems and call necessary information out of database.

The introduction of new technologies in all the systems of the Benin University will reduce costs of the local network running.

Finding new ways of development

The plan of the informatics studies introduction assumes two main directions of evolution:

- scientific research
- training qualified personnel.

Scientific research

First of all, the existing information systems should be mentioned: the Center of Computers and Informatics that expands the use of educational programs promotes different teachers' computer programs of educational control and planning. All the resources of this institution have to meet the requirements of the working information programs.

ICC plays the biggest part in the process of information exchange and in research control. It also has its own Department of Scientific Research.

A foundation has been set up with the aim to finance research, information programs in education and creation of new ones in the same field.

The training of qualified personnel

ICC arranges seminars, aimed at the broadening of knowledge in the sphere of informatics and computer system, and upgrading courses. The correspondence course scheme will be useful for the teaching and managerial personnel because of its information network. This project, developed by Togo, is included in the program of distant education development.

2. THE REVIEW OF INFORMATION INSTRUMENTS

A. TEACHING MATERIALS

The University possesses a wide variety of computer facilities, divided among different systems of training.

Though working with the same programs , SHIC and CALMIR are equipped with different hardware:

- 12 micro-computers PC 8088 EPSON without HDD disc for students;
- 12 micro-computers PC 8088 AMSTRAD with HDD 30 MO;
- 10 micro-computers PC 80386;
- 12 micro-computers PC 80486 COMPAQ , presented by Japan;
- 1 mini-computer PDP 11 together with the PC486, conducting the work of terminals, containing the scientific programs (FORTRAN).

The rest of the computers are represented by the models 8088 and 80386 which serve as an additional instrument of students' studies. The following software are used on these computers:

- Basic, Pascal, Fortran, C, C++;
- Database controlling programs - DBASE III and IV;
- Word Perfect 4.2 and 5.1;
- LOTUS 1, 2, 3.

B. HARD- AND SOFTWARE USED BY THE MANAGEMENT

The management of the University has at its disposal micro-computers, intended for the text work.

The Personnel Department which performs the functions of personnel management and payments, discharges its duties with the help of the micro -computers 386 and 486. The project of these computers' inclusion in the University's information network is being realized now.

The DASS service, responsible for the school system control, has a special school control program, drawn up by ICC. This program functions through the local Novel 3.11 network, which consists of 10 terminals and one server. This network has started the process of computerization of all University's structures.

As to system programming, several programs for text work (WordPerfect, Word and its DOS versions) are used in the University.

As for table editor, one can choose either Lotus 1,2,3 , DOS 0 or Excel IV and V. Some database programs - Dbase IV and V and statistic programs - SLM, SPSS and STATZTCF are used for the more effective control over University structures.

Today, the University adopts integrated information systems as they conclude all the above mentioned programs and therefore colleges prefer working with Microsoft Office and Works.

3. THE DIFFICULTIES OF THE PROCESS OF NEW TECHNOLOGIES INTRODUCTION

As informatization is an irreversible process, one can either put up with it or participate actively in learning new technologies. Nevertheless, this process faces a sufficient number of obstacles.

The main obstacle is the lack of the qualified personnel. Unfortunately, most of teachers are not specialists, and the rest of them constantly leave jobs in state colleges and move to private ones , and visa versa. Usually, they prefer to stay in private colleges because of higher salaries.

Then go financial obstacles. The lack of money for technical supplies delays considerably the new equipment purchasing. That is why the up-to-date computer facilities are not able to reach up the required level.

The limited University's financing of informatics together with the small budget investments can't improve the situation.

And finally , with the permanent growth of equipment cost and the impossibility to purchase new computers, the staff members are compelled to work with the old equipment that often breaks down.

4. FUTURE STRATEGY

The policy of action is the only way of achieving the set *objectives. This strategy should be* set up at all levels of education.. The Higher School of Togo, for example, carries on the informatization plan with the help of the Benin University.

This plan includes the following points:

- introduction of teaching staff training;
- improvement of already existing structures;
- *participation* to international seminars, devoted to the problem ;
- participation to different information projects, worked out by other organizations ;
- consolidation of technical supply;
- cooperation.

INTRODUCTION OF THE TEACHING STAFF TRAINING

This stage precedes the informatization plan. *Specialists have to provide training courses for* teachers and for managerial personnel. They act as technical advisers in the National commissions of informatics and participate in elaboration of new information technologies and their application to informatics.

IMPROVEMENT OF ALREADY EXISTING STRUCTURES

The finding and experience of the existing structures will be consolidated for the improvement of efficiency of work.

PARTICIPATION IN DIFFERENT INFORMATION PROJECTS, WORKED OUT BY OTHER ORGANIZATIONS

Togo has sighed an agreement on its *participation in the international project* of General Education (FAD). This project of setting up distant training through new information technologies and communications (e.g. network REFER) unites 5 countries: Benin, Bourkina Faso, Guinea, Mali and Togo. It is designed for the teachers of different levels of education and with different qualification and skills.

For the first several years, the teacher training courses will be offered as an experiment. Their curriculum won't differ from the University *informatics courses.*

Soon, the well-equipped information centers SIFED, in the University area, will be opened to students and teachers. At the beginning they will be used as an access to information but later the University will be looking for its own access to the information bank. It will give the University an opportunity to gather and distribute information by its own means and in a way it wishes to do it. In fact, the University has been already granted the permission to use the SIFED network as the base for this project.

PARTICIPATION IN THE INTERNATIONAL TRAINING PROGRAMS

Togo pays much attention to the creation of an information server in the colleges of Africa. The *training programs* will have to expand due to the new training centers, which will be interesting and helpful for the specialists and teachers of engineering schools, informatics and computer colleges. The policy of informatics introduction in the system of education stipulates that the teacher training courses will last several years in order to give the larger number of teachers a possibility to get to know the newest technologies. These programs will be guided by the conclusions of the following seminars and colloquiums:

The Seminar «InformAfric», that has been already held in Lome, Togo in December 3-7, 1995.

The Seminar « Electronic networks, information system and databases for scientific research, aimed at global changes in science», arranged by START and IGVP-DIS in the USA , July 17 - August 4, 1995.

The Conference «Informatics and the French-Speaking countries on the way to new comprehension of the essence of barter», held in Cotonu, Benin in November 13-14, 1995.

The conferences and seminars, planned in the nearest future:

The INET conference will be arranged by the Internet society in Montreal, Canada in June 1996. The purpose of this conference is to show the main principles of Internet, to present its networks and new technologies and to illustrate the world's success of Internet for expanding the Internet infrastructure. The Conference INET'96 will be very intensive and the problems of setting up, application and control of the Internet networks will be discussed during a week.

Two groups have been formed for this conference: group # 4- control of the national network (in English) and group #6 - management of local networks in campus or firm (in French).

The International Seminar AGIR will take place in Abidjan, Ivory Coast in July 1996.

The participation in seminars and conferences is very important to the specialists:

- there is a possibility to concentrate on the problems of infrastructure, utilization and control of information networks, expansion of the application of new technologies;
- they can enrich national information networks with the advanced world's technologies;
- they can strengthen the inter-countries cooperation by participation in joint projects. For example, some attempts were made to set database networks in the developing countries;
- the participants to these conferences acquire valuable experience and knowledge, that later can be used for the benefit of the country.

As the majority of the developing countries, Togo clearly realizes the significance of such programs and therefore welcomes the introduction of new information technologies into teaching process.

CONSOLIDATION OF TECHNICAL SUPPLY

As there are still enough problems in this sphere, the technical supply must arouse particular attention. The following measures can be taken:

- support of the joint African centers such as ACTMMICRO;
- establishment of similar centers in the country;
- setting up of close relationship with such specialized organizations as ENSI, that can provide technical support.

COOPERATION

Taking into consideration all the needs of the continent, the necessity of using local, national and international resources and the lack of joint activity in the sphere of information technologies, the introduction of informatics into the education system seems to be a solution of the problem. The following activities should be supported:

- backing of the effective cooperation South-South, concentrating on technical support;
- backing of the effective cooperation North-South in the state private sector and in non-government organizations of African countries. They have to develop education of the African continent by working in the world market of information and communication.

CONCLUSION

In conclusion of this Report we will give a short review of the most important aspects of the introduction of new technologies into colleges of Togo.

The use of the newest information technologies stimulates the creation of new working methods and the obtaining of new knowledge and skills.

Various fields of education will be satisfied after the introduction of 110 new information instruments, which will simplify and rationalize the work and increase its efficiency. Time savings will be spent on the data analysis and decision making.

The teaching personnel of this country reasonably feel a kind of fear to the growing interest towards informatics to the detriment of other disciplines: economics, social studies and culture.

But education, as a development factor, can't ignore the new information technologies because the future of the society is closely connected with informatics. The country should use the achievements of information science to the benefit and development of the whole society.

THE REPORT ON THE INFORMATICS STUDIES IN PRIMARY AN SECONDARY SCHOOLS OF TOGO

PRIMARY LEVEL

There is a lack of computer equipment and the Ministry of Education doesn't have enough funds for its purchasing.

None of the information technologies is used at this level, even by managerial staff.

Schools don't have either computers, or programs and thus it is impossible to arrange computer studies.

There are neither qualified teachers , nor access to computer network and therefore the introduction of new teaching methods will meet a lot of obstacles.

Not having qualified personnel and teaching programs, we have to postpone our participation in international projects for uncertain period of time.

SECONDARY LEVEL

The Directorate only is equipped with computers. They are:

- micro-computer Tandon Targe 40 - 286 (bought in 1988) ;
- micro-computer IPC 286 (bought in 1989, broken)
- micro-computer IPC 386 (bought in 1992)
- dot printer
- laser printer.

The following programs are used:

- Microsoft Word 5
- the program of the Personnel Department control.

Except printers, all the equipment is old and unable to work with new software. Within a short time the computer facilities will be renewed and the use of information instruments will be widened through making a new network for the effective control of information.

THIRD LEVEL

A. The role of new technologies on the third level of education of the state school of Togo

By now, the newest technologies don't play the due role in the education system. Informatics hasn't been included in the curriculum and computers are not used as a teaching tool. The long economic crisis cut the amount of investments in education system.

B. Prospects

In 1989 the plan of informatics introduction was divided into two stages: inclusion of informatics as a school discipline in Lycees - in the first, second and last grades and then providing classrooms with the necessary computer facilities.

The management will be also furnished with computers for gathering and distributing information. Today the elaboration of new projects FAS Togo and PAGED demands well-equipped offices, expansion and perfection of information network. Our desire is to make computer a handy tool for man through using state-of-the-art equipment and newest technologies.

PRESENTED

BY THE MINISTRY OF NATIONAL EDUCATION AND RESEARCH.
LOME - TOGO

NATIONAL REPORT OF TUNISIA

THE TRENDS OF THE SCHOOL'S INFORMATION SCIENCE DEVELOPMENT IN TUNISIA

INTRODUCTION

According to the 8-th Plan of country's development , covering the period from 1992/93 to 1996/97 school years, particular attention was paid to human resources, which determine the development of school information science.

The following main aims stand out:

1) The consolidation of the training system by increasing schools' capacity , strengthening of teaching staff , by introduction of postgraduate teaching education and setting up courses of professional upgrading and refresher courses.

2) Setting up the informatics sections in all engineering schools and management colleges;

3) Including the units on the informatics basics in all courses of school education and of the first years of higher education;

4) Setting up private schools (the problem of diploma recognition, the introduction of the government examinations, etc.)

The government strategy and the Tunisian experience in the introduction of school's informatics are presented in the following chapters of this Report. And in this case, the information science is looked at, on the one hand, as a school discipline and on the other, as a mean of the teaching methods renovation.

In the system of primary education they suppose to make a number of experiments of applying the informatics methodology into some other courses.

THE PROBLEMS OF THE INFORMATION SCIENCE INTRODUCTION IN THE SYSTEM OF SECONDARY EDUCATION

The introduction of the information science in Tunisian schools started in the school years of 1983/84 when the computer laboratories were opened in three colleges (Rades Lycee of Technics, Sadicky college and Sphacs Lycee for men). With the establishment of The Centre of Informatics (CMBI) in 1985, reorganized into The National Institution Of Informatics in 1990 (INMBI), the two experimental lycees and five control colleges were included in the program. In that case the information science course, considered to be the working tool, was to start from the first year. Along with this there were held experiments of making the computer the basic means of teaching with the help of the computer programs and according to the scheme « Studying with the computer».

Since the school year of 1990/91 under conditions of the education system reform the process of introduction of the school informatics was put in a form of a program. During its first phase it had to provide any student, leaving secondary school, with a possibility to obtain skills in using information technologies. During the second phase it has to settle more ambitious problems, connected with the obtaining of cognitive skills and the renovation of teaching.

During this school year this program has covered 34436 students, and in the last year of the target period (September, 1996) it will embrace 46000 students.

RESULTS EXPECTED

In the middle-term plan the steps of the school informatics introduction have to help every student, completing secondary education, to master information technologies. For settling this problem the special program has been worked out. It makes it possible to achieve the prescript aims by September 1999.

The informatics course in the 3-th and the 4-th grades (the 6-th and the 7-th in accordance with the previous system) is taught as an optional discipline. Step by step, all the students of the 3-d grades of the section «Economics», «Math and Sciences» (to the school year of 1999/2000) and «Humane Studies»(to the end of the IX-th planning period) are supposed to be involved in this course. Thus, informatics studies will become a compulsary subject for the 3-d grade, and will remain optional for the 4-th grades.

Together with this, students and teaching staff will acquaint themselves with the various ways of the informatics application in studying different school disciplines. This will promote the creation of new methods of teaching to which the program of the school education reform pays much attention.

SOME RESULTS

A) STUDENTS INVOLVED IN STUDYING THE INFORMATICS COURSES

The introduction of the informatics course provided an opportunity to cover by this discipline about 9000 students in the school year of 1992/93 (6-th and 7-th grades), 17000 students in 1993/94 and 25000 students in 1994/95.

In 1995/96 the school informatics course (2 hours per week) will be taken by 34500 students. This figure includes students of the 6-th grade - 19000 and students of the 7-th grade -15500. Besides , 3148 students will regularly study the informatics course in six experimental colleges.

The extent of involving students in the informatics studies in the 6-th grades will make 62%, 37% and 4% in the sections «Economics», «Math and Sciences» and «Humane Studies» correspondingly; in the 7-th grades - 59, 27 and 2% for the same sections.

In the section «Humane Studies» the course is not adapted to the specific profile of education and that is why it is studied as an experimental discipline in several colleges by only 4% of total number of students.

B) HUMAN RESOURCES

1. Teachers

Information science is taught by teachers with different diplomas: some have the diploma of informatics, others specialize in other school disciplines. The first group includes 110 teachers, the second - 178 (the latter is subdivided into two groups : 111 teachers work full day and 67 have a part-time job). Teachers, who didn't have special skills in informatics, as a rule had undergone training in The National Institution Of Informatics.

One should point out that the coordination of these two types of teachers provides for more successful development of information science as a school discipline and guarantees achieving the prescript aims in this field.

Actually, the work of informatics specialists allows to increase the scientific level of education. On the other hand, the teachers of other disciplines, being well paid and highly trained, assist in the process of amalgamation of informatics with other disciplines, and also promote wider and more successful usage of a computer as a method of teaching.

The requirements to the informatics teachers can be divided into two categories:

- in the short-term plan - the possession of knowledge and skills, necessary for teaching the existing course;
- in the middle-term and long-term plan - there will be a need in a special knowledge for the efficient work in accordance with the improved program , providing more profound knowledge of the information culture and obtaining of new skills in the practical application of informatics.

The program of teachers upgrading implies:

- supplementary general training , broadening the teachers' knowledge of new information technologies and of their impact on the economy and social development;
- training in the methods of teaching;
- supplementary special training in the information science (for the teachers, who don't specialize in this sphere);
- training in new applied information technologies, used in the educational process.

2. Specialists in recruiting teaching

Nowadays one inspector and five teachers-advisers are travelling around the country and recruiting relative teaching staff, while exercising control over the quality of education and training teachers of informatics. They organize show lessons, methodological and educational seminars. They also inform The National Institution Of Informatics about the results of their activity and recommend the ways of improving educational programs. These specialists take part in the working out of an informatics manual , containing both theoretical and practical portions.

3. Laboratory personnel

During the last years the absence of qualified laboratory assistants has limited the possibilities of practical work in computer laboratories and its use for studying other disciplines. This hampered the work of keeping everything in order in computer classes and, moreover, created difficulties with software. Today for providing the most effective use of computer laboratories the position of an operator will be gradually introduced into the staff of every lycee. First of all, this problem is vital for the lycees, which will be equipped with second computer laboratories.

C) INFORMATICS STUDYING PROGRAMS

The objectives of information science studying were stipulated in the Act #93-670 of March 29, 1993 (Articles 635-638). They were determined in the process of elaboration of new educational programs with the assistance of foreign specialists. The main objectives are:

1) The introduction of the information culture to the students by considering informatics as a dynamic developing discipline, applied in various spheres of life. Such approach makes students to comprehend the essence of changes in the information science and, therefore, to understand and to learn it better.

2) The development of students skills in settling problems with the help of definite system methods, using the appropriate instruments. The chosen problems usually deal with different school disciplines, because it develops the inter-discipline culture and gradually stimulates teachers and students to purchase a computer and to use it as a means of self - training.

3) Training of teachers and students for the future use of a computer as a teaching instrument.

D) COMPUTER LABORATORIES

The organization of 109 computer laboratories was the next step in the process of establishing of informatics as a school subject. This took place in the school year of 1991/92 under the Tunisian -

Italian cooperation program. During this school year the number of computer laboratories increased to 160. Each laboratory includes 10 (9+1) or 8(7+1) working areas with two plugged-in printers.

THE PROSPECTS

Thus, nowadays the scenario of informatics spreading in the education system of Tunisia has been worked out. It makes it possible to achieve the set aims by September 1998 for the section «Technology and Economics», by September 1999 for the section «Math and Sciences» and by 2001 for the section «Humane Studies».

The process of informatics spreading will cover the students of the 3-d grades of secondary school. It will be an optional discipline in the 4-th grades.

As a result about 81000 students will be involved in the information science studying program in 1998. This course will be taken by 100, 80, 35% of all the students of the 3-d grade of the sections «Technology and Economics», «Math and Sciences» and «Humane Studies» correspondingly and by the students of the 4-th grade in proportion of 45, 35, 5% correspondingly.

In September 2001, to the date of the completion of the program, the informatics studying will cover 100% of students of the 3-d grade from the sections «Technology and Economics», «Math and Sciences» and «Humane Studies» and 45, 40 and 10 % of students of the correspondent sections of the 4-th grade.

The following program of personnel and logistic support for the process of information science spreading in the education system has been worked out.

A) COMPUTER LABORATORIES

The detailed analysis of the program of informatics spreading in the education system made it possible to present a plan of furnishing new equipment to the lycees. It stipulates a once-in-six-years renovation of lycees' informatics facilities and organization of second computer laboratories according to the numberof students.

Experts say that in order to satisfy the needs the total number of laboratories has to be increased to 203 by September 1996, that means that 43 new laboratories are to appear and 34 laboratories have to be renovated. The number of micro -computers, needed for the program will make 770 and the number of laboratories to be equipped - 43.

During the 8-th plan period the computer purchases will cost 1540000 Tunisian Dinars and the financing of adjustment works - 172000 TD.

During the years of 9-th Development Plan it is supposed to establish 278 new laboratories and to renovate 340 laboratories. The total number of computers that will be needed for work makes 6180 and the number of laboratories for renovation - 278. During the 9-th Development Plan period the capital investments for these purposes will amount to 12360000 TD for equipment purchasing and 1112000 TD for adjustment works.

B) TEACHING STAFF

In order to satisfy the calculated needs for teachers of informatics their total number is to be 230 by September 1995 and 304 by September 1997.

During the 9-th Development Plan the number of teaching staff is estimated as 436 teachers by September 1997 and 720 - by September 2001.

The lack of academic hours will be covered by the overtime work of staff teachers of information science or by attracting teachers of other disciplines.

C) COMPUTER AS A TEACHING INSTRUMENT

1. During the last few years several applied computer teaching programs have been constantly improved and used in schools under total or partial control of inspectors or experienced teachers. Other applied programs are being worked out in the National Institution of Informatics by the inter-discipline group of specialists, including teachers and computer specialists. These process is proceeded by the scientific research works on the concept of educational environment , based on the main trends of the Tunisian educational process.

There also exist applied computer programs, created by the students of some lycees. Among them are:

- program for studying French (the beautiful world of inventions and discoveries);
- program on mathematics;
- program-guide for the National Museum BARDO (multimedia version) ;
- 16-th century in France (documentary database);
- book on Arabic rhetoric.

2. The introduction of a computer into the teaching process in technical education

In the framework of the education system reform, technical school disciplines were officially based on system, rather then on technical principles. Such approach rested on the concept of teaching with the help of a computer and programs of production process imitation and modelling , by using robotics and computer-aided design system.

Thus, all the students of technical classes had an opportunity to work with the resources of such computer design programs as «Autocad» and «Orcad» and to use computer-aided production equipment.

Now there are 2000 work places, equipped with the software for computer design and computer-aided facilities (a mini-lathe with programmed control, a robot, an «automated hand»).

D) INFORMATION

The distribution of the information about new findings in the sphere of informatics and about teachers' projects is one of the most important problems. That is the reason why the National Institution of Informatics publishes aquarterly bulletin since March 1993 and distributes it among different sectors of population.

E) SOCIAL AND OCCUPATIONAL TRAINING

Besides the personnel of the Ministry of Education, officials and clerks of many other state and private organizations (the Ministry of Youth and Childhood Affairs, the State Property Ministry, the Central Bank, the Tobacco Industry Administration) could take the computer training courses by signing a contract.

128 staff members of secondary education lycees who master the applied computer program «SYGEL», 64 teachers willing to get a new profession and 540 working teachers having particular interest in informatics attended training courses in the Ministry of Education.

F) THE MAINTENANCE OF HARD- AND SOFTWARE

The working experience of three regional centers of the National Institution of Informatics in maintenance of all the lycees' equipment was large enough to solve the problem of keeping in order the great variety of involved facilities. Two times a year each computer laboratory was checked by a technical group, which carried on the inventory of equipment and then provided routine maintenance and repair. But the growing difficulties with the operating personnel movements worsen the situation. One should also consider that this kind of problems will be aggravated as the technical base of lycees expands and becomes older. This bring up the necessity of taking measures promptly .

From the moment of its foundation the Maintenance Department did its best in computer facilities repairing. Its activity was carried out in two main directions:

- the increasing of maintenance quality in order to reduce the number of fails. The computer centers visiting schedule is made up at the beginning of every half-year but its execution depends on transport available;
- recovering maintenance with the help of the National Institution of Informatics' facilities.

G) AUTOMATED CONTROL SYSTEM

In the framework of informatisation of administrative departments of the Ministry of Education one can see a fast development of the automated control system «SYGEL», which now covers 380 lycees and embraces such new kinds of activity as the end of a school year events and certain types of statistics.

Moreover, it will expand into new spheres of management in several lycees after checking the automated control system by the «IGEBI» budget.

The scheme of informatics spreading

	School year	***Technics & Economics***		***Math and Science***		***Humane Studies***	
		6-th	7-th	6-th	7-th	6-th	7-th
VIII Plan	1991-92	10%	0%	20%	0%	0%	0%
	1992-93	10%	10%	30%	20%	0%	0%
	1993-94	69%	24%	39%	18%	0%	0%
	1994-95	60%	30%	40%	25%	2%	0%
	1995-96	62%	59%	37%	27%	4%	2%
	1996-97	75%	45%	50%	30%	10%	3%
IX Plan	1997-98	85%	45%	65%	35%	25%	5%
	1999-99	100%	45%	80%	35%	35%	5%
	1999-00	100%	45%	100%	40%	60%	10%
	2000-01	100%	45%	100%	40%	80%	10%
	2001-02	100%	45%	100%	40%	100%	10%

The number of students, covered with informatics studies

	School year	***Technics & Economics***		***Math & Science***		***Humane Studies***		***Total***
		6-th	7-th	6-th	7-th	6-th	7-th	
	1991-92	943	0	2780	0	0	0	3723
VIII plan	1992-93	169	167	4495	3117	0	0	7947
	1993-94	6998	448	6725	3107	0	0	17278
	1994-95	8802	2260	8094	5311	292	0	24759
	1995-96	9724	8922	8598	6235	607	350	34436
	1996-97	14563	8286	12705	7561	1769	681	45565
IX Plan	1997-98	20097	9559	19633	9780	5161	1195	65425
	1999-99	25060	11344	24790	11350	7117	1331	80992
	1999-00	27889	12402	33479	13666	12780	2714	102930
	2000-01	25856	13640	30881	14560	15550	2787	103274
	2001-02	26471	13331	31641	13874	20090	2628	108035

NATIONAL REPORT OF TURKEY

A. COMPUTER ASSISTED INSTRUCTION AND COMPUTER EDUCATION IN TURKISH EDUCATIONAL SYSTEM

The educational systems worldwide have been trying to integrate the use of computers into their educational systems during this decade. Computer Assisted Instruction has become one of the most important issues in educational systems all over the world. The modern age requires individuals who not only know basic skills of writing, reading and arithmetic, it also needs individuals who can use computers. These individuals should be able to state a hypothesis, make observations, collect and analyze data and make conclusions. Therefore the new skills required from individuals became the knowledge and usage of computer technology in solving problems. Computer assisted instruction is the most important tool which provides technology society relationship. Therefore computer assisted instruction and computer education should be a major issue of our educational system to raise individuals who have knowledge of computer technology. In Turkey, the first studies using computer aided instruction and computer education started in 1984 when 1100 microcomputers for high schools, and 1111 computers, in 1985-86 where purchased. In this project each school had one teacher computer that is a server and 10 student computers which were clients. Two teachers from each school were selected and trained on computer literacy at in-service training courses.

The studies on the improvement of the computerisation rate of the schools have been performed with projects developed by the Ministry of National Education (MONE) With the signed agreement between the World Bank and our government, the General Directorate of Computer Education and Services (BILGEM) executes, the CES (Computer Experimental Schools) Project which is a part of the National Educational Improvement Project which started 1990. The main purpose of the CES project is the improvement and widespread use of the Computer Assisted Instruction and Computer Education. The other purposes of the project. are:

- To identify the role and appropriate usage of computers in our educational system;
- To develop the curriculum for computer education:
- To prepare teacher training plans and programs;
- To determine the educational software criteria;
- To evaluate all computer education and computer assisted instruction studies.

Firstly, the project has been executed at 9th grade of 53 high schools which selected according to criteria developed by MONE and the World Bank. While spreading the project across the country, Turkey will benefit by saving time and thereby helping economy. According to the project application, 53 CES laboratories were provided with furniture by the schools own resources according to the physical environment standards developed before. One of the most important items to apply the project continuously and periodically is to train course and formators teachers in computer literacy and computer assisted instruction. The course teachers, formators and administrators were trained in computer education and computer assisted instruction by BILGEM. According to the needs, new seminars and course programmes will continue in the future.

I . THE CURRENT CONDITIONS OF HARDWARE AND SOFTWARE

1. The Current Conditions of Hardware in School

According to the questionnaire which was made to assess the current conditions of schools on computer hardware, software and trained personnel at December 1996, the following was ascertained:

The total number of computers in Turkey

Number of computers	22.476
Number of Laboratories	1.769
Number of computers in laboratories	17.680
Number of computers outside of laboratories	4.796

The spread of the total numbers according to groups

Number of computers in primary schools	2.064
Number of computers in high schools	7.947
Number of computers in vocational high schools for boys	6.832
Number of computers in vocational high schools for girls	1.130
Number of computers in commerce and tourism vocational high high schools	3.152
Number of computers in religion high schools	767
Number of computers in non-formal educational schools	570
Number of computers in schools for handicapped	14

2. The Current Conditions of Courseware in Schools:

A considerable amount of courseware has been prepared by the Ministry of National, including 135 pieces of courseware which are destined for the vocational high schools. In addition to what was accorded to the National Educational Improvement Project agreement, signed between our government and the World Bank, the necessary computers and courseware were bought for 53 CES. These are courseware (science, mathematics, English, educational games, and electronic encyclopedia) and application software (word processor, spreadsheet, and database). These software are in English and an eventual translation of them into Turkish is being studied.

II . STANDARDISATION POLICIES

Studies about the hardware standardisation have been performed. The standard aims at computer laboratories which are 10+1 or 20+1 in schools with 400 students. 5+1 laboratory standard was determined for the primary schools with 200 students.

In establishing the courseware standards, the experience of other countries in computer assisted instruction have been followed. A variety of standards have been used according to the type of courseware and instructional design.

III. THE FACTORS THAT PREVENT THE USE OF NEW TECHNOLOGIES IN EDUCATION

1. Trained Personnel

According to a level assessment examination performed in schools, teachers are selected and trained in universities as formator teachers. These teachers are trained in computer literacy, computer programming and computer maintenance. There are 702 formator teachers existing in Turkey. The main aim is a formator teacher for each school that has a computer laboratory. In addition, to training the administrators on the new technologies used in education, in service training programme were conducted. Many courses and seminars at different levels on computer assisted instruction and computer education were conducted for school administrators, ministry inspectors, and primary school inspectors. There is a need for more trained personnel Also, there is a problem to keep these trained teachers at the places where they carry out their functions.

2. Hardware Condition

Since the number of students in schools is high, there is a need for more hardware to widespread the use of technology in education.

IV. THE INTERNATIONAL PARTICIPATION ON THE USE OF NEW INFORMATION TECHNOLOGIES AND THE ADVANTAGES GAINED BY THIS WAY

Every year, 2 or 3 persons from MONE participate in the MED-CAMPUS that is performed with the support of MONE. Knowledge learned there is explained to other personnel at MONE. By participating in this seminar, new technologies in the world are followed, new technologies and methods are gained on the appropriate use of information technology and development of thinking tools. There is no other participation excluding this one. The participation to this kind of international seminars on the use of technology will provide great benefits to MONE.

B. THE ACTIVITIES OF THE MINISTRY ON THE USE OF NEW INFORMATION TECHNOLOGIES AND THE ADVANTAGES GAINED IN THIS WAY

I. THE IDEA BEHIND THE DEVELOPMENT OF MEBSIS PROJECT

After the completion of the Ministry of National Education Integrated Management Information System (MEBSIS) and especially Provincial Directorates System (ILSIS) subsystem, the flow of the reliable and accurate information between Provincial Directorates and central units of the Ministry would be provided with exact time and in detail, in needed periods and in a financially feasible manner. As a result, the information provided by the system will play a major role on implementation of education policies and development of middle-run and long-run strategies of the Ministry.

II. EXISTING SITUATION WITH HARDWARE AND SOFTWARE

I. Existing hardware used in the MEBSIS project

There is a total of 7 servers which are operational and in use in BILGEM. These are the Two Data General MV9500 and MV1OOOO, two Data General Aviion 5500 and Aviion 8500 which are located in the central building of the Ministry, one Data General Aviion 4300 located in the Balgat Building of the Ministry. In addition to this hardware there are two-more servers, which are Data General SMP 4000, procured in 1995 and located in the central building.

Data general MV1OOOO system (having the following configuration: 8 MB main memory, four disk units each having 592 MB disk capacity, one line printer with a capacity of 1200 lpm and one tape drive) is being-used-in BUTSIS project with 15 dump terminals and 1 dot matrix printer.

Data general MV9500 system (having the following configuration: 33 MB main memory, four disk units each having 592 MB disk capacity, 1 line printer with a capacity of 1200 lpm and 1 tape drive) is being used by many of the directorates including personnel, research and planning directorates.

Data General Aviion 4300 system (having the following configuration: 32 MB main memory, 1 GB disk capacity, 2 terminals and 1 tape drive) is planned to be used as the development platform for the ORACLE based applications.

Data General Aviion 5500 system (having the following configuration: 32 MB main memory, 1 GB disk capacity, 1 CD-ROM drive, 12 dump terminals, 4 dot matrix printers and one 2 GB capacity tape drive) is being used in the YOSIS project.

Data General Aviion 8500 system (having the following configuration: dual M8810 processors. 250 MB main memory, 2x3 =6 GB disk capacity, 2 line printers with a capacity of 1200 lpm and two 2 GB capacity tape drives) is being used in PERSIS project with 7 dot matrix printers and 64 dump terminals. In 1995, the upgrade of this system was completed and 30 dump terminals was procured.

Two SMP 4000 servers and I line printer were procured in 1995 to run the BUTSIS and IMISIS software which were completed before. The transition of the BUTSIS and IMISIS software is about to be completed.

Besides, there are more than 100 486 based PC having different brand names and models. These computers are dedicated to be used in office automation, software development and training fields.

2. Existing software used in MEBSIS Project

Below are the modules of the MEBSIS project and the tools used to develop them.

- Personnel System (PERSIS) were developed using COBOL, SQL*Forms and SQL*Reportwriter and ORACLE RDBMS;
- Budget System (BUTSIS) was developed using COBOL and DG/SQL DBMS in AOS/VS operating system;
- DONERSIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS in MS-DOS operating system;
- Higher Education System (YOSIS) was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS;
- IMISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS;
- SOISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDEMS;
- DISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS.

3. Existing Operating Systems

The following are the operating systems of the various hardware platforms used in office automation, software development, running MEBSIS software and training:

-Unix-AOS/VS-DOS -

Besides, there are Windows based products such as Lotus Notes and other office automation tools being used in the Ministry.

4.Provincial Directorates System (ILSIS) activities which have been developing in the score of National Education Development Project (NEDP)

Our Ministries Integrated Management Information System (MEBSIS) takes part in the scope of National Education Development Project (NEDP) which came into effect after Loan Agreement signed between our Government and the World Bank. Ministries activities in the scope of the project have been carried out by Bilgi Islem Daire Baskanligi which is in the structure of Bilgisayar Egitimi ve Hizmetlen Genel Mьdьrlьgь in connection with the Management Information System (MIS) project. In this respect, the highest priority of the subsystems that is thought to be developed in the scope of MEBSIS is given to the ILSIS and the studies have been speeded up.

ILSIS is planned to be implemented basically in two phases. In, the first phase a pilot is carried out and after the examination of its results, ILSIS, of the pilot application, in the second phase will be expanded to whole country. Pilot application will be implemented in Ankara, Cankiri, Cankaya and Polath provincial directorates of our Ministry. These provincial directorates' interconnection is on center-city administrative district basis. The provincial directorates which will be connected to the existing computer systems in our Ministry for the integration of this system with MEBSIS and its subsystems.

III. STANDARDIZATION POLICIES RELATED TO MEBSIS

The computer systems that have been acquired in the scope of Ministry of National Education MEBSIS project are Unix based open systems. Spreadsheet and word processor applications are Windows based.

IV. THE FACTORS THAT PREVENTS USING NEW TECHNOLOGIES ON MEBSIS

Because of the characteristics of services provided, and costly projects carried out by our General Directorate, the needed high quality personnel cannot be employed. Also it is hard to have such high quality personnel available.

C. MEDIA AND OTHER TECHNOLOGIES IN TURKISH EDUCATIONAL SYSTEM

Use of media in education in Turkey has a special place in non-formal education, whereby the aim of the use of media is generally to support formal education and produce audio-visual instructional materials for the schools in Turkey.

Besides the production of video-cassettes to increase the effectiveness of teachers in the classrooms, there are also some distance education applications.

Developments in education technologies in the world has accelerated with regard to both classroom instruction and distance education. There has been a considerable awareness concerning interactive teleconference activities, multimedia programmes and other similar electronic instruction environments.

D. DISTANCE EDUCATION

Two major distance education applications in Turkey are that of The Anadolu University Open Faculty and The Open High School. In 1995, while the Open Faculty served 711.271 students at university level, the Open High School served 71.309 students at high school level.

Anadolu University Open Faculty provides instruction both through television broadcasts and face to face courses.

Programmes produced by the Anadolu University have been broadcast on TRT's Channel 4, and the evaluation made by the University. Also some written materials such as textbooks and guide books prepared for the Open Faculty students, are part of the instruction. The University also provides courses at undergraduate and pre-undergraduate levels to the Turkish citizens living in Western Europe and the Northern Cyprus Turkish Republic.

Open High School is another distance education institution which was established in 1992. High school curricula used in formal schooling are written in scenario formats for television and radio and are broadcast on TRT's Radio 1, channel TV 2 and TV 4. There are also textbooks and guide books prepared by the Open High School to support the schooling. General student evaluation is done by the Computer Education General Directorate (BILGEM).

The total number of students receiving instruction through distance education at high school and university level is about 60% of the total.

E. EDUCATIONAL PROGRAMMES IN VARIOUS AREAS

Film Radio Television Education Directorate (FRTED), one of the attached units of the Turkish Ministry of Education, provides educational films, video cassettes and slides to countryside schools. This kind of documentaries, cartoons and other programmes produced by The FRTED are broadcast by the TRT.

FRTED has a very rich collection of both television and radio programmes. Today, it is possible to perform an educational programme from the pre-school ages to adult levels using the productions of FRTED.

F. INTERACTIVITY IN DISTANCE EDUCATION AND EXISTING SITUATION IN TURKEY WITH RESPECT TO DEVELOPING TECHNOLOGIES

Neither of the distance education applications of the Anadolu University and the Open High School have an infrastructure for electronical interactivity. Students, in existing systems, can contribute to the educational process only by interacting through mailing.

The Ministry of Education sees interactive technologies as an effective tool to overcome the handicap of "passive students". The activities scheduled as a short term plans of the Open High School towards establishing an effective interactivity are as follows:

1. To establish telephone lines for students to ask questions and have contact with theteachers;
2. To design a question bank program and broadcast it on teletex system.

In the long term:

1. T o assign one or two schools as pilot studies for the electronical classroom project that has been studied for a while by the FRTED and start its application soon;
2. To connect FRTED with a fiber optic line to the TRT which is already connected to the TURKSAT (Turkish Satellite) to extend pilot school broadcasts to the periphery schools;
3. To make FRTED a broadcasting institution and to provide necessary teacher hardware to insert any supportive materials into his/her lecture during the broadcast.

G. THE BARRIERS IN FRONT OF THE EDUCATIONAL TECHNOLOGY IN TURKEY

1. LACK OF TRAINED PERSONNEL

Educational Technology has a tendency to spread out depending on the developments in communication technologies. Therefore, there is a need for an information transfer from the Universities to the institutions serving in the field. New systems should be developed for better transformation of audio-visual and written data, and the applications in the field should follow it simultaneously. Although our country is very close to the Western Countries with regard to the use of telecommunication technologies, it is hard to say the same thing for educational technologies.

The lack of production and investment in this branch of technology brings a lack of personnel in the same area. It is known that some educational technology courses are offered in the related departments of educational faculties. But yet they are not sufficient to meet the requirements of technologic reforms that the Turkish Educational System puts forward.

2. KNOWLEDGE AND SKILLS OF TEACHERS ON NEW TECHNOLOGIES

The developments in educational technologies have been pushing teachers to employ different materials in his/her lecture. This is so especially in the field of distance education. Today, a teacher in front of the camera, is sufficient to some extent simply because he is not on live broadcast and there is no any interactivity. However, with the integration of interactivity to the existing system, teachers will be teaching on live broadcast by using different equipment. This requires a new approach in teacher training. No concrete step about this issue has yet been achieved. Teacher in the formal education is yet far away from the new technologies.

The other problem is the distance between teacher and new technologies. Multimedia technology has not been used in country schools yet. And also there is no teacher training programmes towards multimedia literacy.

3. DIFFICULTY IN RECEIVING THE OPEN HIGH SCHOOL PROGRAMS

Open High School television programmes are broadcast on TRT's channel TV 4. The broadcast is sent through TURKSAT and received by the TV Receive. Only Receivers and further sent via the VHF/UEF TV transmitters to the homes. However, in existing systems, some parts of the country can not receive the programmes. There needs to be some technical innovations for a solution of the problem.

PRESENTED BY
THE MINISTRY OF NATIONAL EDUCATION OF TURKEY

NATIONAL REPORT OF UGANDA

1. INTRODUCTION

During 1992 the National IIP Committee implemented a UNESCO funded project "Sensitisation and Training in Informatics of Decision Makers, Informatics Specialists and Trainers". The project involved seminars that attracted participants from managers in private and public institutions, teachers in schools, colleges and universities.

It was a very successful project that led to a blossoming of interest in informatics and the use of computers. As a result there is now a fast growing acquisition of computers with several new firms having been set to market the new technologies of computer hardware and software. Parallel to the UNESCO project the Institute of Computer Science (ICS), Makerere University, which serves as the focal point for the UNESCO IIP, introduced e-mail into the country for the funded project, the first time through an IDRC (of Canada) funded project, the East and Southern African Network, ESANET that involved the five universities of Makerere University, Nairobi University, University of Zimbabwe, Gambia University and Malawi University. This was also a very successful project which gave birth to the use of e-mail leading to the present fast growing interest in e-mail with ICS serving as a node for many users. Firms have now been set up to provide international e-mail connections (INTERNET) to users. ICS itself is completing the installation of an INTERNET connection which is planned to serve tertiary colleges and national research centres.

2. NEW TECHNOLOGIES IN EDUCATION

Makerere University through its Institute of Computer Science has spearheaded the introduction of new technologies. Teachers in schools and colleges have been sensitised in the use of computers in workshops and seminars. There is an upward trend of computers being introduced in schools, colleges and universities. Although a recent education review commission highlights the importance of computer science in education there is yet no well articulated programme of curricula for introducing new technologies in informatics into the levels of primary, secondary, college and university education. Makerere University on its own has introduced training for a Postgraduate Diploma in computer Science and undergraduate courses in Computer Science. It is also planned that M.Sc. courses in Computer Science be established.

Apart from absence of a formal programme of curricula for informatics there is need to establish training of teachers and other staff that would engage in the teaching of the subject in schools and colleges. This should be done in the teacher training colleges and colleges of technology. However, there has been a modest beginning on this training at the Institute of Teacher Education, Kyambogo (ITEK) and at the Uganda Polytechnic, Kyambogo (UPK). The main constraints faced by these colleges is lack of adequate hardware and software to cope with the number of students they have.

Further when the products of these colleges go to schools they find them unprepared to offer courses in computer science for lack of equipment.

At ICS an attempt has been made to bridge the gaps in training by offering short-term course that have become popular to a wide cross-section of users ranging from school students to employees in public and private institutions. It should be noted that there are other private organisations which also offer similar short-term training.

In order to ensure protection to clients there is need to monitor what is being offered in these courses .This monitoring role could be taken up by the national IIP committee together with the education authorities and the Uganda Computer Society.

The present Uganda industrial sector does not yet have intensive use of computers although interest in this is growing. It is mainly banks and insurance companies that have gone ahead in involving computers in their operations. Some of these institutions have their own in-house training.

3. NATIONAL POLICY

After the initiatives by the Uganda Computer Society and the national IIP committee proposals for a national policy for informatics and computer science have been made. These were eventually incorporated into the proposals for a national Science and Technology (ST) policy and submitted by the Uganda National Council for Science and Technology (UNCST) to government for approval. UNCST is a legal body set up by government to oversee and promote research in and implementation of ST for development. It is therefore expected that the government will arrange to have an ST policy approved based on the submission by UNCST. The policy proposals for informatics encompass the issues of:

Taxation, where the taxes on computer equipment should be low enough to encourage acquisition of the equipment.

Training requiring the establishment of a formal introduction of teaching computer science at all levels of education with accompanying provision of curricula and arrangements for acquisition of equipment.

Standardisation with an establishment of a regulatory body to oversee the acquisition of equipment with the purpose of ensuring quality for customers and standardisation where possible.

Promoting the introduction of IT in industry, commerce and trade.

4. PARTICIPATION IN INTERNATIONAL PROGRAMME

The Institute of Computer Science being a focal point for UNESCO IIP is participating in the UNESCO Regional Informatics Network for Africa (RINAF). The aim of the project is to establish a national e-mail network which would be linked to a regional network and eventually provide an INTERNET connection.

This project is at an advanced stage with equipment acquired and training provided to users at selected points in the country. The value of RINAF is that African countries would be connected thereby offer an opportunity to benefit them from each others experiences in research and development which are at similar stages in these countries. The Institute of Computer Science (ICS) in collaboration with the University of Bergen Norway is to develop post-graduate training at M.Sc. and Ph.D. level in Computer Science. It is also envisaged that ICS should develop into a regional centre for training in Computer Science and telematics.

These programmes at ICS will greatly benefit in producing the manpower required to promote the New Technologies in the country and the region.

PRESENTED BY

PROF. P.E. MUGAMBI
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NATIONAL REPORT OF UKRAINE

EDUCATIONAL AND INFORMATICS IN UKRAINE: POLICY AND NEW TECHNOLOGIES

1. INTRODUCTION

Application of computers in education in Ukraine has deep traditions. As early as in 60s together with introduction of specialities "Programming" and "Computers" in universities of Ukraine, in Kiev Polytechnic Institute, Institute of Cybernetics of the Ukrainian Academy of Sciences, L'viv Polytechnic institute, Simferopol and Kiev Universities, in some military universities computers have been used for tutoring and student knowledge testing.

From 1986 informatics became an obligatory course for secondary schools and state programs of computers introduction in educational system of Ukraine, aimed at computer literacy achievement and education quality improvement. have been started. As well as in other countries, at the end of 80-s in many universities and secondary schools of Ukraine an activity aimed at creation and application of information technologies (IT) in education was held mostly by teachers-enthusiasts. A spectrum of these activities was quite wide, comprising nearly all levels of education, many subjects and didactic functions of tutoring programs. At the beginning of 90s tens and hundreds of thousands of specialists were involved in research, creation and application of IT in education due to decreasing of computers' cost. and some achievements in carrying out programs aimed at computerisation of education.

Above-mentioned steps allowed to achieve certain restricted goals in computerisation of education, including improvement of computer literacy, introduction of informatics in secondary schools, embedded training at. working places, which in its turn opened the way to solve such problems as:

- Individualisation of instruction as a technique for developing student's creative abilities.
- Training in cooperative skills using telecommunication means.
- Building interrelations between training, professional work and research activity.
- Humanitarisation of public and vocational education, etc.

What is going on in Ukraine now in the field of education and informatics? To answer this question, we suggest a short description of a genera] situation in Ukraine.

2. THE MAIN DIRECTIONS OF SOCIAL AND ECONOMIC REFORMS IN UKRAINE

It looks like a paradox, but together with a legal act of great historical importance - obtaining a state independence by Ukraine in August of 1991, the state found itself in a hard situation of economic disorder. As a result, the volume of gross revenue has been shortened in 2.3 times, industries output - twice, agricultural production - by one third. Income of citizens has been decreased up to 19% from the level of 1991 (Lukinov, 1996).

Despite difficult economic situation Ukraine still is a country with developed industrial and agricultural infrastructure (see Appendix 1) and rather qualified personnel, education and training of which is supported by powerful educational system (see Appendix 2). Programs aimed at going out of economical crisis are developed and carrying out now, which should support formation of unite a new market model, including (Lukinov, 199f); Marchuk, 1996):

- System of macroeconomics and economic control, financial and credit regulation in strict legal framework and free market conjuncture.
- Preservation of existent industrial and technological basis.
- Achievements of scientific and industrial progress and existing intelligent potential together with attraction of foreign technologies.
- Mutually profitable and parity relations in

world community with definition of own niche in the international markets.

- Social orientation of economic development.

With industrial and agricultural output in Ukrainian export, an important place must occupy an intelligent production as licenses on new techniques, technologies and materials. Import in its turn should be directed at acceleration of scientific and industrial progress and at accelerated increasing of production of own goods, food, home devices etc.

3. PECULIARITY OF INFORMATIZATION OF EDUCATION IN UKRAINE

In spite of the efforts of society and state executive authorities the system of education in Ukraine is at. present in deep crisis (Kuchma, 1995). Financing is extremely low. Withdrawal of teachers and educational specialists is taking place. Among students the intention to obtain fundamental education is going down, requirements to the level of training and common culture have decreased. Textbooks, manuals and didactic means supply is quite insufficient, the gap between leading educational establishments and peripheral ones are increasing. For example, in the last. 6 years the amount of new computers installed in secondary school per year has decreased (table 1).

Table 1

Dynamics of equipping Ukrainian secondary schools by computer classes

Year	Number of computer classes installed	Number of computers installed	Level of computerisation %
1991	148	1628	27,7
1992	464	5082	30,5
1993	141	1776	32,0
1994	92	1104	32,8
1995	68	882	33,1
1996 (01.04)	18	216	33,2

Today only one third of Ukrainian secondary schools are equipped with computer classes, and one computer workstation is shared by mere than 70 students (table 2).

Table 2

Computers in Ukrainian secondary schools

	Total	Including schools		Cities	Including schools		Villages	Including schools	
		I stage	II stage		I stage	II stage		I stage	II stage
Number of Schools equipped with Computer classes	7185	160	7025	3752	54	3698	3433	106	3327
Number of Schools equipped with Computer working places	94623	1461	93162	55206	1245	53961	39417	1004	38413

The situation in Ukraine as to equipment of higher educational institutions with computers and implementation of information technologies is shown in tables 3 and 4.

Table 3

Computers higher in educational institutions of Ukraine

	Total	Including those with processor				Including			
		286	386	486	Pentium	classic universities	technical and trade universities	academies	institutes
Number of computer working places	35527	10658	9592	2102	113	4456	13288	7424	10359

Table 4

The number of computers per 100 full-time students at Ukrainian higher educational institutions

Groups of educational institutions	classic universities	technical universities	machine building	metallurgy and mining	technological	transportation	economy	construction	pedagogical
Number of PCs per 100 full-time students	6,45	9,05	10,32	7,22	6,02	7,09	8,48	7,46	3,23

Despite weak, in general, development of telecommunication and computer infrastructure of Ukraine, leading educational institutions successfully solve tasks of informatization of education (Dovgiallo, 1993; Bykov et al, 1993; Gritsenko et al, 1993; Gritsenko et al, 1995) that are typical for developed countries (see i.e. Levrat, 1992).

From previous analysis and information on Figure I we can derive that:

From the point of view of information technologies in education Ukraine is neither developing nor developed country: it is a country in transition that needs:

- to develop the infrastructure of communication and information technologies;
- to support and develop existing intellectual resources and to become integrated in world-wide educational and information society.

4. PRIORITIES OF IMPLEMENTING OF INFORMATION TECHNOLOGIES IN EDUCATION IN UKRAINE

The Ukrainian state needs the rapid evolution of content, methods and means of public and vocational education to the level of international standards (Zgurovsky, 1996). Ministry of Education of Ukraine and National academy of sciences of Ukraine have prepared a conception of implementing informational technologies in education that is a part of the National Programme for Informatisation of Ukraine. Let us describe main ideas of the conception:

Idea 1

"Education & Informatics" in Ukraine is considered as an important component of the general process of Ukrainian society informatisation. The Cabinet of Ministers of Ukraine approved main directions of National Programme of Informatisation of Ukraine that plan to create in near future competitive computer industry and to reach relevant telecommunication infrastructure in Ukraine.

Idea 2

The goal of informatization of education in Ukraine is to increase the effectiveness of teaching and learning processes by expanding volumes of information to be learned and improving methods of representing and transforming of this information both for professional, educational and home usage.

The process of informatization will require training of teachers and students to effectively use modern informational technologies and to understand corresponding international standards. For this purpose a system of individual education based on intelligent tutoring systems and distance learning technologies will be created.

Idea 3

Ukrainian informatization Programme (see Figure 2) is considered as a system of interrelated results, resources and jobs. Axes A and B represent infrastructure of Ukrainian "Education and Informatics" and axis C describes expected results.

As a general result, in the field of education the saturation of educational establishments with modern computer, communication and IT facilities will occur. These events will lead to deep changes and intensification of training in all subject areas. Networks of educational knowledge and data bases, local and international, as well as access facility to state and foreign academic data and knowledge bases will be disseminated; computer-based didactic laboratories for training teachers of new generation will be organized in many educational and research establishments.

5. TELECOMMUNICATION AND INFORMATION TECHNOLOGIES FOR EDUCATION

Today in Ukraine there are several distributed commercial networks such as FidoNet, Relcom, GlasNet connected to the Internet. There is a comparatively well developed UUPC network which provides e-mail services on the commercial basis. UUPC network is originally the part of Russian RELCOM network. It charges equally commercial, educational and academic users and provides the service which does not match the international standards due to long delivery time (up to 10 hours on average). The main drawback is the use of extremely unreliable public telephone network as the basis for communication. Ukrainian IP academic and research network (UarNet) was started in 1994 (Saban, 1994) due to urgent need of the research and academic community. It is intended to provide services to universities and other higher educational institutions, libraries, museums, non-government funds and organisations. The main objective of the initial development stage is to establish the wide area backbone connecting the main cites in different regions of Ukraine .

The governmental funding for UarNet is under discussion. The UarNet has to become self funding network and nodes will be charged according to the bandwidth they request. State Innovation Fund, Ministry of Education and Academy of Sciences are most important among government institutions able to provide internal funding for the network. The expenses for international connectivity and networking hardware cannot be covered at present, without international support. The initial development stage of UarNet has also been supported by international projects. International Renaissance Foundation has provided seed funding for international Lviv-Warsaw link. United Nation Project has provided some funding for a separate satellite link for Ukraine. International Soros Science Foundation funds a project aimed to develop modern telecommunication infrastructure for several leading academic centres of the former Soviet Union. Kiev Base Computer Network with the links to leading Kiev universities and research centres is Ukrainian part of this project.

The first experience with educational networking has been obtained during IBM "Pilot Schools" program for the Former Soviet Union countries, in which 150 Ukrainian Schools were participated. These schools took part in HELLO and RAINS projects which included exchange of letters and e-mail communications (through UUCP) between Ukrainian and European participants.

Since 1992 research group at Glushkov Institute of Cybernetics and Kiev Polytechnic Institute investigate the possibility to apply telecommunication networking for Ukrainian educational system needs. This research shows that in comparison with developed countries Ukraine has poorly developed telecommunication infrastructure. The most of computers in educational institutions arc IBM PCs running DOS operating system. The others computers like SUN, DEC, Mackintosh may be found only at leading universities. Analysis of necessary personnel skills points on the lack of UNIX and TCP/IP experience at many of Ukrainian schools and universities. Educational networking in Ukraine takes its the first steps. It is presented by leading schools and universities FTP and WWW sites: there are only few WWW sites serving mainly as informational tool and FTP sites serving for software exchange. In spite of above constraints Ukraine is *ready* to assimilate modern Western experience in educational networking. Still 82 of Ukrainian educational institutions had in 1995 full Internet access (table 5).

Table 5

The number of higher educational institutions with Internet connection

Universities	Academies	Colleges	Other institutions	Total
48	17	12	5	82

The main goals of Ukrainian educational telecommunication network are:

- Incorporating telecommunication technologies into educational system and Internet literacy for teachers and students.
- Exchange of software and other educational materials.
- Distance education support.
- Professional education in telecommunications.

Experiments show that telecommunication networks provide an excellent possibility for various new forms of education. Computer-based networking bring new learning possibilities in traditional education, either by providing learning to a wide audience at a distance, or by providing new ways of learning in a more flexible and open way. These technologies allow the passage of different media or combination of media (graphics, sound, hypertext) over a distance. Creating open learning environments is a challenge to traditional computer-based learning systems. Distance educational systems are open for participation, time and place independent.

The strategy of Ukrainian telecommunication education network includes:

- government support for main international links;
- developing of regional and local nodes at educational institutions and interconnecting them into overall network;
- development of informational resources for the network.

At present Glushkov Institute of Cybernetics with National Technical University "KPI" start joint project on developing of base node of national educational computer network with links to UarNet and auxiliary nodes at Charkov, Dnipropetrovsk and Sumy.

The next level of education networking is achieved during European Commissions funded Copernicus project: "Flexible and Distance Learning through Telematic Networks". The Project is aimed to developing the infrastructure for distance computer-based education in Ukraine by developing courseware for distance education, and providing Internet links to the leading European research and educational centres. During the project new methods for flexible and distance learning via Internet for individual and group modes will be investigated and applied within the national and international context. Besides Ukraine the participants of the Project are University of Twente, the Netherlands, the Coordinator; University of Exeter, United Kingdom; Kaunas University of Technology, Lithuania; University of Sofia, Bulgaria. The main practical result of the project will be the development and approbation of unique distance 4-monthly course "Using communication technologies in the Internet".

In 1996 International Research and Training Center of Cybernetics UNESCO/IIP at Glushkov Institute together with the Eurasia foundation started organisation of distance training classes in Ukraine. The fulfillment of this initiative will give a possibility for a wide Ukrainian audience to obtain necessary skills and knowledge in the field of communication technologies and will give them an opportunity of direct dialogue through Internet with world community, that will promote further democratisation and reformation of Ukrainian state.

6. INFORMATION TECHNOLOGIES AND TEACHERS TRAINING

The rapid development and implementation of information technologies made a paradox situation in the education: computer, audio and video means for delivering and presenting learning material became really open to general use, but. they couldn't be effectively applied in classrooms because teachers can't manage to master potential possibilities of IT and include them to their didactic repertoire. This situation is common for the most: countries of the world. The same is with the Ukraine.

To introduce computers and IT in schools and higher educational institutions it is necessary to organise appropriate and effective in-service and pro-service teachers training. Simple use of electronic study book and manuals prepared by computer manufactures can't solve the problem: any teacher as the representative of creative profession prefers to use self-made electronic training materials on his/her lessons rather than delivered unified ones. The good compromise here is to give teachers the possibility to adapt unified electronic material into their own version.

Table 6 contains the overview of educational software, being delivered to schools and universities by Ministry of Education of Ukraine.

Table 6

Educational software fund at Ministry of Education of Ukraine

	Total	From general amount, for		From general amount for training								Embedded training
		universities	schools lycees	informatics	chemistry	physics	math	foreign languages	tools	computer-based technologies	modelling	
The number of educational programs	412	214	198	80	58	87	76	22	30	19	18	17

In-service and pro-service teachers training is fulfilled by central and regional institutes and pedagogical universities on the level of initial computer literacy with the support of existing educational software (Table 6).

As to the training of teachers who want to be the authors of courseware there are some institutions, for example Kharkov State Pedagogical University (Kukharenko, 1995) which are involved in development and dissemination of special educational tools (Globus, Scenarium, Lesson, Adonis, Helena) for tutorial scenarium implementation and texts, graphics and multiplication import,. These tools also make analysis of student responses - multiple choice, numerical and textual. With the support of such tools it is possible to organise effective training of courseware authors using the strategy *"From teacher's own educational software to general purpose it".* The next level of teachers-authors training is represented with approach of International Research and Training Center UNESCO/IIP at Glushkov Institute of Cybernetics (Gritsenko et al, 1995). The essence of the approach is to use intelligent tools in support of learning & tutoring activity. Teachers are involved in such kinds of activity (to their choice) as: using an expert systems shell for support of student's learning (Dovgiallo, 1993; Bykov et al, 1993); creating an electronic handbook on computer technologies in education (Gritsenko et. al, 1992), using tools for creating natural language interfaces, hyper/multimedia information systems, learning environments, adaptive CAI systems, etc.

7. CONCLUSION

The implementation and dissemination of IT for the education in Ukraine depends on further World Community help for

- communication and information infrastructure development;
- existing intellectual resources, support.

Now Ukraine has such help from:

- European Communities - Copernicus, Tempus-Tasis, Intas programs.
- Eurasia Fund.
- Soros Science Foundation.
- Canadian, American and European sponsors.

What. kind of Ukrainian impact may be useful for World Community?

This impact include:

- Theory and "know-how" for educational software.
- Intelligent components and tools for educational technologies in traditional and distance case.
- Electronic didactic products.
- Knowledge bases for different subject domains.
- Implementation and delivery of distance education.

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APPENDIX I

UKRAINE

Situated in south-east part of Europe, Ukraine stretches from wide Donetsk virgin lands up to Carpathian mountains, from Polessie up to Black and Azov seas. Its area is 603,7 thousands sq. km. This is the second-largest country of Europe. Its population is close to that of France, and its volume of the gross product - to that of Italy. Population of Ukraine is 52,1 million, the urban population - 68 %, and agricultural - 32 %. Quantity of the inhabitants on 1 sq. km. is 86,3. 46 % of the population of Ukraine are males and 54 % females. The main population of country - Ukrainians - 72 %. In Ukraine live also Russian, Belorussian, Judish, Moldovan, Polish, Bulgarian and representatives of other nationalities. State language is Ukrainian.

In an administrative structure of Ukraine there are Autonomous Republic of Crimea, 24 regions, and two cities of a republican subordination - Kiev and Sevastopol.

Ukraine is president and parliament country. Independence Act was approved by Supreme Soviet of Ukraine on 24th of August 1991 On the 1st of December 1991, 90% of country's population approved their will of independence during national referendum The first President, of Ukraine was L. Kravchuk, the second and current president is L. Kuchma. In total 26 political parties are registered now and multi-parties formation is continuing.

More than 32 million of the citizens of the country have high and professional education (complete and partial).

More than half of population of Ukraine is engaged in a national economy, including in the field of material manufacture - 74 %, and in non-productive sphere - about 26%.

In total volume of manufacture of country the main part is occupied by metallurgy - 21,8%, mechanical engineering and metal-working industry - 19,5 %, fuel industry 14,3 %, food-processing industry - 15,1 %.

Ukraine has a lot of minerals, two large coal-fields, more than 40 oil, 110 gas, and 50 oil-and-gas fields, various metal deposits, etc.

The Ukrainian metallurgical base is represented by ore mining and processing enterprises. The machine-building centre are Kharkov, Lvov, Donetsk, Lugansk, Kramatorsk, Dnepropetrovsk etc. The output electric power station are Zaporozhskaya, Krivorozhskaya, Pridneprovskaya etc. The basis of Ukrainian hydro-electric resources is the Dniper cascade. The biggest nuclear power plants - Chernobylskaya, Rovenskaya, Ylizhno-Ukrainskaya etc. Ukraine has more than 30 % of world black earth supply. More than 30 million of hectares are used.

The agroindustrial complex plays the great role in Ukraine. Here almost all kinds of agriculture food-industry are collected. The main brand of food-industry are sugar industry, meat., milk, salt, canning industry etc. Ukraine has a nice climate and soils for growing various plants, such as wheat, corn, sunflower, flax, buckwheat, oats, etc. There are also a lot of gardens and vineyards. The leading branch is plant-growing. The leading role in stock-raising plays the meat and milk plants and pig-breeding. The sheep-breeding, poultry farmers, fish plants and others are extended.

National Academy of sciences of Ukraine is the supreme research establishment of the country, which organizes and conducts research in the main directions of modern science. 163 research organisations, as well as special design and research enterprises belong to the Academy of sciences. It has 6 research Centers in Ukraine, including South, West, Dniper, South-East, Donetsk and Crimea.

There are about 26 thousand of open libraries containing 420 million of information units.

National Ukrainian culture has deep roots and rich historical traditions, which are developing in modern theatre and cinema, literature, art and architecture.

Museums of Ukraine are world-famous. The most known among them are Kiev-Pechersk Lavra, Sofia Dom, national reservation at Hortitsa island, Perejaslav-Hmelnitsky, as well as Museum of historical treasures, central archive and museum of literature and art etc. Now one can count about 200 state historical, literature, art and local lore museums and more than 6000 amateur museums that are not supported by the state.

APPENDIX 2

THE SYSTEM OF EDUCATION IN UKRAINE

The system of education in Ukraine includes more than 50 thousands establishments - from pro-schools institutions up to establishments for post-graduate's training, with about 15 mln. students and than 1,0 mln. teachers.

In Ukraine there are 23,2 thousands pro-schools establishments, in which 1,9 mln. children are being brought up by 241 thousands educators. There are 21,3 thousands general schools, from them 121 gymnasiums and 124 lycees, where more than 7,0 mln. students are trained and 582 thousands teachers work. The vocational education is represented with 1176 establishments, where 637 thousands students are trained and 60,5 thousands engineers and pedagogues work.

The system of higher education of Ukraine consists of 163 universities, academies and institutes (14 classic universities, 44 technical and branch universities, 29 academies and 76 institutes), 746 technical schools and colleges, 546 establishments for post-graduate training and 123 private educational establishments. In a system of higher education of Ukraine 1,5 min. students are trained, among them 71 thousands students are trained in private bodies. There are 14 thousands post-graduate students and doctorates. In higher educational establishments of III-IV accreditation level there are 78 thousands teachers, among which 57% PhDs, and in schools, colleges and technical schools 51 thousands experienced teachers works.

In the system of Education of Ukraine more than half of research potential of country is concentrated. Tins system provides the education for 176 students on every 10 thousands population and enables to enter the high educational establishments for 35 % school graduates.

PRESENTED BY

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Fig.1. *Ukrainian position in "Education and Informatics"*

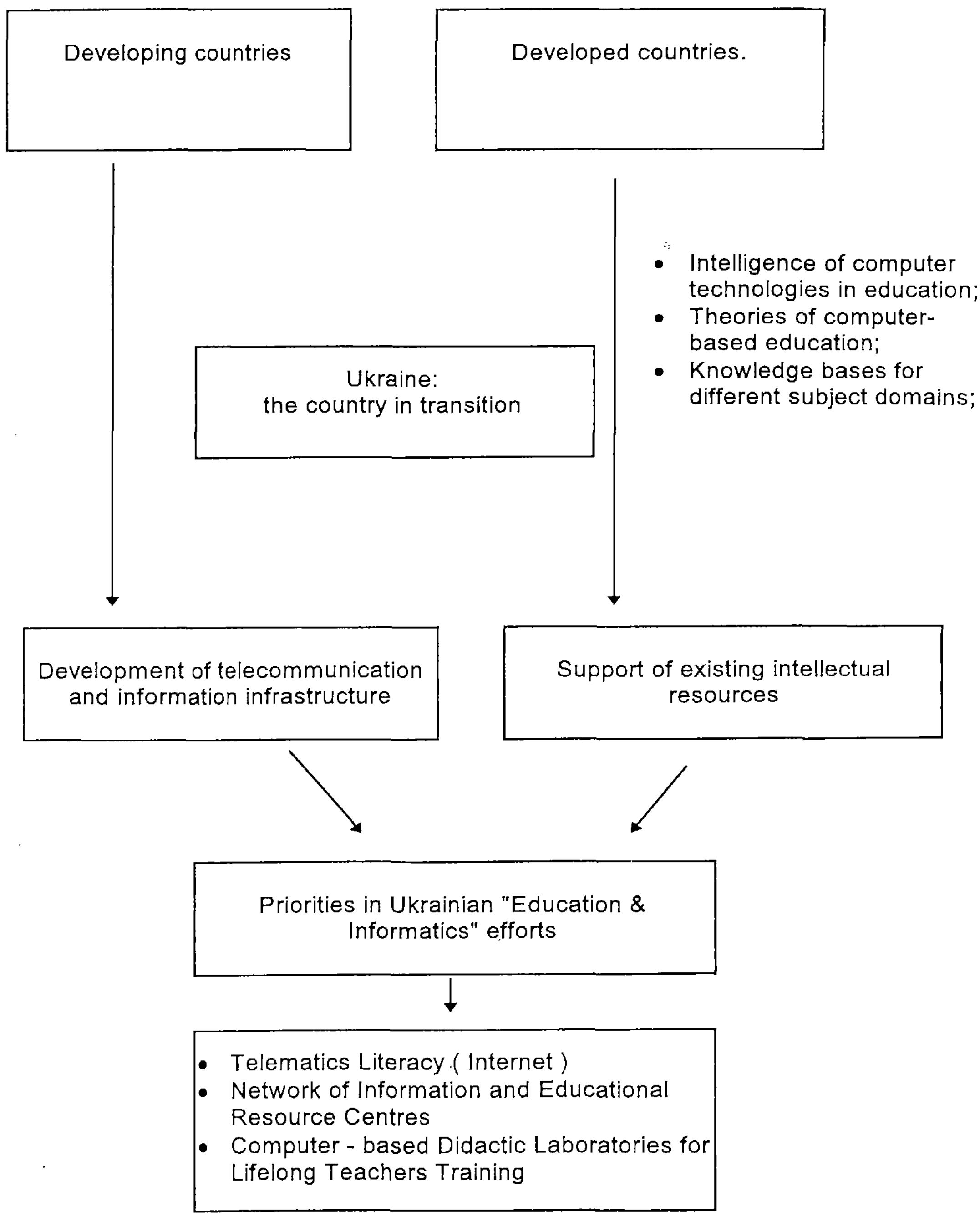
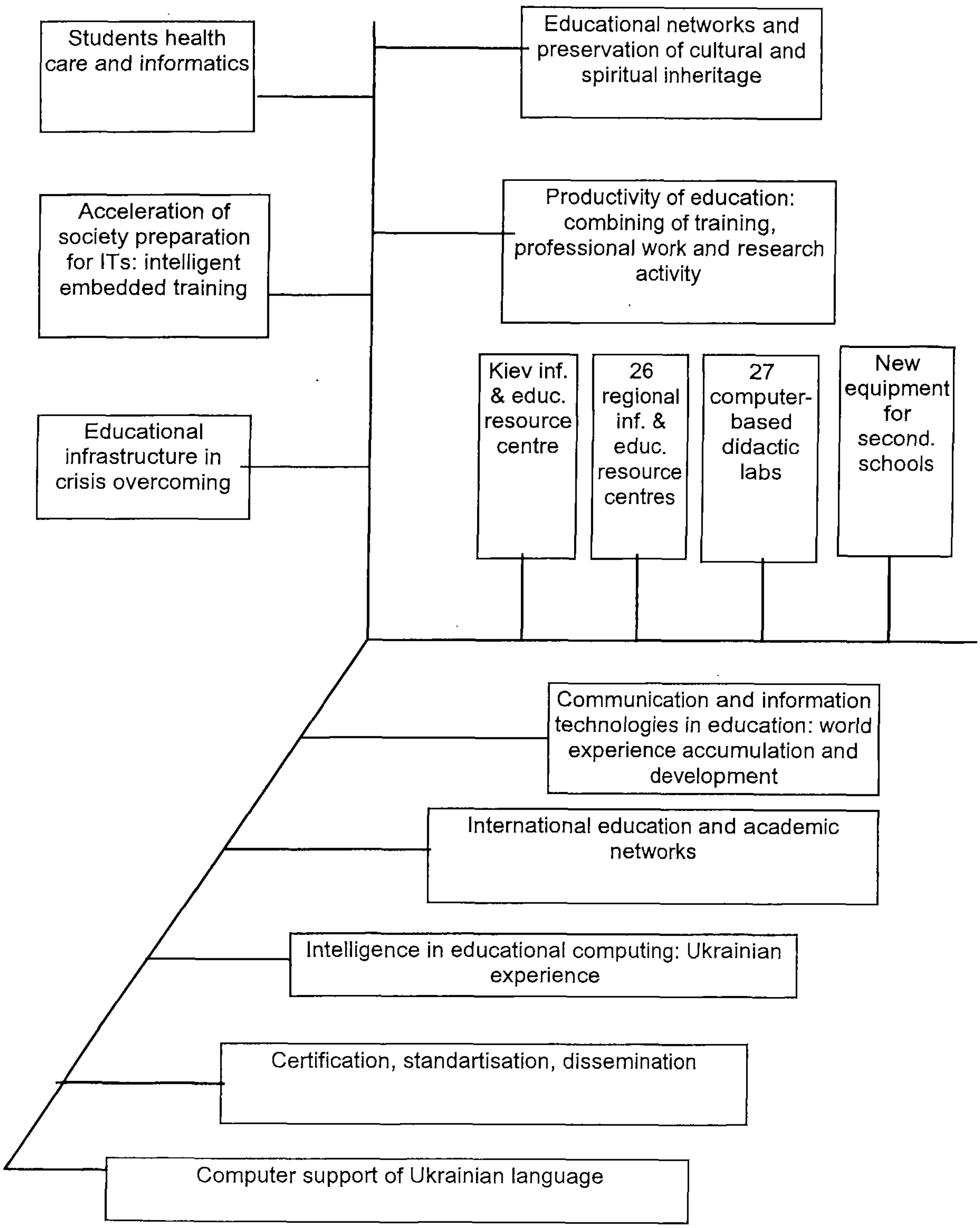


Fig.2. *Basic activities of education informatization in Ukraine*



NATIONAL REPORT OF UZBEKISTAN

DEVELOPMENT AND INTRODUCTION OF NEW INFORMATION TECHNOLOGIES IN EDUCATION

INTRODUCTION

The documents called "Informatization Concept for the Republic of Uzbekistan" and "Informatization Concept for the Ministry of Higher and Vocational Education of the Republic of Uzbekistan", which are based on the analysis of information society development among the leading nations, point out principal features outline main trends of development of informatics in our Republic. They also contain programs intended for step by step realization of these concepts.

Tashkent State Technical University (TGTU, formerly Tashkent Polytechnical College), which has such departments as "Software for Computers and Automated Systems", "Automated Systems for Information Processing and Control", "Computers", and "Radio Engineering and Radio Systems", is the leading college in the Republic to educate specialists in information technologies and telecommunications. TSTU participates in two of the above mentioned programs, i.e. "Mathematical Software" and "Personal computer".

A big team of experienced research scientists and professors works in TSTU and trains professionals in information technologies and telecommunications for all branches of human activity and economy of the Republic.

Graduates of the University have enough experience to use, develop, and introduce software of the following kinds:

- system software (databases, communication control systems, emulators, compilers and programming languages, security systems, operating systems and their extensions).
- general purpose applications (teaching and testing systems, text and word processors, computer graphics, financial programming and analysis, mathematical and statistical software, automating, desktop information systems etc.).
- special applications (banking, investment control, medicine, agriculture).

We are rather users than developers of software of the first group; however, software of the second and third groups created by our specialists can successfully compete in the world market provided that we abide by international standards.

One of the main aims of the program for informatization of education is to introduce new information technologies at all stages of continuous education. To that end, development of theoretical foundations for computer-aided education, automating of education, development of games and business educational programs, development of universal student grading systems are named as the main tasks of the program for informatization of education.

Further on we will speak about research and development of interactive computer systems for testing and grading of students' knowledge that has been done in Tashkent State Technical University for the last 2-3 years.

DEVELOPMENT OF INTERACTIVE TESTING COMPUTER SYSTEMS

The future of independent Uzbekistan depends to a far extent on its scientific potential, which is determined by the education level of university graduates. This is why college education needs further enhancement.

One of the directions of this enhancement is improvement of the student grading system. The government decreed to introduce a multilevel system for testing college students, which (the system) has the following aims:

1. Quick checking of the knowledge level of students.
2. Increasing impartiality of grading.
3. Controlling the educational process.
4. Gradual passage to the rating system.

By a decree by President I.Karimov, since 1993 all college entrance exams are based on multiple-choice testing with subsequent computer processing of the results. It is irrefutable that using multiple-choice tests, which are widely used in many economically developed countries, allows one to impartially check knowledge and professional skills of college students, schoolchildren, and school graduates.

Testing may be used not only in education, but in many other spheres where one has to evaluate skill levels of a person willing to occupy a certain position. Moreover, testing may be used both during the studies and at the exams, which allows to exclude the possible influence of personal factors upon the examination process.

All conventional forms of student grading require much effort and are very time-consuming, which may lead to loss of time required for study. This is why optimal organization of exams using computers is of great value in practice.

TESTING STUDENTS: METHODS AND FORMS

The problem of evaluation knowledge is difficult to formalize. This is why, when using a fully automated testing system, the system itself should be the examiner, while the teacher plays the role of an expert.

There are two directions of research on automated testing:

- development of methods of testing, tests for various subjects and computer processing of the results of test.
- development of automated testing systems to be used both at exams and during the studies.

Let us consider the second direction in more detail.

Earlier, tests used only as auxiliary means of education and knowledge evaluation. Moreover, due to small number of computers available and high price of computer time, the access to computers was quite restricted, so testing with templates had the highest currency. Further on, one started using computers to process template tests.

Nowadays that personal computers are more and more widely spread and the prices of hardware and computer time are continually falling, computer testing has begun to spread more and more widely.

Let us consider these two methods of testing separately.

TESTING WITH TEMPLATES

The test tasks which are handed to the students are written on special cards. Each task consists of questions or simple problems, to which the student should give answers during a definite period of time. When the test is finished, the cards are processed either manually or using a computer.

When using a computer, numbers corresponding to answers chosen may be either scanned by a scanner or entered in a computer manually; after that the computer does the grading and prints out the results. Processing of all the tests is simultaneous and centralized.

The main disadvantage to this method is that processing of the results, i.e. comparing with the pattern, takes much time. The time needed for entering the results of a test on a group of 20-25 students in the computer and subsequent processing of these results is much more than the time required for doing the test itself.

Another drawback of pattern testing is that it requires much effort to prepare cards with questions, and it requires much paper to print them. Summing up, let us list the main features of template testing:

- The testing is performed with the use of template cards with questions and answers.
- The results are processed either manually or with a computer.
- The student knows his/her results not immediately after the test, but only when all the tests have been entered into the computer and processed.

COMPUTER TESTING

When computer testing is used, the person being tested sees the task on the computer display. Together with the task, he/she receives an instruction for entering the answer (with keyboard or mouse). This method is more universal and flexible than the one described above. The task itself may be either a question with a set of answers to choose, or a simple problem. Hence, the testing is performed in the form of a dialogue with computer, with user friendly interface as a rule.

The results of a test may become known either immediately after the student has entered an answer for each task, or when the time for test is up.

Thus, computer testing has the following features:

- The test is performed in the form of a dialogue with computer.
- The dialogue may be realized in the form of a user-friendly interface or in the form of an order.
- The student learns his/her results immediately after the test is finished.
- Modern computers allow much more possibilities to present a task on a display than one has with template testing on cards.

FORMS OF TESTING

Tests give to all the persons being tested equal opportunity to show their psychological features and business or personal qualities. The results of tests are easy to evaluate and to process by computer.

According to the number of persons being tested, tests are divided into individual tests and group tests; according to the form of answers, tests are divided into oral and written; according to the character of mental action tests are divided into verbal and non-verbal.

In a verbal test one is suggested to choose a statement characterizing the extent to which a given property takes place. A variation of the above is possible, where one is suggested to numerically grade this property. Universality, simplicity and efficiency is an advantage of this kind of tests.

Non-verbal tests are used when testing understanding. There are three kinds of such tests:

- Tests for understanding pictures.
- Tests for understanding fictitious situations.
- Tests for understanding written text.

Such tests are used for evaluating individual psychological characteristics of a person.

Most popular are the so called "multiple-choice tests". In these tests one is suggested to choose the correct answer among those given. Sometimes there are only two alternatives: true or false, plus or minus, yes or no. More alternatives are often given, and one is to choose one of the answers (either the only correct one or the best approximation to the truth).

EXISTING AUTOMATED TESTING SYSTEMS: A SURVEY

For the time being, various automated testing systems are used in colleges. To name a few:

- "Autotest" (created at POVTDS department of Tashkent State University).
- "Test" (created in TashGEU)
- The system created in TGTU.

Most of these systems, while differing by presentation of text on the screen, video mode (text or graphics), structure of reports they create and data bases they use, have some common features and drawbacks:

- A unique subject matter is hardwired into the system. This prevents wide usage of a system, since creating tests in new subjects or making alterations in the existing tests require the expertise of a programmer.
- The system is oriented to only one kind of test: either final exams or tests performed during the studies.
- Poor user interface and low level of service.
- The system assumes that only one correct answer for each question is possible, and neither the questions nor the answers are weighted. This feature prevents complete and impartial grading.
- It is impossible to store results of the testing, which prevents statistical processing of the results.
- The set of output forms is restricted, and it is impossible to add new or change existing forms without making changes to the software.
- The system cannot work in both text and graphics mode.

If graphics mode is used, then the system often works only with EGA or VGA adapters, which prevents using CGA or Hercules monitors.

Let us compare testing in text and graphics video modes.

When using text mode, it is difficult to display graphic information, and it is almost impossible to use various fonts and special characters. If graphic information is present in the task, the student has to switch between graphics and text mode, which considerably hampers understanding of the task and complicates dialogue with the student. The advantage of this mode is high speed and simplicity of displaying information, as well as the possibility to quickly scroll the text in case it does not fit in the screen. All these features stem from the fact that text mode is the standard mode for IBM-compatible computers.

If the testing system uses only graphics mode, the information is displayed on the screen much slower (the factor may vary from 2 to 20), and more RAM is required for organization of complex dialogues (because graphics information consumes more memory than text information). The screen area occupied by a raster image depends on the graphics mode used, and the color palette may also change when changing graphics mode. An advantage of graphics mode is the possibility to use various fonts, vector fonts included, and to choose the most appropriate layout for displaying information on the screen.

Thus, there is a need in a new testing system, which would optimally use the advantages of modern hard- and software and would not have the disadvantages of the existing testing systems.

DIAGNOSTICS AND EVALUATION OF STUDENTS KNOWLEDGE

Diagnostics of students' knowledge, that is, evaluation of the results of education, is one of the main aims of tests and exams. It is based upon the information obtained at exams and tests that one gets the data necessary for improving the educational process.

The conventional methods of diagnostics are as follows: oral and written exams, tests, quizzes, questioning, work in laboratories, etc. Multiple choice tests pursue the same aims as the conventional methods.

METHODS OF GRADING

All present methods of evaluation of knowledge are based on rating the students. The conventional rating scale may contain either two ("passed" or "failed") or four ("excellent", "good", "satisfactory, and "bad") grades.

Simple and customary as they are, these conventional methods have some disadvantages.

First disadvantage is subjectivity of evaluation: each teacher evaluates the student according to his/her own criteria.

Second disadvantage of these scales is their low discriminating power: they are not fine enough for entrance exams or evaluation of professional skills.

Scales with at least 5 grades allow one to take into account many parameters determining the level and quality of the student's education. Such scales are most effective when using automated knowledge testing systems.

A classical approach to grading students with the aid of automated systems consists in assigning a definite number of points (a "weight") to each question and computing the total number of points. Two versions of this approach are possible:

Version 1. There is only one correct answer to each question. In this case the computation of the total number of points is very simple: one just adds the ratings (=weights) of individual correct answers; the resulting sum is the rating of the test (note that ratings of different questions may differ).

Version 2. Several correct answers to one question are possible, and one is allowed to choose several answers simultaneously. In this case one adds ratings of individual questions as well, but these ratings are computed as follows:

1. If an answer with zero weight is present among the answers chosen, then the rating of the question is zero.
2. If no zero weight answer is chosen and the total number of chosen answers does not exceed

the number of absolutely correct answers, then the rating of the question equals the sum of weights of the marked answers.

3. If no zero weight answer is marked, but the total number of marked answers is greater than the number of absolutely correct answers, then the rating of the question equals the arithmetic mean of ratings of the marked answers.

It is clear that the first version is a particular case of the second one.

The final grade may coincide with the total number of points, or else it may be obtained from this number by placing it on the grade scale and determining into which interval on this scale it fits.

Our testing system allows one to use all of the described above methods of grading.

FEATURES AND REQUIREMENTS FOR COMPOSING MULTIPLE CHOICE TESTS

The following requirements for composing tests are essential:

- Tests should be highly reliable, economical, easy for usage and computation of the results.
- Prior to testing, a list of qualifying requirements on the subject in question should be composed.
- Test questions should be concrete and unambiguous.
- Test questions may be divided into groups either in the order of increasing difficulty, or according to *sections of the course program.*
- It is recommended to give 4 or 5 versions of an answer to each question. The number of answers to a question should not exceed 7 so as not to make a task too difficult to understand.
- At least one correct answer should correspond to each question; it is possible to have several correct answers to the same question.
- Each question and each answer should be assigned a number (weight). The weight of a question should correspond to its difficulty, and the weight of an answer should correspond to its correctness. None of the weights of answers to a given question should exceed the weight of the question. All weights should be positive integers.
- Each correct answer is assigned a number of points (the more difficult the question and the more correct the answer, the more points are assigned).

THE UNIVERSAL SYSTEM FOR EVALUATION STUDENTS KNOWLEDGE (UNITEST)

Thus, a necessity in developing of a universal testing system for multistage control of students' knowledge has emerged. The system should be usable with any subject that allows formalization of the course.

The aim of the system is to promptly provide the faculty with reliable information on the knowledge level of students, relieving professors of such tedious and time-consuming work as preparing tests and processing their results.

The possibilities of the system "Unitest" are described below.

The system supports:

- Testing on various subjects.
- Data base of the students participating in the tests.
- Generation and printing of reports.

The system allows:

- *To make testing both in text and graphics mode.*
- To answer a question once or several times.
- To choose more than one answer to a question.
- To use weights of questions and answers (weight of a questions corresponds to its difficulty, weight of an answer corresponds to its correctness).
- To perform comparative analysis of results achieved during a given period of time (both individually and by a student group as a whole).
- To perform statistical analysis of the answers.
- To edit format of the existing output forms and to create new output forms.

The system has user-friendly interface, highly developed service, and a subsystem of context-oriented help. User interface requires use of a mouse.

The system is portable to a wide variety of MS DOS versions and IBM compatible computers. The system can work in a local network.

The system can work in the following modes, depending on the type of the test:

- Current testing: on finishing a topic or a group of topics.
- Testing at an intermediate stage: on finishing a large group of topics.
- *Final testing: on finishing a course.*

The lists of questions and the versions of answers are prepared by the faculty. These lists are entered only once, before the testing; later they are saved in the library of questions, which can be edited if necessary.

The lists of student groups are entered once a year, and the lists of students are entered once a semester. It is possible to edit these lists, too.

Main output forms of the test are:

- Test record, which contains results of students' groups at a given test.
- Student's record, which contains results of a given student in a set of tests.
- Statistics of answers.
- Exam sheet of a student.

It is possible to alter the existing output forms and to create new ones.

The system works in a dialogue mode. The structure of the dialogue is determined by a script, which contains menus of functions with comments upon their realization.

The system implies the following division of work among users (i.e. professors and students) and the system itself.

- The professor:
- decides upon which topic, subject, or to make computer testing;
- compiles the list of questions with answers (there may be several correct answers to one question);
- develops the grading scale;
- organizes and supports the data base.

- The student answers the questions in the "Testing" mode and gets his/her rating.

The system itself is responsible for:

- Input checking of the information entered into computer.
- Generation of files and writing them on disks.
- Arithmetical and logical processing of the information.
- Outputting the data to display and printer.

The system is written using database system FoxPro 2.0.

FUNCTIONAL SCHEME OF THE SYSTEM "UNITEST"

Both the system "Unitest" and its main subsystems have modular structure. This module branched structure adds to flexibility of the system, enlarges the lifetime of the system, and allows one to increase its functionality by adding new modules if necessary.

The system is oriented to testing with "question-answer" scheme.

The system "Unitest" consists of four subsystems:

- Initializing subsystem.
- Testing subsystem.
- Record generating subsystem.
- Administrative subsystem.

The functions of the initializing subsystem are as follows:

- Loading of initial settings of the system.
- Opening databases and checking their integrity.
- Refreshing index files.
- Setting the system date and time.
- Forming the system environment.

The functions of the testing subsystem are as follows:

- Choosing the test.
- Entering the biographical data of the person being tested.
- Testing.
- Processing the results of the test.
- Diagnostics.

Databases of the testing subsystem are created by the administrative subsystem. The module "Choice of a test" chooses the test that will be given to a student. The module "Biographical data input" reads the biographical data of a student from the groups and students databases and processes these data. The module "Testing" forms the tests, permutes questions and answers inside the test (this is done in order to lessen the probability of guessing the correct answer), and performs testing in the text mode. The module "Processing results of testing" computes the ratings according to the algorithms described in the section "Methods of grading" and saves the obtained results in the results database, to be processed further by the record generating subsystem. The module "Diagnostics" displays the results of the test in the screen.

The functions of the recording subsystem are as follows:

- Choice of the form of the record.
- Entering record parameters (the group, the test, date of testing, etc.)
- Generating the record and its output to the screen or printer.

The functions of the administrative subsystem are as follows:

- Creating databases in case they are absent.
- Reindexing databases.
- Supporting the information base of the system (working with students and groups databases, supporting the reference file of tests and the library of questions, forming questions for the text mode).
- Configuring the system environment.
- Copying and recovering databases.
- Encoding databases.
- Configuring, editing, and printing output forms.

INFORMATION PROVISION FOR THE SYSTEM

The system "Unitest" distinguishes three kinds of information: input information, output information, and reference information.

Input information consists of lists of questions and versions of answers to these questions; these are prepared by the faculty.

Output information consists of testing records and statistical information on answers to separate questions.

Reference information consists of students and groups databases.

USING "UNITEST"

The system "Unitest" is intended for multistage evaluation of students' knowledge (current, intermediate, and final testing). It can be used with any subject that allows formalization of the course.

"Unitest" supports:

- Testing on various subjects.
- Supporting database of the students participating in the tests.
- Generation and printing of reports.
- Multistage evaluation of knowledge.

"Unitest" allows:

- To choose both one and several answers to a question.
- To answer a question once or several times.
- To assign weights to answers and questions.
- To attach up to 7 versions of an answer to a single question.
- To place the versions of an answer in a random order.
- To keep an unlimited number of tests in the system.
- To choose at random any number of questions for a test form the library of questions. The number of sections of the library of questions from

which the questions are chosen should not exceed 100; however, the total number of sections in the library and the total number of questions in a test are unlimited.

- To perform a comparative analysis of progress of a student or a group as a whole during a given period of time.
- To print out questions and answers to them.
- To copy and restore data.
- To make testing both on separate computers and in a local network.
- To exchange data between different computers.
- To merge testing results obtained on different computers.
- To perform testing in the text mode.
- To use various mathematical symbols, Greek letters and pseudographics symbols in questions and answers of the test.
- To enter questions and answers of arbitrary size. If a task does not fit on the screen, it may be scrolled.
- To set up to 50 intervals in the grading scale.
- To enlarge the number and complexity of checking parameters without much difficulty.

"Unitest" has:

- A very user friendly interface and well developed service.
- The possibility of changing system settings (color palette, sounds, etc.) according to the needs of a user.
- A powerful context-oriented help subsystem, which will help you in any situation.
- A built-in calculator, which supports, besides standard arithmetical operations, such functions as square root, trigonometric functions, logarithms (decimal, binary, and natural), exponent, exponentiation to an arbitrary power, conversion from degrees to radians and back, operations with parentheses.
- An ASCII table, using which one can enter mathematical and pseudographic characters, as well as Greek letters.
- A built-in set of redefinable macros for line drawing with single or double stroke, which can be used to decorate tests.
- A built-in report generator, which allows the user to edit existing output forms, as well as create a new output form from scratch.

The system works in a dialogue mode. Prior to using the system a database, which contains lists of students and groups, the library of questions, and the descriptions of tests, should be created.

It is possible to enter questions on different subjects separately. Once entered, these questions can be edited.

After the system has finished working in the "Testing" mode, it displays the results of a test on the screen.

"Unitest" supports both keyboard and mouse, provided that a mouse driver is installed.

The system contains a built-in text editor, which allows you to enter and edit tasks for students. This editor supports all the functions you may need in your work with texts of questions and answers. The size of the edited text is practically unlimited. The editor supports such functions as:

- Cutting, copying and pasting fragments of text, as well as exchange of data between editing fields.
- Searching and replacing text strings.
- Hyphenation.
- Undoing and redoing (i.e., undoing of undoing) editing operations; these functions are useful if you change your mind about the editing operation you have just performed and decide to revert the text to its previous state.

USING "UNITEST" IN EDUCATIONAL PROCESS

The universal system "Unitest" consists of three subsystems:

- Testing subsystem.
- Record generating subsystem.
- Administrative subsystem.

In the administrative mode the reference information (lists of groups and students), as well as the questions, is entered and edited. Moreover, such operations as changing the system settings, changing colors, copying and restoring data, information checking and creation of databases, are also performed in this mode.

Prior to using the system a database, which contains lists of students and groups, as well as lists of tests, is created; sections of the library of questions are created, too, and the questions are entered into these sections.

Lists of groups are entered only once in the beginning of an academic year, but they may be edited later on.

Lists of students are entered and corrected once a semester. Before testing begins, a list of qualifying requirements should be composed.

When this list is ready, tests on a given subject are written and entered into the library of questions. One section of the library corresponds to one group of questions.

It is when composing a test that weights are attached to questions and answers, the rules for choosing answers are established, etc.

In order to organize testing, a list of tests to be used is made. For each test, a list of sections of the library of questions that will be used in this test, as well as the number of questions from each section that should be included in the test, are given.

Since the system stores large amounts of information, the administrative subsystem supports such functions as reindexing databases, data compression, copying/restoring data, and encryption/decryption.

Preferably, one should make a reserve copy of the data immediately after testing or editing the reference information. Reindexing and compression should be made after recovering from system errors or making substantial changes in databases. It is possible to configure the system so that it does reindexing and compression at the beginning of every job.

The encryption/decryption function is intended to protect database (texts of tasks included) from unauthorized access.

The data on the students that have passed the tests are written to a special file, which is subsequently used for generating output forms. System administrator (professor) should revise this file regularly and remove obsolete information from it.

The system can be configured according to the needs of a user. This function is accounted for by the "System configuration" mode.

The system can work in a local network; several users sharing one personal computer can use the system independently, for each user can have individual configuration and define paths to his/her personal databases.

Results of work on several independent computers may be merged.

When the lists of students and groups are entered and libraries of questions and the list of tests are created, one may begin testing.

First, the student should choose a test, then the title of the group and his/her name. The system generates a test of library questions. When generating tests, the system shuffles questions and answers in order to lessen the probability of guessing the right answer.

The student can choose more than one answer to a question; however, if the student chooses all the proposed answers, the rating of this test will be zero. It is possible to answer one question several times, to skip some questions and to return to others.

Each answer is evaluated, then the total number of points is computed, and the result of a test is displayed on the screen.

As we mentioned before, results of tests are stored in a special file of results. After each testing, the statistic on the answers to each question is added to the library of questions.

Printed record of the test can be obtained both *immediately after testing and later on. The latter* option allows one to analyze progress in the studies of a student of a group and to find out to what extent the students have digested what they had been taught.

The system "Unitest" has been successfully tested in exams at several departments of TSTU and is being introduced into other colleges in the Republic of Uzbekistan.

We believe that the universal system "Unitest" is a program product that will play, in conjunction with the modern hardware and pedagogical ideas, the leading role in the science-based organization of teaching.

INTRODUCING NEW INFORMATION TECHNOLOGIES INTO EDUCATIONAL SYSTEM OF THE REPUBLIC OF UZBEKISTAN: CURRENT STATE AND PROSPECTS

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Our epoch is marked by penetrating of computers and computer-based technologies into all branches of economy and into education, too. The Republican "Law on Education" stresses the importance of computerization of and introducing new information technologies into education.

An analysis shows that the rate of informatization in the Republic does not answer the demands of the moment. Informatics and its components should become object of planning, analysis, and control by the state. The information infrastructure of the Republic should be formed of scientific and industrial structures that process information, provide users with information service, develop and support automated information systems, prepare the and consult personnel in informatics.

The main objectives of computerization of education are:

- Intensifying of education and enhancing its quality throughout all educational structures.
- Automating of control over educational process with the aid of teaching and testing systems.
- Organizing continuous computer education.
- Organizing high quality pedagogical diagnostics and vocational orientation.

An objective of great importance is creating computer-based refresher courses, especially for state employees, and putting an end to computer illiteracy.

The development of science and technology in our independent country will have no prospects without computer literacy of the population and using new information technologies in practice.

The Republican law "On Informatization", whose objective is providing economical, legal, and administrative foundations for information infrastructure, shows clearly what a great importance is attached to informatization in our republic.

The mentioned law states that the main trends of state informatization policy are determined by the "Informatization Concept for the Republic of Uzbekistan".

This concept pursues three main purposes:

1. Development of modern information technologies, extension of information services to all subjects of the state.
2. Assistance in forming information systems in economy and social sphere.
3. Joining the Republic to worldwide information systems and networks.

The Republic has some experience in realizing these purposes. In particular, as early as in the end of sixties pupils in some of Tashkent schools were taught (at optional lessons) some notions about computers and work with them.

In order to create, investigate, and introduce computer-aided technologies, specialized departments of universities were founded, as well as the scientific and production union "Cybernetics" under the supervision of the Academy of Science. During this period a firm foundation of the future development of information technologies in Uzbekistan was created.

In the present report, the history of development new information technologies and of introduction them into the educational system of Uzbekistan will be regarded in its historical, hardware, software, and methodological aspects. We will also describe the prospects of development of these technologies, as well as problems pertaining to it and possible means of their solution.

PROVIDING EDUCATIONAL ORGANIZATIONS WITH COMPUTERS

In the second half of the eighties a new school subject, i.e. "Basic Informatics and Computer Equipment", was introduced, and computers began to be supplied in large numbers to schools. This triggered drastic changes in the process of fighting with computer illiteracy.

By the moment the Republic acquired her independence, about 2500 of 8000 schools were supplied with computers. For the most part these were Soviet-made computers DVK-1, DVK-2, KUVT-86, CORVET, AGAT-7, AGAT-9, UKNTs, and PRAVEC-8 (the latter was produced in cooperation with Bulgaria). At that time a few Japanese "Yamaha" computers were delivered to the Republic, but their number was negligible.

These were only the first steps. The industry of the former Soviet Union was developing and mastering the production of various kinds of computers. Unfortunately, they were incompatible with one another at both software and hardware levels; moreover, when a new model of the same computer was released, upwards compatibility was not maintained. Schools had computers of more than 10 different models by then.

Meanwhile, it was known that as early as 1981 the first IBM PC with a 8086 processor and the MS DOS operating system had been released. The experts knew when IBM PC/XT with a 8088 processor, and a bit later IBM PC/AT-286 and PS/2 with a 8086 processor appeared.

These and other computers of foreign make caused admiration not only by their performance but by the fact that they were compatible with earlier software, regardless of the width of data bus in the processor.

However, in spite of all this knowledge and enthusiasm, nothing could be done when all the decisions concerning education, allocation of computers to schools included, were made thousands of kilometers apart from Uzbekistan.

Since we have acquired independence, the Government of the Republic has been paying much attention to endowing schools with computer equipment. By 1995 the number of secondary schools equipped with computers had attained 4500, which is over 50% of the total number. 94% of these computers are the 8 bit computers mentioned above, and only 6% of computers in schools are modern IBM compatible computers.

Since 1991, IBM PS/2 computers have been shipped to schools. 96 schools received this equipment, and an extensive experiment according to the "Pilot Schools" program began.

The wide variety of models of computers has caused many problems with development of the software and adjusting it for each separate model of computers, with technical support and repairs, which requires great additional expense.

The Ministry of Education of Uzbekistan makes great effort to further supply schools with modern computer equipment (IBM compatible, for the most part), in which both software and hardware compatibility is maintained, which goes with many application programs, and which can work with various external devices. To that end, a special institution called "Uzbekuchavtomatika" was formed with the purpose to carry out, under the supervision of the Ministry, the computer policy in education. At present all the works having to do with shipment, installation, and support of computer equipment are performed by the personnel of this organization. "Uzbekuchavtomatika" has all possibilities to assemble local educational networks from ready modules. Thus, all proposals concerning joint production of modern computers will be considered thoroughly. It should be noted that there are really many things to be done with school computer equipment besides supplying computers to the schools that do not have them, namely, step by step upgrading and replacing physically and morally outdated equipment .

This is why it is noticed in the above mentioned "Informatization Concept for Republic of Uzbekistan" that mastering of production of computer equipment will attract modern technologies to the Republic, which will substantially raise the culture of production, train the personnel and enlarge the assortment of electronic devices. This should considerably lower the prices of computer equipment, which will make it more available and more attractive for an average customer, raise both the export potential of the Republic and the employment of the population. Personal computers owned by private persons should be widely used in education, science, and information service.

SOFTWARE

To overcome computer illiteracy, software is as important as hardware.

When supplied to schools, computers were, as a rule, endowed only with an operating system, a BASIC interpreter, and several game programs. The educational software, which could have aided the teacher in class, was as a rule lacking, and the available educational programs had serious disadvantages.

First, these programs were written by experts in computers, or sometimes physicists and mathematicians, but not by teachers in the subjects these programs were supposed to teach. As a result, the programs were of little use for giving lessons.

Second, most of these programs displayed too much text, which occupied almost all the screen. Poor graphic capabilities of the then existing computers made the use of pictures in educational software restricted or outright impossible.

Third, most of educational software was oriented to Russian speaking students, and it was for the most part impossible to translate the programs into the state language.

Fourth, about 90% of the existing educational software is intended to teach mathematics, physics, or informatics. Other subjects are still waiting for attention of the developers of educational computer programs.

The mentioned problems were seriously aggravated by the wide variety of computers the schools had. Due to the lack of compatibility, any educational computer program had to be ported to all existing models of computers (for example, programs for AGAT-7 were not suitable for its later modification, which was AGAT-9).

Before 1991 it had been the above mentioned "Uzbekuchavtomatika" who supplied educational software to schools. Later on it had to stop these activities, because the expense of porting software to various models of computers proved to be too high.

Since then the policy of the Ministry of Education has changed. Now it is the enthusiastic teachers themselves who create educational computer programs. These teachers, who have hardly mastered programming, try to realize their didactic ideas in the form of computer programs. To tell the truth, the quality of the resulting programs is not always high either. It turns out often that this software is impossible to use without its author and apart from the methods of teaching used by its author. However, this is the best one can attain if the educational software is created in school, because the didactic problems are posed and solved by the same people; it turned out that it is easier for a biology teacher to study a programming language, than to for a programmer to master biology.

What is left to the Ministry is to choose the best (by didactic characteristics, design or other parameters) educational programs, to polish them up with the aid of professional programmers, teaching instructors, and psychologists, and then to supply the resulting software to other schools.

According to this policy, Ministry of Education organizes an exhibition of best educational software or a contest of educational computer programs every two years. The winners, who are named by experts, are awarded. In 1994, 9 best educational programs were named, while in 1995 the number of these attained 46.

It goes without saying that this policy alone cannot solve all the problems pertaining to educational software, but the number of these problems is gradually decreasing. The tendency to further uniformization of school computer equipment should also make the problems less acute.

It is here that a new challenge for experts in new information technologies is in order: to create new utilities for creation of educational computer programs. Using these utilities, teachers would be able to create nice looking and didactically efficient programs.

It should be said that there are many people in the Republic whose duty is to create educational software, but at present their efforts are concentrated on mastering, adaptation, and selling foreign program products. The abundance of foreign program products lowers the level of national products and makes it more difficult to find areas in which chances for commercial success exist.

This is why it is necessary to give legal status to computer programs as information product, to monitor the development of the market of information products, to coordinate efforts of programmers and stimulate their activities. With this approach adopted, one can expect that even in the nearest future such products as numerical programs, artificial intelligence systems, data bases and data banks, expert and teaching systems, text processors oriented to the Republican standards of office work, Uzbek language drivers, bookkeeping and bank programs will appear on the market. Actually, such programs already exist; one should reveal them, legalize them, and provide for their standardization and sales.

DIDACTIC PROVISION

Soon after computers appeared in school and the new subject "Basic Informatics and Computer Equipment" (for the sake of brevity, further on we will call it "Informatics") was introduced, three questions began to emerge; "What to teach?", "How to teach", and "With what textbooks to teach?".

Such questions on the part of teachers and teaching instructors demanded for immediate answers. Thus, first sillabi appeared, as well as first experimental textbooks, which were used throughout all the former Soviet Union in the 9th and 10th grades of school.

Although all the textbooks were experimental, it seems that nobody analyzed results of this experiment. At least nobody was interested in the results of testing various textbooks, which came to the Republic one after another.

Unfortunately, neither national and territorial peculiarities of the Republic nor models of the computers available were accounted for in these textbooks. As a result, teachers were always in the state of search for sources necessary to prepare for the next lesson.

This is why, before the first textbook written by Uzbek authors appeared (this textbook is experimental, too), many various textbooks had been used in schools to teach informatics.

The objective of teaching informatics remained vague and unattainable in practice. It was understood that the main goal of the course was to give the schoolchildren an idea of informatics as science, of methods and means of solving problems on computers, of interplay between informatics and computer equipment. However, thanks to the shortage of computers in schools, in most schools informatics was taught without computers.

In the above mentioned "Informatization Concept for the Republic of Uzbekistan" informatization of education is called an urgent task. Taking into account this concept and modern requirements for education, in view of the imminent informatization and introducing information technologies into all fields of activity, the Ministry of Education issued a document called "Concepts of Teaching Informatics". This document names final and intermediate objectives of teaching informatics. It suggests also that the course of informatics be moved in the direction of earlier grades.

For example, according to this concept the study of informatics should begin in the 8th grade of the 11 year school. Basics of algorithms and programming in BASIC should be studied in the 8th and 9th grades (according to the syllabus of former Soviet school, this was to be done in 10th and 11th grades).

The 10th and 11th grades are devoted to studying new information technologies. Main system, instrumental and application programs, which are applied in various branches of economy, are studied in some detail.

The didactic provision for informatization of the education is performed by the Research Institute of Pedagogical Sciences and by the Republican Scientific and Didactic Educational Center. All educational and didactic material (textbooks, exercise books, teacher's books etc.) and educational program products are tested and approved prior to introducing them into schools.

A document called "State Educational Standard in Informatics" has been issued. In this document the main requirements for the course of informatics as a whole, as well as for separate stages of this course, are clearly indicated.

The main goals of the mentioned document are:

- Improving the quality of teaching informatics by stating mandatory requirements to the students' knowledge.
- Securing the kernel of the informatics course with various programs and types of textbooks, and various national and territorial models of education.
- Improving the school educational process by gradual diversifying of education.
- Aid in creating and testing educational and didactic materials in informatics that conform to the requirements for the students' level of knowledge at various stages of education.

The educational standard in informatics states two levels of requirements for the students' knowledge.

The first level corresponds to the maximal results of the students. One may say that this is the level of abilities. It may be achieved by using appropriate textbooks and didactic materials, as well as by quality of teaching. Thus, when determining the level of knowledge of a well performing student, this level of abilities is used.

The second level determines the obligatory minimum of knowledge in informatics. This is the lower bound for the results of teaching informatics.

Thus, the standard and the concept define a "corridor" which is to determine and direct development of educational processes in informatics and introducing information technologies into education.

Issuing of the standard had good effect upon both the level of students' knowledge and the system of training teachers in pedagogical colleges and refresher courses.

TEACHING IN PEDAGOGICAL COLLEGES AND REFRESHER COURSES

Informatics is a comparatively young but rapidly developing science. It is noteworthy that the domains of its study and application expand every day. Quite recently informatics was studied in the finishing grades of secondary school, and now this science is on the threshold of nursery school. At present more than 100 nursery schools are endowed with computers, and this number is incessantly growing.

Spreading of informatics and new information technology in the educational system has a great positive influence upon teaching other school subjects, but every innovation in the educational process requires taking appropriate administrative and didactic measures. This system of measures consists of the following steps:

- The concept and educational standards of a new subject are established.
- Basing on the above, programs of courses are created.
- Textbooks are written according to the programs.
- Finally, the teacher, who is responsible for introducing new subject, is trained.

These steps are taken in the indicated order every time a new subject is being introduced into school.

Not meaning to belittle the significance of any of these steps, we would like to stress the importance of training the pedagogical personnel. Indeed, suppose that standards and concepts are ready, programs and textbooks are written; if the teacher is not trained adequately, all these concepts and textbooks will not have the desired effect.

The validity of the above statement is corroborated by the present-day state of teaching informatics in the schools of the Republic. The most obvious problem is the diversity of levels of teaching in different schools, which leads to different levels of knowledge shown by graduates.

One of the reasons of this diversity is insufficient professional and didactic expertise of some informatics teachers. In order to prepare informatics teachers, special courses for teachers of mathematics, physics and some other subjects were organized in 1986-1990. Various organizations (universities, pedagogical colleges, teachers' refresher courses, etc.) were in charge of these courses, and the programs of the courses varied as well. As a result, different teachers achieved substantially different levels of training.

Another reason is that school informatics develops rapidly and pervades the educational process. Thanks to this rapid development, the above described order of introduction new subject into school education is not observed: before a concept of teaching has emerged, programs are written, before textbooks are written, teachers are trained. This also has bad effect on professional skills of informatics teachers.

The necessity of giving an adequate training to all informatics teachers brings to life the problem of raising the quality of teaching informatics in pedagogical colleges and refresher courses.

We do not mean to deny the role played by pedagogical colleges in preparing informatics teachers. However, we would like to stress the role of refresher courses. Indeed, college takes only five years of the teacher's life, while the rest 30-35 years of his work the teacher has need in regular brush-up of his skills. This is especially true for informatics, where knowledge becomes obsolete every 2-3 years.

Taking into account this peculiarity of informatics, the Ministry of Education gives much effort to enhancing forms and methods of teaching informatics at refresher courses. The Ministry created a centralized system of refresher courses, which is headed by Central Institute for Raising Teachers' Qualification (CIPKRNO) and comprises 14 regional Institutes for raising qualification. Each of these Institutes has a Department of Informatics, where teachers of Informatics have their refresher courses and teachers of other subjects and school administrative personnel are taught the course "Introducing Computers and Other Information Technologies into Educational Process".

State standards for teaching Informatics and New Information Technologies at teachers' refresher courses have been developed, and new programs for refresher courses in Informatics and New Information Technologies are written.

There are still same problems whose solution could raise the level of teaching in pedagogical colleges and refresher courses. The most serious of them is shortage of the necessary equipment. Most of the pedagogical institutes and institutes for raising qualification have no modern computers, which makes practical Informatics classes ineffective.

In spite of all the effort made in the Republic in order to solve this problem, the present state of economy prevents purchasing large stocks of modern computers and supplying them to educational organizations.

NEW INFORMATION TECHNOLOGIES IN EDUCATION: CURRENT STATE AND PROSPECTS

From the very beginning of teaching informatics in schools, a search for applications of computers to other school subjects has begun. At Informatics lessons the scope of teaching went beyond the syllabus. Teachers and gifted pupils wrote primitive programs for processing numerical and textual information, some teachers developed text and graphic editors in collaboration with their students.

The actual acquaintance of schoolchildren with New Information Technologies began in 1992, when first IBM PS/2 computers arrived to the Republican schools. Informatics classrooms with these computers were installed in 94 schools; all of these schools started an experiment according to the project "Pilot Schools".

Unlike the traditional course of Informatics, which is oriented at teaching programming to children, the concept underlying the project "Pilot Schools" has preparing users of computers as its objective. This is why many educational, demonstrational, and instrumental computer programs are involved with this concept. During their classes, the students gained experience in working with text and graphic editors, with various integrated program packages including databases, spreadsheets and editors.

Unfortunately, many of the computer programs that had been meant to be used in this project, were never shipped to the Republic. After disintegration of the Soviet Union the experiments were finished as well. Now all the schools that used to participate in the project, as well as other schools, teach children according to the unified program, in which all the aspects of teaching informatics, in particular those envisaged by the project "Pilot Schools", are included.

At present the Republic is going towards complete computerization of such branches as banking, taxation, social security, and others where New Information Technologies are introduced. Whence, a challenge to the educational system: school graduates should be able to work with New Technologies.

Taking into account the importance of this work, such themes as working with spreadsheets, databases, teaching programs (foreign languages, office work), various editors, are included in the syllabus.

By order of the Minister of Education, modems are installed in the administrative educational organizations of all levels. These organizations are thus joined by a computer network, which allowed to introduce paperless technology into management of educational organizations.

It is noteworthy that modems are installed in school "PRAVEC-8" computers, so now the schools having such computers can be connected to one another by modem and familiarize their pupil with yet another advantage of new information technologies.

Of course, the process of introducing new information technologies into educational process runs into serious obstacles. The first of them is, as we mentioned before, the insufficient number of computers in schools. Not all schools can afford to purchase new licensed program systems. It would make sense to renew the work upon the project "Pilot Schools". Taking into account new situation, it will be necessary to establish direct contacts with foreign partners from outside fSU. There is a great field of activity for analogous projects in other educational organizations (pedagogical colleges, institutes for raising qualification, etc.).

To attain the mentioned objectives, the following tasks are in order:

1. Taking stock of the computer equipment in schools and colleges and replacement of obsolete computers by modern ones, as well as supplying the required number of modern computers to educational organizations.
2. Didactic revising of the existing school courses with inclusion of the computer as means of teaching; computers should be used for doing and presentation of school tasks.
3. Development and purchase of new licensed program systems, which will allow one to teach and test students in various subjects with the minimal participation of the teacher and the maximal orientation at the student.
4. Development of programming language translators, language translating programs, text

editors for all languages spoken in the Republic.

5. Development of standard educational blocks in principal subjects: physics, mathematics, chemistry, foreign languages, biology basing on the best didactic recommendations, and of utilities which allow the teacher to prepare for the classes basing on these blocks.

The tasks for the nearest future are as follows:

1. Modernization of the existing and supplying new computer equipment to schools: 800 classes per year.
2. Creation of a public pool of algorithms and educational programs:
- Instrumental programs for teachers.
- Sets of educational blocks.
- Ready-made lessons.
- Exam-taking programs.
- Didactic materials.
3. Annual refresher courses for teachers; the theme should be "Using new program systems in education".
4. Teaching basic computer literacy to adults in rural areas.
5. Creating a computer information network and a data bank for the Ministry of Education.

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NATIONAL REPORT OF ZAIRE

ABSTRACT

The theme "Education and Informatics" comprises two aspects:
1. Using new information technologies in the educational system as a teaching tool.
2. Introduction of informatics as a new discipline in teaching syllabi.
Information technologies in the first aspect have not yet found their way into the national educational policy. Of course, there exist some experimental programs that imply using information technologies for education, but they are far from being completely taken stock of. Moreover, these programs are realized by non-state organizations and commercial companies in the framework of their cooperation with educational institutions.
Informatics in the second aspect is an object of attention of the Zairean administration, which has been applying much effort during several years to introduce this discipline into the syllabi of the primary, secondary, and higher education.
In brief, this is the state of affairs related to the theme "Informatics and Education" in Zaire.

INTRODUCTION

In Zaire, as well as in other countries, new information technologies and informatics in particular are regarded as necessary working tools in all areas of life.

The variety of applications of new information technologies and the wide scope of the problems solved with them indicate how great is the influence these technologies may have upon the process of development.

All spheres of social life are getting within reach of the great capabilities of these technologies. The educational system is no exception to this tendency, even though it has numerous problems to encounter:

- The overpopulation of the country;
- The weakness of infrastructure;
- Shortage of didactic materials;
- Non-adaptedness of teaching programs.

It is these problems that caused the session of the General States in Education (Etats generaux de l'education), which took place in Kinshasa from January 19 through January 29, 1996, with the assistance of UNESCO, the UNO Development Program and the World Bank.

The analysis of the ways of transformation of the educational system lead the States to a conclusion that education "for all and by all" is necessary for Zaire. This is a praiseworthy aim, which, however, may very well remain a good wish if one does not use the great opportunities offered to the peoples by new information technologies.

This is where the interest of Zaire towards congresses devoted to informatics and education stems, in particular to that was held in Paris in November, 1989, and to that scheduled for July, 1996 in Moscow.

In the present report, which is prepared for the latter congress, the situation related to usage of new information technologies in education is analyzed. The degree of infiltration of new information technologies in the education is estimated, the possibilities of standardization and the prospects of international cooperation are discussed. Much attention is paid to the presentation of computer equipment and software Zaire has at its disposal.

I. INTRODUCTION OF NEW INFORMATION TECHNOLOGIES INTO THE EDUCATIONAL SYSTEM OF ZAIRE

I.I. REALIZING THE IMPORTANCE OF THE PROBLEM ON THE POLITICAL LEVEL

The political administration of Zaire has actually realized the importance of new information technologies and the opportunities offered by them for securing dynamic development and progress of the national educational system.

An evidence for this realization is provided by presidential decrees prescribing the creation of special organization responsible for the problems of informatics. Among these decrees one may list the following:

1. Decree No 72-419 of November 1, 1972, establishing Zairean Information Service.
2. Decree No 76/104 of May 29, 1976, establishing Zairean Permanent Council on Informatics.
3. Decree No 76-356 of December 23, 1976, regulating the questions of acquiring and using informatic equipment.

4. Decree No 83-033 of January 27, 1983, establishing the Presidential Service for Informatics development in Zaire.

5. Decree No 83-034 of January 27, 1983, regulating the sphere of information activities in Zaire.

6. Decree No 87-242 of July 23, 1987, establishing Presidential Research Service.

7. Decree No 87-243 of July 27, 1987, regulating the sphere of information activities in Zaire.

Further on, a great number of conferences was held, at which specialists form various spheres of activity discussed the problem "Informatics-Education". At each of these conferences, the questions of education were on the agenda, even though not always they were the principal items. This concerns, in particular, the problem of equivalence of diploma specialists in informatics have.

The National Sovereign Conference is coming into its new period of development, when experts should discuss the problems of teaching informatics particularly. As a remedy, some recommendations were suggested, among which there are studying and using new information technologies by teachers, students, and administration of educational institutions.

During the session of the General States in Education that was held on the suggestion of the Transition Government according to the recommendations of the National Sovereign Conference, the task of introducing a course in informatics and adjacent technologies into the new educational system was named as a priority.

The attention that the government paid to this session is clearly indicated by the following words: "The political will is the key element, without which no structural changes in the cultural and educational space are possible". This session allowed all the persons having to do with introducing informatics and adjacent technologies into the national system of education on all levels, to get a deeper knowledge of the problems pertaining to it. According to the recommendations of the General States in Education, National Committee of the regional information network in Zaire included the question "Education and Informatics" in the list of priorities of its working program for 1996.

One may hope that accomplishing of this project, which is intended to stimulate the work of all persons and organizations involved, will give rise to a great number of initiatives and stimulate the process of introducing new information technologies, as a tool of teaching, into the educational system.

1.2. TEACHING INFORMATICS

Many educational institutions - primary, secondary, and higher - have informatics courses in their syllabi.

This situation cannot be regarded as the result of isolated initiatives of the private sector only. The present achievements resulted from the analytical efforts that had been made by the state authorities during last several years. Indeed, the introduction of informatics courses into the educational system was, as we mentioned before, initiated by Presidential Service for Informatics development in Zaire, which was later reorganized into Presidential Research Service. It is only later that private schools appeared, which specialize in teaching informatics and act under the supervision of presidential services and in cooperation with specialized departments of the ministries related to the national educational system.

At present, informatics is taught in both public and private colleges as well; these colleges prepare specialists in informatics on various levels.

I.3. NATIONAL PRIORITIES IN EDUCATION AND INFORMATICS

The General States outlined some priority measures to be taken to secure innovations in the educational sphere, teaching informatics included.

I.3a. Innovations

1. Introduction of informatics courses in primary and secondary school.

2. Creating the "Informatics" section in the system of high school education.

3. Standardization of programs for training information teachers on all levels.

I.3b. Measures to be taken

1. Creating special programs that correspond to the particular features of each level and each discipline.

2. Creating a program that will allow to create the "Informatics" section in the system of high school education.

3. Creating a unified program for training informatics teachers.

4. Creating a program for popularization informatics via mass media by the ministries related to the national educational system and the ministry of culture.

I.3c. Practical measures

Creating the "National commission for introduction informatics into the Zairean educational system".

I.3d. Working program

For the short term:

1. Joining in the work of the National commission for introduction informatics into the Zairean educational system.

2. Active popularizing work with the Zairean authorities that will cause them to exert more political will in the field in question, and with various other partners (with coordination of their efforts).

3. Enlightening the national intelligentsia on the necessity of studying informatics and its usefulness for the development of the country.

4. Training highly-qualified professors that will be able to teach school teachers new information technologies.

5. Gradual introduction of informatics courses on various levels of education via several experimental schools.

6. Creating experimental independent information centers that will be joined to local, subregional, regional, and international networks

and will be able to provide information service to a great number of nearby schools.

7. Providing support for private initiatives and projects of state-independent associations with coordination of their activities.

For the longer terms:

1. Creating data banks on main spheres of national life.

2. Developing structures for production of software adapted to the needs of research and education with the features of the national environment taken into account.

3. Creating servers joined to international data banks.

4. Purchasing computers for educational institutions in order to help them in solving their didactic, scientific, and administrative problems.

I.4. NEW INFORMATION TECHNOLOGIES AS PEDAGOGICAL TOOL

New information technologies are very poorly represented in our educational system. There exist centers of professional and general education in the country that use methods of "computer aided teaching". However, the experience of these centers is not acquired by numerous schools and colleges. This situation is due to the absence of the national policy for introduction of new information technologies, as teaching tool, into the educational system.

I.5. DIFFICULTIES

One may distinguish the following groups of problems caused by the lack of coordination in the system of teaching informatics and non-adaptedness of new information technologies to the particularities of the educational system:

I.5a. The political situation

In spite of the presence of the political will, there are political problems that prevent some projects concerning vitally important problems of the leaving century from realization, projects related to new information technologies included.

The long duration of the transition period in the political life of the country and the isolation from international connections prevented all the governments from initiating projects able to provide for progress in the field in question.

I.5b. Social and economical crisis

Social and economical difficulties are smothering our country and make us put off the realization of any innovations that imply transfer of technologies and demand for massive investments.

Indeed, if our schools have already run into problems with providing schools with conventional didactic materials, how can one think of innovations that demand for a steady flow of investments? Thus, *the school infrastructure, which is not ready to* accept new technologies, remains one of the most serious obstacles.

I.5c. Lack of qualified personnel

Although our country does have some potential in informatics, it experiences lack of trained personnel capable of teaching and adapting to the new program. To solve this problem it is necessary to prepare specialists that will teach the teachers.

I.5d. Problems with electricity

The realization of this problems in this country will meet serious difficulties, especially in the inner regions, where electricity is not yet installed. However, the towns are for the most part provided with the electric power, which will secure fulfillment of the program.

I.5e. Insufficient development of telecommunication networks

In spite of the existence of telephone and several private data transmitting networks, the existing telecommunication infrastructure prevents using new information technologies in the educational sphere on a large scale.

II. EQUIPMENT, SOFTWARE AND TEACHING PROGRAMS AS MEANS OF EDUCATION AND ADMINISTRATION OF THE EDUCATIONAL SPHERE

II.1. NEW INFORMATION TECHNOLOGIES AS A TEACHING TOOL

Lack of the national policy in introducing new information technologies does not mean that the authorities underestimate their great capabilities. The administration of the country gave support to some governmental organizations that were oriented at creation of computer-based educational systems for some categories of the population.

By way of example one may name the Maman Moboutou foundation, whose occupation is computer-based training of secretaries and plumbers; this training is oriented at girls and boys respectively. The teaching center of this foundation was equipped by Canada, and now it has a powerful computer network and specialized software.

Many private schools are beginning to use new information technologies as well; they use them to solve elementary pedagogical problems in secondary and even primary school.

II.1. Information equipment

The stock of information equipment the administration of educational system has at its disposal can be divided into two parts: the equipment of the ministry of primary, secondary, and professional education and the equipment for the higher education. It includes two minicomputers HP3000 and a few microcomputers respectively.

Concerning the number of computers used for teaching purposes, it is quite small, and only a few educational institutions have such computers at their disposal. One may name the Information school of the Ministry of Finances, which (the school) has one minicomputer. Besides, a few educational institutions have microcomputers, very imperfect as a rule.

Many schools have a need in information equipment that could be used for teaching, but their needs are often left unsatisfied because of the high price of electronic equipment. Here, one would like to suggest the state to make purchase of information equipment for the needs of educational system tax-deductible, according to the recommendations of the National Sovereign Conference. Moreover, one should make purchases of computer equipment in the framework of projects of international cooperation tax-deductible as well.

It is necessary to develop the system of humanitarian aid in education, as it is done with medical service. The reason for such a solution is that the developing countries cannot make use of the system effect that results from interaction of the components in the triad "Education-Industry-Informatics".

We would regard this situation as justified when educational institutions, government and non-government organizations of developed countries help their colleagues from developing countries to make use of this effect, at least "on the periphery".

II.1b. Software and educational programs

One can only be sorry for the present situation with software, for the lack of educational software that meets the specific requirements of our educational programs. Stimulating the inventiveness of specialists in informatics with the aid of specialists in teaching might be a solution to this problem. On the practical plane, it is necessary to create the conditions for protecting copyright and to think of such stimulators as prizes, scholarships, etc.

II.2. NEW INFORMATION TECHNOLOGIES AS AN ADMINISTRATIVE TOOL

The possibility of using the computer for solving administrative problems is a reality one cannot doubt. State authorities, with the aid of the World Bank, provided the country with an information center whose aim is to computerize all the administrative system in the Ministry of Primary, Secondary, and Professional education. One should admit, however, that many functions and problems remain beyond the scope of computerization due to the lack of the information culture, on the one hand, and to the insufficient coordination of efforts, on the other hand. The most computerized field is somewhat specific: it is processing the results of graduate exams, that are held before issuing the diploma.

Among other computerized spheres one may name such as calculating the salary, statistics, financial control and accounting, budget control, control of human resources, processing of cardfiles, archives, the document flow control, etc.

III. USING BROADCASTING FOR EDUCATION

Using broadcasting equipment for education had begun considerably earlier than informatics emerged in the Zairean educational space.

As early as 1963, that is but three years after the acquisition of independence, a religious radio station appeared in Kinshasa. This station was named "African technical radio service" (ATRS). First it was supervised by catholic missionaries, later protestants joined in. The specific feature of this station was that its broadcasts were entirely devoted to the questions of education and culture.

The necessity of adapting this station to the technology of that time lead to the creation of a TV center, which was named "Tele-ATRS". The objectives and ideology of Tele-ATRS coincided with those of its predecessor; as a result, the arrival of Tele-ATRS caused increase in the influence of audiovisual media upon the sphere of pedagogics and education.

However, in 1973 ATRS and Tele-ATRS were nationalized, and an organization called "National Directorate of Educational and Cultural Programs", which had the same objectives as the mentioned stations, appeared.

After the "Zairean Directorate of Broadcasting and Television" was organized in 1983, National Directorate of Educational and Cultural Programs was incorporated into its structure and began its department called "Educational and school Radio and TV".

As it is clear from the name, the basic aims of Educational and school Radio and TV remained the same, but technical difficulties caused decrease in efficiency of this department. The percentage of homemade programs dropped from 90 to 50.

At present, the program "Open school" that is broadcast by the national radio and TV enjoys great popularity among both Zairean teachers and pupils.

Other educational programs are aimed at large groups of the population and often contain sections intended for raising qualification of teachers from the informal sector.

Rural radio stations, such as "Radio Candip", also play an important role in solving the problems of professional and general education of the people. Strengthening of their position resulting from liberalization of the national market of audiovisual production, as well as the proposed upgrade of the equipment of the Zairean Directorate of Broadcasting and Television with the aid of the International Program for Development of Communications, are the two main means of enlargement the scope of using broadcasting for education.

IV. POSSIBLE STANDARDIZATION POLICY

Without the special policy for introduction new information technologies into the educational system and without mentioning it in the framework type law on national educational system, standardization measures in this field can be taken only within the framework of the information-computer educational policy.

IV.1. STANDARDIZATION SERVICES

In the text of the corresponding law, the following standardization services are named:

IV.1.a Presidential Service for Informatics Development in Zaire (PSIDZ)

As we mentioned before, the first organization to work upon standardization in this field was PSIDZ. It is pointed out in Article 13 of the decree establishing this organization that "Presidential Service for Informatics Development in Zaire (PSIDZ) organizes and supervises research in informatics".

There is no direct mention of standardization in this article, but in practice PSIDZ has the functions of inspecting organization that inspects, according to the law, the fulfillment of educational programs in informatics.

IV.1b. Presidential Research Service (PRS)

In the decree that establishes PRS, this service is assigned the tasks analogous to those of PSIDZ. In the Article 14 of Presidential Decree No 87/243 of July 22, 1987, which replaced the corresponding decree of 1983, the same words are contained: "Presidential Research Service organizes and supervises research in informatics. This research may concern equipment, software, educational materials, applied information systems, questions of creating information computer centers".

The fact that, according to the Article 2.14 of the Decree No 87-242 of July 22, 1987, which established PRS, this organization is to provide for "development in the territory of the country informatics-related activities by promoting education systems and research programs in informatics" leaves no doubt about the intent of the authorities to solve, in the framework of this act, the problems of informatics aided education development, as well as of development of new information technologies.

It should also be pointed out that these questions will be discussed at the sessions of National Sovereign Conference and General States in Education.

IV.1c. Legal rules in standardization

Without special policy for introduction of new information technologies as a teaching tool into the educational system and without the special service responsible for standardization in this field, one has to rely upon the regulations concerning informatics and computer related activities.

Still there are no special legal base that would prescribe official procedures or establish obligatory standards.

As we mentioned before, various services whose task is to standardize teaching programs in informatics do it according to the concrete problems and priorities established in this field.

IV.1d.. Prospects

Establishment of standardization services and forming an obligatory complex of procedures and standards related to introduction of new information technologies into the educational system should enrich the general policy of adaptation these technologies to the problems of teaching.

Thus, one should state a policy first, so as one could determine the tasks of a standardization service and the rules regulating its activity. At the present stage one should take into account the following ideas that will allow to achieve better results in this work:

1. This policy should be in accordance with the policy of introducing new information technologies into educational sphere; this latter policy should be a real constituent of the educational policy.

2. The standards should ensure uniformity and compatibility of information and computer equipment and its telecommunication base, uniformity of performance and compatibility of the software used for teaching, flexibility of its usage.

3. It is necessary to provide for uniformity of the syllabi of primary education in informatics, so as to avoid the danger of "losing the roots" after transfer from one educational institution into another during or after the academic year.

4. The efforts aimed at promotion of education and standardization should be applied to all the regions of the country and to all educational subsystems (public, private, etc.).

5. The educational software should correspond to the programs outlined in the national educational policy and concern the disciplines contained in these programs.

6. The standardization service whose task is to work with introduction of new information technologies into educational sphere should be created by ministries related to the educational system, in cooperation with the corresponding state services.

V. INTERNATIONAL COOPERATION

All the countries that participated in the first Congress "Education and Informatics", which was held in 1989, realised that cooperation in all fields of applications of new information technologies to education is a must. It was declared that the aim of this cooperation is to "shorten the gap between developed and developing countries and converge on an equity basis". However, two obstacles paralyzed the political will exerted by the Zairean authorities.

The first obstacle was severing the structural cooperation with the main partners of Zaire. For the educational system this "cutting off the oxygen supplies", meaning by oxygen the foreign aid, implied real withering.

The second obstacle is related to the financial difficulties of the country, which had to deal with other first order social and economical priorities.

The inclusion of developing countries into international cooperation in the field of introduction of new information technologies into education may bring these countries more trouble than benefit if the developed countries and international organizations do nor offer specific structures and mechanisms of cooperation related to transferring technologies and experience, information exchange and joining international information networks, acquiring and adaptation of the reliable educational software, training of teachers.

In this case such a decision cannot be made without sacrifices.

As it was pointed out at the first congress in Paris, the prerequisite is "the necessity to solve the problems of usage new information technologies basing on the analysis of possibilities of each country from the standpoint of its economic, social, and culture prospects".

After all, the cooperation is of vital importance not only for the developing countries, but for the developed countries as well, since all the parties to cooperation benefit from exchange of information and experience.

CONCLUSION

Our country has no alternative to introduction of new information technologies in the educational system, now that economics is being internationalized. Our first necessity is the transformation of the political will of the authorities of the country into concrete decisions. This should be accompanied by efforts in wide propaganda of informatization ideas among the population in order to form the information culture. This is a necessary prerequisite for developing the educational policy including new information technologies as a teaching tool and for the readiness to accept plans and to choose variants of their fulfillment.

However, the political will and the necessary information culture should be supplemented by international cooperation implying the aid on the part of developed countries and international organizations.

A merit of the technology itself is its "neutrality", which offers the opportunities of its relatively easy assimilation, although the high rate of moral aging, which is characteristic of new information technologies, can put the developing countries into a vulnerable position due to the necessity of regular upgrading the equipment and its technical service.

NATIONAL COMMISSION OF ZAIRE FOR UNESCO
AFRICAN REGIONAL INFORMATION NETWORK
NATIONAL CENTER

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УДК 378 : 007

UNITED NATIONS EDUCATIONAL, SCIENTIFIC
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EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS OF THE SECOND INTERNATIONAL CONGRESS

(consist of the 1 st, 2 nd, 3 th, 4 th volumes)

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EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

(IN TWO BOOKS)

2nd BOOK

Moscow, Russia

1-5 July 1996

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 3d VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

«EDUCATION AND INFORMATICS»

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the second book the 2nd UNESCO International Congress "Education and Informatics" held in Moscow on July 1-5,1996.
The book contains the texts of papers and appearances of participants of the Congress at the Opening and Closing Ceremonies, plenary sessions, and in the course of discussions of the topics at the Commission meetings provided by the Congress Program.

The arrangement of materials published in this volume is determined by the organization scheme of the Congress work.

Each day of the Congress work began with a reports plenary session at which the invited papers on the main topics of the Congress were presented. They were followed by the Commission meetings devoted to the following topics:

Commission I: Tendencies and experience in the introduction and use of new information and communication technologies in educational systems;

Commission II: Latest developments in the field of new information and communication technologies and their use in education;

Commission III: Cooperation for the use of new inrormation and communication technologies in education.

The following six themes were discussed in each Commission:

Theme 1 – Learners;

Theme 2 – Teachers;

Theme 3 – Techologies;

Theme 4 – Social, economic and cultural issues;

Theme 5 – Educational Policies;

Theme 6 – International co-operation.

According to the Congress Program (pablished in volume 1 of the Congress Proceedings), 49 specialists from 26 countries and 8 international organizations presented their papers at plenary sessions and Commission meetings. 27 participants of the Congress gave their considerations in discussions of papers.

The 3d volume consists of 8 sections. The first contains reports at the Congess Opening Ceremony and papers presented at the first plenary session. The texts of reports and speeches devoted to the topics discussed at the Commission meetings are included in Sections 2–7. Section 8 covers the material presented at the final plenary session.

Material of Sections 2–7 is distributed in the following order:

- Papers presented at the plenary session;
- Papers presented at the meetings of three Commissions organized at the Congress;
- Speeches of participants in the course of discussions.

In editors' opinion, such an order will help the reader gain an integral insight into the problems considered at the Congress, taking into account different approaches and views on each of the topics discussed at the Congress.

The arrangement of material in sections corresponds to the order in which reports and speeches were listed in the Congress Program. A great diversity of approaches to the problems has emerged during the Congress work and, accordingly, in preparation of this volume for publication (as well as in preparation of volume 4 which contains communications and abstracts of papers presented at the Congress). This seems to be quite natural in view of the extent of each problem. The diversity of approaches manifested itself, in particular, in the use of different (including new) terms, which can be explained by inadequate elaboration of the conceptual formalism in that comparatively young discipline as informatics. In some papers and communications the ideas were put forward and defended which are disputable from the viewpoint of experts and editors and cannot be accepted by our readers. However, these ideas were completely retained in making up this volume. Some materials called for editorial correction, without which, in our opinion, the appropriate level of publications could not be achieved.

The Editorial Board will accept with gratitude corrections and suggestions from authors and readers. Their references will promote the continuation of discussions initiated by the Congress and provide the next step to the unification of terminology and basic concepts used in this area.

Analysis, selection, and preparation to the issue of this volume were performed by/the UNESCO Institute for Information Technologies in Education and by the International System Research Centre for Higher Education and Science (the UNESCO's affiliated Centre). References, notices and suggestions from our readers will be accepted with thanks by the Editorial Board.

They should be sent to the Centre's address: 117292, Moscow, Kedrov str. 8/3, the Centre's General Director, Academician of the Russian Academy of Education, Eduard A. Manushin fax (095) 129. 3190

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2ND UNESCO INTERNATIONAL CONGRESS « EDUCATION AND INFORMATICS», MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION

V. G. KINELEV

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

*EDUCATIONAL POLICIES
and NEW TECHNOLOGIES*

PROCEEDINGS
OF THE SECOND INTERNATIONAL
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VOLUME III

REPORTS AND SPEECHES

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

Part I

OPENING CEREMONY

ADDRESS

V. G. Kinelev

DEPUTY CHAIRMAN OF THE GOVERNMENT OF THE RUSSIAN FEDERATION
CHAIRMAN OF THE STATE COMMITTEE FOR HIGHER EDUCATION
OF THE RUSSIAN FEDERATION

Ladies and Gentlemen,
Colleagues,

It is a pleasure for me, on behalf of the President of the Russian Federation, Boris Nikolaevich Yeltsin, to read out the address he has sent to the participants in this Congress.

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

I warmly welcome the participants to UNESCO's Second International Congress on Education and Informatics, which is now opening in Moscow.

You represent the governments and scientific and business communities of many countries, United Nations Specialized Agencies and other international organizations. I am convinced that such a representative forum will be able to indicate how to develop education and identify opportunities for using new information technologies in this field.

The Congress has particular resonance because it is taking place on the cusp of two centuries and two millennia. The decisions taken today will influence the lot of humanity in the future.

It is significant that your intellectual forum is working under the auspices of UNESCO. This international organization has rightly earned respect for its substantial contribution to consolidating the efforts of education, science and culture professionals and creating the conditions for the sustained development of the world community.

I would like to wish the participants in the Congress good luck and success in their valuable work, and peace and prosperity to their countries and peoples!

Boris Yeltsin

Ladies and Gentlemen,

Allow me to welcome you on behalf of the Government of the Russian Federation. We are extremely pleased to see you here in Moscow, the capital of Russia. I hope that this Congress will be a wholly outstanding event in the life of the world community, and, it goes without saying, identify new ways forward in the development of education and the new information technologies. I would like with all my heart to wish you success in your work. With your permission I now declare UNESCO's Second International Congress on Education and Informatics open.

Thank you.

The original is presented in Russian

ADDRESS TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

Colin N. Power

ASSISTANT DIRECTOR-GENERAL
FOR EDUCATION, UNESCO

Mr. Kinelev,
Mr. Sadovnichy,
Professor Bauknecht,
Distinguished Participants,
Ladies and Gentlemen!

It is a great pleasure for me to welcome you to this Congress, the Second International Congress on "Education and Informatics", on behalf of the Director-General of UNESCO, Mr. Federico Mayor.

Very sadly he is unable to be here and so I am now filling in for him. Yesterday in Guatemala and El Salvador he became ill and, unfortunately, cannot be with you. He very much wanted to show his solidarity with the people of Russia at this historic point in their history and also his solidarity with the countries and the organizations represented here.

As you know, he has a deep interest in the theme of this Congress and is committed to ensure that all have access to knowledge and information, scientific, technological, for the benefit of all. UNESCO is devoted to the promotion of the sharing of expertise and knowledge.

It is indicative of the worldwide interest in the new information and communication technologies that we have approximately 1,000 participants and observers at this Congress, representing 70 Member States of UNESCO, many UN organizations, intergovernmental and nongovernmental organizations and the private sector which produces the hardware and the educational software we need to make our dreams of an enriched learning environment for all a reality.

As you know, the first International Congress on "Education and Informatics" was organized in 1989 at UNESCO's Headquarters, in Paris. It was one of my first duties as Assistant Director-General for Education to oversee the planning and development of that Congress. In the seven years that have passed, tremendous developments have taken place in the information and communication technologies. Indeed, it is a measure of the rapidity of these changes that terms such as the Internet and the World Wide Web were not even mentioned during the first Congress.

The function of this morning's session is to open this Congress, so I will not give a long speech. But I do want to suggest that the new information technologies present us with a formidable challenge to our sense of equity, justice and of solidarity around the world. It is important to note that UNESCO's international congresses are truly international, that is, they include representation from the poorest countries in the world as well as the richest, those who do not have access to the technologies as well as those who are at their cutting edge. It provides us, then, with an unrealized opportunity for the sharing of knowledge and for promotion of understanding between peoples and of cultures.

It is appropriate that this Congress should be taking place in Russia with its long and distinguished tradition of scientific and technological development and of education. In this connection, I would wish to reiterate the tribute which the Director-General paid to the Government of the Russian Federation at the ceremony in Moscow, last April, on the centenary of the birth of the chemical physicist Nikolai Semenov, and assure the Russian Federation of UNESCO's continuing support for its efforts to preserve and to develop Russia's outstanding scientific, technological and intellectual heritage. The Director-General asked me to inform you that he is following with great admiration the process of democratization here in Russia, which is liberating the moral and intellectual potential necessary for the development of the country and of a culture of peace throughout this world. Education is essential to this democratization process, to development and to peace. The new information technologies, equitably shared and properly employed, can enhance the potential of education to shape a broader future for us all.

I wish to conclude by expressing once again our gratitude to the host country for its leadership and for the impeccable preparation of this Congress, and to the Moscow State University for generously agreeing to host it. I should pay tribute as well to the International and the Russian Organizing Committees of the Congress, and especially to you, Mr. Kinelev, for the enormous efforts which you personally have put into the preparation of this very large and complex Congress. It is now up to us, Ladies and Gentlemen, to ensure that the Congress does provide us with guidelines for the policies and the actions needed in order to ensure that the new information technologies serve the cause of lifelong education for all, which is the central platform of UNESCO's programme.

Thank you.

The original is presented in English

ADDRESS

Kurt Bauknecht
PRESIDENT, THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING (IFIP)

Distinguished Guests,
Ladies and Gentlemen!

I am very pleased to be here and to address you in this opening session.

A few words about IFIP and its mission.

IFIP is a multinational federation of professional and technical organizations concerned with information processing. From any one country, only one such organization can be admitted as a Full Member. On 1 January 1996 there were 44 organizations as Full Members, 3 Corresponding Members, and 10 Affiliate Members, representing countries from all regions of the world.

In short words, IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people. IFIP helps to bring together professionals at the leading edge of practice and experience and acts as a catalyst to advance the state-of-the-art.

Of major importance is the technical work of IFIP and so I will give you the aims of our Technical Committees and of 71 Working Groups which are actually in operation:

- To stimulate, encourage and participate in research, development and application of Information Technology (IT) and to foster international co-operation in these activities.
- To provide a meeting place where national IT Societies can discuss and plan courses of action on issues in bur field which are of international significance and thereby to forge increasingly strong links between them and IFIP.
- To promote international co-operation directly and through national IT societies in a free environment between individuals, national and international governmental bodies and kindred scientific and professional organizations.
- To pay special attention to the needs of developing countries and to assist them in appropriate ways to secure the optimum benefit from the application of IT.
- To promote professionalism, incorporating high standards of ethics and conduct, among all, IT practitioners.
- To provide a forum for assessing the social consequences of IT applications; to campaign for the safe and beneficial development and use of IT and the protection of people from abuse through its improper application.
- To foster and facilitate co-operation between academics, the IT industry and governmental bodies and to seek to represent the interest of users.
- To provide a vehicle for work on the international aspects of IT development and application, including the necessary preparatory work for the generation of international standards.
- To contribute to the formulation of the education and training needed by IT practitioners, users and the public at large.

IFIP is governed by a *General Assembly* (GA), which meets once every year and consists of one representative from each Member organization. The General Assembly decides on all important matters, such as general policy, the programme of activities, admissions, elections and budget. The day-to-day work of IFIP is directed by its Officers, the President, Vice-Presidents, Secretary and Treasurer, who are elected by the General Assembly and together constitute the Executive Board. The Council, consisting of the Officers and up to eight Trustees elected from the General Assembly, meets twice a year and takes decisions which become necessary between General Assembly meetings. The headquarters of the Federation are in Laxenburg, close to Vienna, in Austria, where the IFIP Secretariat administers its affairs.

A major event in the IFIP programme of activities is the Congress, held every two years. Thirteen world computer congresses have been organized by IFIP in the past. The forthcoming Congress 1996 will be held in Canberra, Australia, at the beginning of September. The 15th IFIP Congress is scheduled to take place in Vienna and Budapest in September 1998 and the venue for the Congress 2000 will be Beijing, China. In addition to congresses, IFIP through its Technical Committees organizes yearly more than 70 international events, from small workshops to major conferences such as the World Conference on Computers in Education, Computer Applications in Production and Engineering and Information Security. The proceedings of IFIP congresses and other events are published and distributed worldwide. These form a comprehensive library of development in information processing with over 750 titles.

IFIP aims to assist developing countries in their application of information processing and co-operates with UNESCO and other intergovernmental organizations to achieve this objective. Responsibility for planning and overseeing this work rests with the Developing Countries Support Committee (DCSC), which promotes co-operation with developing countries through the use of IFIP's experience, technical information and knowledge, to help them in their specific needs and requests. The programme includes the distribution of IFIP publications, projects, regional activities, including training courses and a lot of seminars.

The technical work, which is the heart of IFIP's activities, is managed by a series of Technical Committees (TC). Each Technical Committee supervises a number of working groups which deal with specialised aspects of a field of a parent Technical Committee. Up to 4,000 specialists, who work worldwide, are deeply involved in the work of our working group's and are active all the year along.

This, ladies and gentlemen, is IFIP. And IFIP is an experienced environment willing to contribute to the advancement of information technology and processing in the whole field of education worldwide.

Thank you very much for your attention and, with all the good wishes from the IFIP family, I wish you a productive, excellent Congress.

The original is presented in English

ADDRESS

Armando Rocha Trindade

PRESIDENT, INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION

Mr. Deputy Chairman of the Government of the Russian Federation,
Professor Colin Power, representing the Director-General of UNESCO,
Distinguished Rector of the Moscow State University,
Mr. President of the International Federation for Information Processing,
Ladies and Gentlemen!

It is a privilege to talk to you at this very important forum on education and informatics with so many delegates from so many different countries, which shows the importance of this link between informatics and education, an importance which will be growing in the years to come.

We have no doubt that information technologies and telecommunications will have a growing role in tomorrow's society. And, of course, education has to prepare people to deal with this knowledge but the reverse also applies, and perhaps in a more important way. We need informatics for education, we need informatics to disperse knowledge all around the world, to democratize education, to democratize and increase opportunities of access to education and training for all the peoples on earth. There has been an increased recognition of this fact that we need to disperse knowledge in many different places in a flexible time schedule for everybody and this had the answer, the so-called open and distance learning methodology, which supposes that people can learn by themselves if properly supported by a system, if they are accessing very comprehensive and quality documents on the knowledge and subjects they are learning.

UNESCO has been giving to this subject a very great deal of attention with its programme "Learning without Frontiers", and the International Council for Distance Education, which I am representing, is co-operating with UNESCO on this effort to improve and to foster flexible or open or distance learning everywhere in the world. And this effort has been producing results and we are seeing that interest in distance learning methodologies is exploding all around the world. Every month new systems are created everywhere, systems using conventional methodologies either in education or in training. Conventional universities, schools, are adopting new streams of distance education so as to diversify, on the one hand, the populations they can reach and, on the other hand, to make more productive their learning action.

Companies also, companies dealing with information technologies and telecommunications, are giving an increasing attention to distance education. They believe they can play a very important role in the dissemination of knowledge everywhere and there are in the Organization I represent, the ICDE, which includes open and distance learning systems, educational authorities, private companies dealing with training and education, but also these new telecommunication operators which are bringing in their knowledge and their know-how into this Organization, in the hope that in the future the global networks will be able to disseminate information, learning and training a bit everywhere in the world.

The ICDE, which is an old Organization founded at the end of the 1930s, is represented in 109 countries and is affiliated with UNESCO. We are carrying now in Moscow, which shows a little bit the importance of distance education in this moment, we are carrying a parallel congress to this one dealing with distance education and we are doing that in partnership with the Association of International Education of Russia. And it is a fact that the numerous contributions, and we have many of them presented at this conference, which are arriving everyday show that this is a very moving, very changing field where many things have to be still approached that we do not know enough about, even the learning process we have to understand better, the new applications of all kinds of technologies to learning processes and to learning systems. All of these deserve our efforts.

Ladies and gentlemen, I am sure that this event will have the success it deserves and thank you very much for your attention.

The original is presented in English

ADDRESS

V.A. Sadovnichy

RECTOR, LOMONOSOV MOSCOW STATE UNIVERSITY (RUSSIA)

Deputy Chairman of the Government of the Russian Federation
Vladimir Georgievich Kinelev,
Assistant Director-General of UNESCO
Mr. Colin Power,
Congress Participants,
Ladies and Gentlemen,
Colleagues!

This is not the first time that Moscow University has, cordially and hospitably, hosted such a high-level international forum within its walls. On each occasion we have felt pride at the honour the leaders of top national universities from all over the world have accorded us by choosing Russia and its premier and oldest university for their important professional meetings.

Allow me on behalf of the 70,000 academics, professors, other staff and students of Moscow University to extend a warm welcome to the Congress and express our belief in its undoubted success.

I am convinced that this Congress, dedicated to such a topical issue as the link between education and informatics, is bound to be an important step in the development of higher education in every country on the threshold of the twenty-first century.

This address does not, of course, propose any sort of detailed personal analysis of the substance of the question on the Congress's agenda. It is a multifaceted and complex question. However, as rector of the University hosting the Congress, I would like to say a few words about our own understanding and view of the issue.

The basic principle applied by Moscow University in implementing varied extensive programmes in the new information technologies - from producing computer textbooks to taking part in the development of international telecommunication networks - is that only top-flight academics, professors and lecturers can ensure the effective use of the relevant communication techniques and equipment in scientific training.

The information and education policy of Moscow University is based on a considered, systems approach to hardware and other, similar resources, which is not automatically consumer-oriented or uncritical. They are useful only in competent, professional hands. For Moscow University, which has more than 8,000 holders of doctor's and candidate's degrees carrying out academic and research work with 30,000 undergraduates and postgraduates, it is the only possible approach. The fact that most of the academic and teaching staff of the university can easily use the new and even the latest information technologies has meant that up to 1,000 specialists, with the highest qualifications in the fields of informatics, applied mathematics, computer technology and cybernetic of economics, are graduating from our university every year. Other results of the computerization of Moscow University will be apparent to you as you take part in the visits specially organized for you and at the exhibitions where there will be many interesting exhibits on informatics education. I invite those who so wish to go to the foyer of the conference hall to take a look at the 485 megabyte CD-ROM prepared especially for this Congress, which presents a collection of unique material on the University over the entire period of its 240-year history, from the time of its foundation in 1755 until May of this year.

Having successfully met the challenge of the systems approach, Moscow University is now addressing another important task - creating its own general information system. Our aim is to ensure that the international educational community has the broadest possible access to the enormous basic science potential and the equally powerful teaching and methodological base of our university and all the universities of Russia. Many higher education institutions in Russia and many foreign universities will contribute to this information system, focusing on the development of genuinely scientific education. The spectrum of basic sciences at Moscow University is extremely wide and the science faculty, working on the most important questions in natural sciences and the humanities, is both modern and productive. Indeed, it is planned to hold in this hall the congress of university arts faculties, which should be held, in line with a UNESCO decision, in 1997 in Russia.

I would like to take this opportunity to thank UNESCO most sincerely and, in particular, Mr. Federico Mayor, an eminent leader, for the great attention paid to Russian higher education and its historic leader - Moscow University. The signing, on his initiative, of a direct agreement on co-operation in education, science, culture and communication between UNESCO and Moscow University for 1995-1997 and to 2001 is in itself an unprecedented act for such a prestigious international organization having treaty relations as a rule only with state structures. And the fact that, in this case, the second party to the agreement is Moscow University implies recognition by the global educational community of its unique place in the circle of leading world universities, which cannot fail to inspire our university body and bolster faith in our own capabilities.

Dear friends and colleagues!

The Congress on Education and Informatics has begun its work. Moscow University will try to do all it can to create the best possible conditions for its productive work and to ensure that each of you receives all due attention and care. I hope that you will remain satisfied throughout and learn much that is new and useful about Russia, its universities and Moscow University.

I would like to draw the attention of Congress participants to a particular circumstance. The timing of the Congress coincides with the most important event in the life of all Russian universities and Moscow University in particular. Tomorrow, 20,000 university entrants will storm through the doors of Moscow University to take the first entrance examination for Moscow University entry. It is an exciting and lively occasion. A new generation of Russians, the country's youth, hope and support, is entering Moscow University. Allow me on your behalf to wish the entrants to Russia's higher education institutions every success in their competitive examinations and admission to our worldwide community of science, education and culture.

I would tike once more to express our gratitude and profound appreciation to the delegations of all the 91 countries attending the Congress. This Congress will undoubtedly enrich us all with new ideas, bring us closer together in the hard work of developing world education so that the coming century will be a century of knowledge, science, and culture, a century of genuine humanism and the triumph of human dignity. Moscow University will make every effort to ensure that the Congress runs smoothly.

Thank you for your attention.

The original is presented in Russian

OPENING PLENARY SESSION

EDUCATION AND CIVILIZATION

V.G. Kinelev
DEPUTY CHAIRMAN OF THE GOVERNMENT OF THE RUSSIAN FEDERATION
CHAIRMAN OF THE STATE COMMITTEE FOR HIGHER EDUCATION
OF THE RUSSIAN FEDERATION

Ladies and gentlemen, dear colleagues!

I would like to begin this report with words of gratitude addressed to Mr. Mayor, Director-General of UNESCO, members of the Programme and Organizing Committees of this Congress, the Government of Russia, all those who have overcome many difficulties and made it possible to hold the Second International Congress "Education and Informatics" in Moscow. Please accept my most sincere thanks.

Dear colleagues!

We have assembled here today to join our efforts, attempt to take a look into the future, define the main aspects of education, as well as human civilization in the 21st century advancing on us relentlessly. We are increasingly aware of the approach of the next millennium not simply as a red-letter date in the world calendar. It impels us to comprehend the past, form a new understanding of the purport of life, determine the contour of the future, as well as - which is particularly important today - unite our actions directed towards building a better future for all people living on our wonderful and beautiful planet Earth.

It has so happened that destiny has bestowed on us the great privilege of taking part in this remarkable event and invested us with great responsibility for what the world will be like in the 21st century. These two sentiments compel us to cast a look on the past and read anew the great book of the history of mankind's progress towards knowledge, a book in which pages of great triumphs of human reason alternate with pages full of tragedy. I believe that each of us is excited by the thought that most of the pages of this centuries-old chronicle of mankind's history are still awaiting interest in this source of great revelations and record of tragic delusions of humanity on the endless path of its tireless advance for many thousand years towards the unattainable and hence even more coveted Truth. "Learn the Truth, and Truth will make you free" - such is the promise given to man in one of the most ancient books.

Already the first few steps man has taken along the path of knowledge confronted him with the problems riveting our attention today: those of accumulation, selection, systematization and transmission of information. The stone walls of caves, the clay tablets of the Assyrians, the papyrus manuscripts of the Egyptians, the parchment manuscripts of the Greeks were the first vehicles of information on which our ancestors recorded and tried to hand down to succeeding generations their experience of the world around them in drawings, cuneiform characters, and letters. However, many centuries had passed before man burdened with the load of accumulated facts started reflecting on the necessity of their selection and systematization and drew an unsteady but crucially important outline of future science.

It is known that science as a purposeful study of the laws of natural phenomena and society originated among the ancient Greeks; their inimitably original character of thinking and activity, as the British scholar John Bernal asserted, consisted precisely in that aspect of their life which we have termed the scientific mode of thinking. By this he implied not plain knowledge or the art of science but an ability to separate verifiable facts from allegations suggested by emotion and tradition. In this characteristic mode of thinking, the scholar writes, two different aspects may be differentiated: the rational and realistic, that is, an ability to prove a contention with arguments and a reliance on universal experience.

Science has since traversed a long path of difficulties and contradictions. But what does the experience of ancient peoples evidence? What is the part of their great heritage we must never forget? It is primarily their constant links with nature, their faith in the universal principle of life, their determination to proceed in their constructs from the organic unity of the world around them. Science and the arts in their views are friendly partners in the common process of creation and construction. For instance, in some hymns of 'Rigveda' the numerical correlation of the world order are in a definite analogy to music; the principle of harmony in the teachings of Pythagoras and his followers is science and music.

But it is not only the unity of science and the arts that characterize the cognitive activity of our ancestors. They actively used their knowledge to solve many sophisticated practical problems. The observatory on Mt. Id in front of Tenedos Island was built by Cleostrates not only for observation of complex sea currents in the Dardanelles but primarily to maintain the security of Milesian commerce. The excavations of Wiegand unearthed the ruins of the Hera temple on Samos Island reputed to be the pioneering creation of the art of construction engineering, and even a cursory look at the temple is enough to convince the viewer that its architects and builders had broad engineering knowledge and a mathematically accurate sense of proportion. This harmony baffling the imagination of modern man was praised in highly figurative style by the great Russian poetess Marina Tsvetayeva:

'We are asleep, but through the slabs of stone
We see a guest from heavens in a garb of petals
0 world, you need to understand!
A bard discovers in his slumber
The law of stars and the formula of life. '

Accumulation of knowledge, the emergence and development of spiritual and intellectual life appreciably changes ethics and customs. It becomes clear that whoever learns the mysteries of knowledge gets into his hands fantastic power by which he 'rules everything through all'. The problems of education are beginning to attract not only philosophers and men of letters but also politicians. Education is assuming a mass scale. Schools and academies are mushrooming. The intelligence of the ancients deserves admiration. They, as it seems to me, were aware no less clearly than our contemporaries are aware of the enormous significance of a high level of upbringing and education of citizens for the destiny of state, because upbringing and education shape human characters: democratic education serves democracy and recreates its structural order, while oligarchic education reproduces the oligarchic lineage with equal relentlessness. Time has proved the wisdom of Aristotle's phrase: "Superior education maintains a superior order'.

What do we see taking a cursory look at the ancient framework of civilization? It was built by outstanding architects and engineers; all of the most important elements of education and science have come down to us from hoary antiquity and preserved their significance to date.

The next epoch, the Enlightenment and the Renaissance, indisputably made a contribution. Here the palm of priority certainly belongs to Italy, the homeland of the Renaissance. Although the Russian philosopher A.Losev noted, evidently for a good reason, that the Italians themselves called themselves 'Renaissance' people, knowing nothing about similar epochs in other countries. However, if the Renaissance is interpreted as the awakening of a new social stratum and comprehension by the latter in this context of all the enormous possibilities inherent in education, science and information, the scholar was probably correct in saying that the Renaissance was practically omnipresent, in different epochs, with a different content, although Renaissance culture was in-disputably not-superior to the culture of Italy of the Renaissance.

Anyway, it was precisely in Italy that first European universities arose. Here learned academies and centers of world culture were born. Under its radiant skies Michelangelo and Leonardo da Vinci created their immortal works. The ruler of Florence Lorenzo Medici instituted Europe's first public library, the Venetian Republic adopted the laws on patents, the first in mankind's history. We owe to the Italian humanists the 'heavenly golden rain of ancient manuscripts' that has fertilized the soil of the New Times.

The book is the first and perhaps the greatest stage of the information revolution. It is clear than ancient manuscript scrolls could not lay the foundation for developing mass education. The invention of book-printing raised the institutions of general education to a height unattainable therefore. The reformer Luther translated the Bible and demanded that the authorities open schools for the enlightenment of young people in all cities and towns of Germany. The famous Czech educationist Jan Komensky wrote the 'Great Didactics', in which he expressed his desire to 'teach everything to all, comprehensively'; that is, he substantiated theoretically, as it were, the principle of democracy, encyclopedic knowledge and professionalism in education, in which many precious seeds of future educational 'harvests' were concealed. At a much later date, the great Denis Diderot would pronounce the wise words praising the book and education: 'People cease thinking, when they cease reading.'

All that prepared and predetermined the advent of a new epoch, the Renaissance. It was associated, in the first place, with the leaders of European thought and culture: Locke, Montesquieu, Descartes, Pascal, Voltaire, Diderot, Rousseau... This constellation of great names could be continued, but the most ponderous contribution to the school of modern science was made by Francis Bacon. He penned a number of outstanding works explaining the idea of Great Resurrection of Sciences, which laid the foundation, as I see it, for the scientific and technological and information revolutions of the future.

The great saga of human knowledge contain pages marked with a special sign, and I would list among them primarily those which contain examples of combination of the potentials of the human mind and technology. Of course, tools, instruments and machines have long been used by man to accomplish practical tasks. The new times, however, require new machines. Man fully realized how difficult it is to implement construction, pursue scientific research, handle commercial and trade deals, relying on the resources of the human mind alone, which, in addition, was extremely undependable as a 'data bank'. Death disrupted the threads of life and relegated to the abysmal realm of Hades many discoveries of great value, so the secrets of ancient masters were lost irretrievably. It was probably from the time of Daedalus and Hero of Alexandria, who sought to design machines with functions similar to those of living things, from the 'ring of Pascal' as his contemporaries called his calculating machine, from the summation and multiplication machine of Leibnitz that the first faltering steps were taken towards the modern world of machines and computers. The entire further history of human activity is inseparably linked with the development of means of selection, storage and transmission of information. The invention of the typewriter, telephone, telegraphy, radio, dictaphone, television, the computer, the modern means of overland and space communication are the stages and ways of the formation and triumph of the information age. One has the impression that all the people have adopted Norbert Wiener's contention to the effect that to live a real life means to live and have correct information.

But what does information mean today?

This is an enormous area of scientific knowledge associated with the reception, storage, processing, transmission and use of information.

Just as in the majority of sciences, in informatics it is possible, in highly conventional terms, it is true, since this is connected with the study and use of one and the same object "information" to identify two major directions: theoretical informatics and applied informatics.

In accordance with the modern conception of the structure of the subject of informatics, theoretical informatics, which is a mathematical discipline, makes wide use of mathematical modeling methods to process, transmit and use information, thereby laying the foundation on which the whole edifice of information rests.

Applied informatics presents an enormous choice of means of informatics, including informational computer technology, networks and complexes of electronic computers, technical means of communication facilities and computerized telecommunication systems, audio and video systems, multimedia systems, program software, computer and information media. Applied informatics is usually regarded as one containing information technologies of training, design, management of projects, processes and systems.

The development and advancement of the methods and facilities of modern informatics have allowed confident entry to the sphere of education and scientific research. It is precisely with informatization of education that we associate today the realistic potentials of building an open system of education to allow every person to choose his or her own trajectory of education; a radical change in the technology, of obtaining new knowledge by means of more efficient organization of the cognitive activity of students in the education process on the basis of such an important didactic property of the computer as individualization of the education process while preserving its integrity by programming and dynamic adaptation of automated educational curricula.

Perfectly new opportunities for teachers and students are opened by telecommunication technologies containing in their foundations global telecommunication networks and intellectual computer systems. Unification of such systems and networks already today makes the basis for the new infrastructure of the planet: *the infosphere.*

It is hard to overestimate the influence informatics has produced on the progress of practically all sciences. It has not only multiplied the possibilities of obtaining ever more complete knowledge of objects of study but has also caused the need for evolving a new philosophy of scientific research.

The large scope of the processes which took part in information technologies at the turn of the century, their growing role in forming the image of the present and future mankind makes one search for such examples in the outgoing century. Looking back and assessing all the achievements of the outgoing century, I shall venture to single out the main thing: the concept of relativity laid down by Albert Einstein, Sigmund Freud and Karl Marx in the material, spiritual and social worlds. Their brilliant insight gave mankind the possibility to realize that the world is not what it looks like, that we cannot trust the empirical perception of the concepts of space and time, good and evil, law and justice, the nature of human behavior in society. They restored to people an awareness of the fact that the concepts and laws reflect not only the objective reality of the material world but also the social world, of which Thomas Hobbes remarked as far back as the 17th century that 'all social laws of the state must obey the same rules as mechanics and geometry'. A violation of either of these inevitably leads to catastrophe. Unfortunately, the outgoing year gives us quite a few examples of oblivion of these fundamental truths which caused and is causing irreparable harm to nature, the world of living things and man himself.

The turning point between the two millennia is drawing closer. We shall soon see the departure of the 20th century which showed the world some features of a new civilization unknown before. Man made a breakthrough into outer space, descended far into the ocean depths, designed sophisticated machines like Hephaestus, harnessed thermonuclear energy and became its hostage, learned to use the wealth of nature on an unprecedented scale, but succeeded much less in healing the wounds caused to nature.

Indeed, what is happening in our period of the technogenic culture of mankind's development? According to estimates of paleontologists, during all the time of life evolution on earth about 500 species of animal and vegetable organisms have become extinct in succession. Today, their number is about two million. As a result of felling forests alone the total loss adds up to 4 to 6 thousand species a year. This is roughly 10 thousand times the natural background rate of their extinction before the advent of man. Simultaneously, the planet is actively 'colonized' by members of what may be called a 'technical population''. Today, about 15 to 20 million of different machines, technical instruments, devices, and structures augment the size of this 'population' each year.

Man has proved unadapted to this new rate of civilization development. This occurred not today but somewhere in the thirties and forties of the 20th century, when some outlines of the earning scientific and technological revolution, energy, outer space and information revolutions came into view. The Spanish philosopher Ortega y Gasset remarked on this circumstance in 1930, saying: 'Today catastrophe is visiting man himself who has become incapable of keeping step with his civilization. Growing civilization is nothing less than a painful problem. The greater the achievements, the greater the dangers of civilization.'

Since then, after 60-odd years, that contention has been corroborated hundreds and thousands of times. Our knowledge is becoming a 'Pandora's box' of its own kind, from which many ills escape to the world. The new methods of agriculture have caused 'green revolutions' which cannot continue without a gigantic supply of chemicals. The growth of the requirements of modem man has given birth to the gigantic consumer industry, this Moloch devouring everything without a respite or rest. Natural resources are being drunk up, cut out, landed as catch and destroyed with monstrous intensity. The power industry has become an inevitable companion of any developed country. It has caused an enormous number of disasters which may well end up in worldwide catastrophe. The indefatigable efforts of the best scientists have probed unable to protect the world against AIDS, mass diseases, alcoholism and drug addiction.

All this is evidence of the absolutely unsatisfactory state of public morals, educational philosophy and industrial technological practices. Society has, in fact, reconciled itself to the existence of a 'unidimensional man', professional training, a narrow lop-sided world outlook. Differentiation and socialization allegedly dictated by the logic of scientific progress are, in fact, pushing the world to the brink of catastrophe. Individual representatives of culture or the ecological movement are often simply helpless in their efforts to curb the instincts of the crowd clinging to a comfortable and pleasant way of life.

In this context, it becomes obvious that the entire system of knowledge of the world, man and society must be exposed to an agonizing revaluation. To a definite extent we shall have to return, although at a higher spiral of development, to the integral knowledge, philosophy and uniform order of the universe. In other words, to fundamentalization of education on the basis of organic unity of its natural science and humanitarian components. It is imperative to bring to a neat system not rejected by the world and man the entire aggregate of knowledge, religious faiths, cultures and technologies. It would be wise to begin from developing a universal model of a harmonious world. Man must see scientifically, visually, materially his interrelationship with the surrounding world. The culture of peoples, ecology, informatics, the study of countries, the study of religions, mathematics, physics, biology and other subjects must make up a program of knowledge of universal man, whose actions will have the aim and purport in gaining 'universal knowledge' and the 'integral world' described in their writings by Vladimir Vernadsky and other representatives of Russian cosmism. This process must be accelerated before it is too late.

Today, as, perhaps, never before, it is necessary to secure practical realization of the triad 'ecological upbringing - ecological enlightenment - ecological education.' All the parts of this triad are closely interconnected; they constitute the basis for cultivating an ecological world outlook in the population based on an awareness of the need to preserve mankind's environment necessary for life, which is now, in effect, the entire biosphere of the Earth.

No country, however modern and developed its economy, is capable of solving these problems facing all mankind. Here it is necessary to unite the economic, intellectual and spiritual potentials of the entire world community.

In my opinion these problems could be divided into two main groups. The first group refers to global problems in the development of human civilization, whose present stage is characterized by the existence of a number of grave crises: economic, ecological, energy, information, as well as a sharp exacerbation of ethnic and social conflicts in many regions of the Earth. The possibility of successful overcoming of these crises and conflicts, in the consensus of opinion, is determined to a significant extent today and will be determined to a still greater extent in the future primarily by the level of education and culture of society. Indeed, already today at the end of the 20th century the fundamental dependence of our civilization, the specifics and qualities of the personality which are created by education have become fully manifest. This is largely due to the fact that the instrumental possibilities of thinking of modern man have assumed truly. planetary scope. They contain unheard of opportunities and unprecedented hazards. What will prevail in real historical conditions will largely depend on education, on schools and universities. It is a risk but there is hope here!

There is, however, another group of reasons pointing to the need for fundamentalization of education. It is conditioned by the fact that the development of the world community in the last few decades has been focusing more and more obviously on the priority of the human personality in the system of education. According to modern concepts, the formation of a widely educated personality requires the solution of a number of interconnected tasks. First, it is imperative to harmonize the relations of man with nature by making him learn the natural science picture of the world and the problems of the biosphere and the Universe as a whole, understand the place of man in nature and on this basis solve the problems of ecology and, on a broader plane, of the noosphere. Secondly, it is imperative to proceed from the assumption that man lives in society and for his harmonious socialization it is necessary for him to become assimilated by the excising cultural environment through the study of history, law, culture, economics and philosophy. Thirdly, modern man lives in the conditions of a richly saturated information environment, so the task facing the educational system is to teach him to live with its current, to create the prerequisites and conditions for continued self-education. Fourth and last, the personality must be in accord with itself which requires a certain body of knowledge in the fields of psychology and physiology and acquaintance with literature and the arts. This sensation of modern man was forcefully expressed by the poetess S.Dvornik:

'The burden of trifling earthly cares is nothing.
Each bears them up in grief
But where to find the strength for the heaviest burden
The burden of one's own self?'

Thus, the necessity of solving both the global problems of mankind and of meeting the vital needs of the personality lead us to the idea of fundamental education.

The following question would be relevant: 'What must be the basis for this fundamentalization?'

Evidently, fundamentality in science and fundamentality in education. These concepts have features in common and differences, and the correlation between them changed in history. For the first time, the conception of fundamental education was formulated by Humboldt in the early 19th century, and it implied that the subject of such education must be that fundamental knowledge which it is precisely today that fundamental science is opening at its frontiers. Moreover, it was supposed that education must be directly integrated into scientific research. In the next 100-odd years this ideal of education was realized at the best universities of the world. In time, however, the rift between the ideal model and reality became more and more appreciable. The gigantic and ever increasing body of knowledge led to the necessity of their adequate structuration and reflection in educational disciplines which eventually turned fundamental education into an independent and major field of man's intellectual activity.

Therefore, to secure funadamentality and integrity of education it is necessary to achieve at first the same aims in the fundamental sciences themselves, since the differentiation of sciences in the 20th century reached a degree where specialists from different departments of what was formerly united science often cease to understand each other. In recent time, it is true, the situation has been changing, and integration and interdisciplinary trends have been coming to the foreground, but it is still a long way to the final solution of this problem. Therefore, scientists and educationalists are now faced with a task of first priority: to identify the integrity of each of the fundamental sciences, then to reveal the integrity of natural science as a whole and the entire body of humanitarian knowledge and, finally, at the next stage, to evolve the fundamentals of integral fundamental education.

The transition to a new educational conception, which is based on fundamentalization of education, is recognized by all as a fully mature task; however, determination of ways of this transition requires discussion and comprehension. In my opinion, this transition must not be reduced to a simple increase in the volumes of each of the fundamental natural science and humanitarian disciplines: analysis of the existing educational plans and programs indicates that the possibilities here have practically been exhausted. It must be a matter of qualitatively new aims of education, new principles of selection and systematization of knowledge, compiling of fundamental educational courses in each of the traditional natural science and humanitarian disciplines and their coordination with each other to achieve a new quality of education of the personality and society.

One of the key tasks of this new stage of development of education - the overcoming of the historically developed disassociation of the components of culture - natural science and the humanities - its overcoming by means of their mutual enrichment and a search for the foundations of integral culture at the new stage of the development of civilization. Inclusion of the cycle of general natural science disciplines into humanitarian education, and, accordingly, the cycle of general humanitarian disciplines into natural science and technical education must be a mayor element of this process.

The problem of including into humanitarian education elements of natural science knowledge is especially complicated in view of its novelty. Needless to say, this must not be a conglomeration of fragmentary and oversimplified information from different natural sciences. On the contrary, this must be integral conceptual courses in mathematics and natural science oriented towards forming elements of rational thinking and ideas of the modem scientific picture of the world and reckoning at the same time with the specifics of the mentality of humanitarian specialists.

The new educational paradigm reflects, in my view, the requirements of human civilization on the threshold of the 21st century. The further development of democracy and market relations, the achievement of harmony between the personality and society, in agreement with nature, is possible on a basis of broad fundamental and integral education capable of meeting the requirement of man for change in the spheres of activity through his lifetime. Advancement of the general standards of education of society, elimination of one-sidedness in its psychological principles will lend society the necessary stability, due tolerance in association between people and genuine freedom of thought and action to each individual. Cicero's wise and profoundly meaningful words will finally come true: "We are really free, when we preserve out ability to reason independently, when exigency does not compel us to defend ideas imposed on and, in a way, prescribed to us."

Under the new social and economic conditions, a new solution is found to the contradiction which has always existed between fundamental education and professional training. Orientation toward narrow professionals reflects the level of interpreting the social protection of the personality in the last few decades. Today the situation is changing. Real social protection is available only to a widely educated person capable of flexibly reorganizing the direction and content of his activity in connection with a change in technologies or market demand. Narrow professional training in some specific field must be gradually withdrawn from the education system and pass into the sphere of production and other professional activity.

It would be relevant to draw the attention also to the fact that man, society, the world community, and civilization in the process of development manifest more and more clearly their most essential, that is, fundamental qualities and features. In this context, it is important to set up such a system of education and such structure of education that would be capable of identifying, following up and introducing into the milieu of the students the latest scientific knowledge of these fundamental qualities. Consequently, it must be a question not of securing the mastering of all knowledge, because in our age this increment and renovation have assumed such rapid rates which cannot be assimilated by man for all his determination but of focusing attention on mastering the most essential fundamental, stable and lasting knowledge, lying at the foundation of the scientific picture of the present world represented by the world of outer space, the world of man and society, the world of human civilization and the global fundamental processes occurring within them.

The specifics of this educational system should evidently be expressed also in the fact that this educational system must be capable not only of equipping the student with knowledge but also, in view of the steady and rapid renovation of knowledge in our epoch, of forming the demand for continuous independent assimilation of this knowledge, learning the skills and habits of self-education, an independent and creative approach to knowledge during the full active period of life of the individual. Education should ultimately become such a social institution which could offer the individual various sets of educational services allowing continuous study, securing for the mass of the people the possibility of postuniversity and additional education. For this purpose, it is necessary: to diversify the structure of educational programs, according to each a possibility to construct the educational trajectory best suited to his or her educational and professional abilities. It should not be forgotten that the process of cognition must give people the joy of acquiring a new understanding of the word, the purport of life, and one's own place in life. C.-M.Taleyrand was right to allege that 'It would be stark madness, some cruel charity to want every person to pass all the stages of education.' From this it follows that of the major problems of the late 20th and early 21st century the key is the problem of searching for the relevant organizational structure of the educational system and its institutions which would secure transition from the principle 'Education for all life' to the principle 'Education through all life'.

Finally, the securing of perception of the modern scientific picture of the world requires innovation in the most important matter: the content of education and its structure. In the educational process priority should be attached to such scientific knowledge, means of education, educational technologies and methods, disciplines and courses which are capable of reflecting the fundamental factors of the ambivalent process of integration and differentiation in science, using the achievement of cybernetics, synergetic and other fields of knowledge arising at the junction of sciences and allowing entry to the systemic level of learning reality, seeing and using the mechanisms of self-organization and self-development of phenomena and processes.

Top priority here must be given to disciplinary and interdisciplinary courses, which contain the most fundamental knowledge providing the basis for forming general and professional culture, prompt adaptation to new professions, specialties and specialization's, which are the theoretical basis for the broad development of applied research and development. Consequently, it is a question of such knowledge that, firstly, is capable of forming a broad, integral, encyclopedic view of the present world and the place of man in this world;

secondly, it allows overcoming subject dissociation and isolation which at one time, in the 18th century, was normal and had a progressive character, because it allowed one to master the fundamentals of knowledge at the level of sciences which had already formed as such by that time but which were still standing side by side and had no strong interrelations and interpenetration, and today are becoming an ever more formidable obstacle in the way of evolving an integral scientific world outlook and learning the fundamentals of united human culture in its humanitarian and natural science aspects.

The adoption of interdisciplinary educational courses and knowledge would allow overcoming this dissociation, uniting in joint creative work both in the instruction process and in scientific research representatives of natural science, technical and humanitarian sciences, making them actively involved in the assimilation by students of an integral world outlook forming a broad view on the phenomena and processes in the modern world thanks to the advantages of integrated knowledge received at the junction of natural science, humanitarian and technical sciences and opening the road towards mastering the fundamentals of a united human culture harmoniously combining the natural science and humanitarian principles.

At the end of the 20th century, the trend towards the formation of the world community into a common whole, the transition of its members from confrontation, shooting and cold wars, and tensions towards rapprochement and cooperation on many global, regional and interethnic problems is becoming increasingly manifest.

These essential changes in the world community are providing the soil for ever more consistent advancement from national estrangement and self-isolation to interaction and cooperation in the world educational community as well, towards its formation into an integral whole, taking account of the ethnic specifics determined by the requirements, interests and aims of the relevant country.

Hence the need for pooling our efforts in developing and implementing professional-educational programs, developing academic mobility, crating national and regional banks of scientific and educational-methodological information capable of setting up links with the world data banks and resources of knowledge, supplying these banks with technologies securing access to the world telecommunication networks.

There is yet another crucially important social aspect generated by the development of modem society which merits attention. The entry of society to the post-industrial age sharply raises the status and role of an educated and highly cultured person, a creative person both in production and in the nonproductive spheres. This has been caused by the fact that with the existence of such advanced technology and high technologies which mankind has at the boundary between the 20th and the 21st centuries, their highly productive utilization let alone their creation and perfection are possible only with the availability of workers possessing such qualities.

Hence the great attention being given today to man, his culture, education, the development of his creativity and abilities, the provision of the requisite conditions for that, democratization of the productive and nonproductive spheres, humanization of the entire way of life of man. In this context, education development on humanistic and humanitarian principles in our day is becoming its most important fundamental quality on the threshold of the 21st century, each of us is trying to define the main features which will determine education in the coming millennium.

Education for the 21st century is called upon to be education for all. As our civilization advances further, people without an education are ousted beyond the limit of living conditions worthy of man. Therefore, infringement of the right to education, including its unsatisfactory quality lead to intellectual and cultural degradation of the personality, which is incompatible with stable development.

Education for the 21st century must have the ethical dominant at the core of its meaning. It is not only a matter of the need to educate the new generation in the spirit of peace, mutual understanding and tolerance. No less imperative, in my view, on the threshold of the 21st century is ecological upbringing and, on a broader plane, the evolving in each individual of global ethics and a global awareness of responsibility as the standards of principle for new humanism, for a new united and integral world.

Education for the 21st century is called upon to have a creative and innovative character. In the world where change has become a feature not only of scientific and technological progress but also of the way of life of the masses, schools and universities are in duty bound to pass on to the new generations knowledge accumulated earlier and prepare them for the solution of problems the individual and society have never confronted before.

Education for the 21st century must be built on scientifically substantiated knowledge. Only on this condition will it be capable to form the personality possessing knowledge and capable of theoretical and critical thinking. Education where science is subjugated to ideology, manipulative pedagogical technology, narrow pragmatism are fraught with serious danger of deformation of man, turning him into a blind functionary who has practical skills but no ability to think and hence irresponsible.

Finally, education for the 21st century must be multiform, adequate to the cultural and ethnic diversity of mankind meeting the all-round requirements of social, professional and confessional groups, as well as individual spiritual requirements.

In a situation of snowballing information growing like an avalanche the problem of determining the principles of selection and systematization of knowledge become highly important. For this we have to seek new forms of their synthesis and perhaps again draw upon the great ideas of encyclopedism. The answer to these question cannot be simple and unequivocal. They will take time to be discussed and comprehended. This Congress has a special role to play in this matter.

I hope that in the 21st century in the field of international cooperation the value imperatives will be linked with the formation of a common educational space of which C.-M.Talleyrand spoke almost two centuries ago, justly alleging that 'Education is, indeed, a special power, whose field of influence cannot be determined by any one person, and even national power is not in a position to set its limits: the sphere of its influence is enormous, endless...'

Today this major power is showing the world lofty examples of its 'state' organization where irreconcilable contradictions and the furious heat of passions are resolved not by force of arms but by force of the intellect.

Dear colleagues!

I believe I would not be mistaken in expressing my confidence that the 2nd International Congress of UNESCO 'Education and Informatics' is an exceptional event in the life of the entire world community, because the path it will follow in the next millennium will largely depend on the results of this Congress. I wish to believe that the next millennium will bring all the peoples peace and accord, the realization of their bold hopes and aspirations, the triumph of lofty intelligence and noble human spirit.

Let us base our unity on the prophetic words of the great Russian scientist and humanist Ivan Pavlov: 'My faith is faith in that the progress of science will give a happy life to mankind. '

Thank you.

The original is presented in Russian and English

NEW PERSPECTIVES FOR LEARNING IN THE INFORMATION AGE

Colin N. Power

ASSISTANT DIRECTOR-GENERAL FOR EDUCATION, UNESCO

Mr Kinelev,
Deputy Chairman of the Government of the Russian Federation,
Mr Sendov, President of Bulgarian Parliament,
Members of the Bureau, Distinguished Participants,
Ladies and Gentlemen!

Education is undergoing a revolution as profound as any since the invention of printing. New information technologies are transforming the perspectives for teaching and learning in all societies. They offer students the possibility of assuming greater control over their own learning, of working more effectively and at their own pace. They place at their disposal a wide range of information sources, scarce expertise, the net, virtual reality, and resource materials. They free teachers from whole class lecturing, enabling them to help individual pupils and become managers of class learning, rather than solitary information providers. The new technologies have the potential to enable us to reach the unreached, by eliminating frontiers and barriers to knowledge created poverty, distance, family circumstances, physical disability and the formal education system itself offering new possibilities for interaction and communication among students and teachers.

You will not be surprised to hear me say this, you yourselves said as much at the 1989 UNESCO Congress, and I am sure you will be saying it here again in Moscow. Yet technology is still only delivering its potential in a very small proportion of the schools, colleges and training departments of the world; and we have yet to prove that it could do more, that it is the powerful and beneficial agent for change that many of us believe if could be.

In part this is because of money. We all know of the huge asymmetries in educational spending between countries. Average expenditure per pupil at all levels ranges from some $4,200 per annum in the industrialized countries to $220 in the developing countries and a mere $38 in the least-developed countries. Even within a well-off nation, there can be a difference in spending between institutions from over $9,000 to less than $2,000 per student per year. However, overall education expenditure does not necessarily rerlect the priority given to technology by government and administrations in their budgets. Equilly, a large expenditure on technology is not always reflected in the quality of education provided.

It is in fact very difficult to find out just how cost-effective the use of technology is in different educational and cultural contexts. Most statements made about the cost, power and impact of new imformation technologies (NITs) are not based on sound research. What there is, is too often left unread, or ignored. Educators have too many pushers of panaceas to their problems, unsupported by sound data. One of the objectives of this Congress is for us all to collect sound data on policies and programme from each other, and to get some ideas as to priorities for new research and development and to plan how we may better share it. UNESCO is exploring with the Russian Federation the establishment of an Institute for Information Technologies in Education. With this in mind, the Congress may wish to advise us on the needs which such an Institute may serve.

Those of you who were at the UNESCO Congress in Paris in 1989 resolved that there was a need for a greater equity in the provision of, and access to, NITs for the learners of all nations. Part of this was to be achieved through the sharing of practice and expertise, and we have made some progress in this. UNESCO, with the assistance of IBM, has set up an education server on which information on UNESCO's education activities and those of its Member States, NGOs' (e. g. Education International, ICDE, ICET and ICASE) is available on the Internet. You will be hearing more at this Congress about how we would like to develop this service, and we hope you will have ideas to give us on how we use it to support the professional and information needs of teachers and educational institutions.

It is important that this Congress generates concrete plans for action and does not remain at the level of generalities. In spite of all our endeavours in 1989, the difference in provision of and access to NITs between the haves and the have-not nations is greater than ever. Because the West has been largely responsible for the development of the technology and the software, and courseware to goto go with it, it is also a fact that Western cultural values increasingly dominate NITs. Not the least part of this dominance is through the use of the English language. This tends to increase the difficulty of universal access and may lessen the desirability for the provision of the technologies.

There is a very real concern that NITs may lead to a homogenization of education, a loss of individual cultural differences and moral and ethical degregation – racism, pornography, violence - as well as the treasures of the Hermitage are made accessible through the net. We must consider at this Congress, how we can use the technology to help preserve our intellectual and moral values and difference as well as allowing us all a better understanding and knowledge of our different cultures. A powerful technology dominated by any one set of values could become divisive, but the technology has an intrinsic potential to become socially cohesive to unite the edicators of the world if its use is sensitively planned. Personally I would like to promote the co-operative developent of multimedia interactive packages on cultural and natural heritage sites. Chfidren should learn about their own heritage first, and then about sites of other countries, with the help of multimedia packages. I am sure that the problems of what could, at worst, become a form of cultural imperialism will crop up throughout the Congress, but especially when you are considering the theme "Social, Economic and Cultural Issues".

Another dominant force in the development of new technologies are the manufacturers of hardware and software. Education is generally too small a spender to innovate for itself. It usually has to rely on development for another market, often the comparatively rich consumer of business markets, and then gives its attention to adapting these developments to the needs of education. Technology is changing at a rapid rate and there are always pressures to buy the latest productions least from the salesmen and women. How can UNESCO help protest small developing countries and help provinces and institutions in decentralized systems make wise purchasing decisions any implement sound informatics policy?

Education needs to consolidate new ideas. We cannot afford to change the curriculum - with all its surrounding paraphernalia of tests, textbooks, examinations, in-service training for teachers, resources for learners - as frequently as a computer company changes its operating system. We need to achieve the difficult reconciliation of stability with progress and look carefully at the implications of all changes. It is used to be a maxim that a new method had to prove it was better before it should be adopted. We must consider the cost of change - the cost of training as well as equipment, the running costs and the cost to teacher confidence. This Congress should share experiences relating to teacher professional development and perhaps resolve to continue to share them electronically after the Congress. Through the technology could we not agree, for example, to share and become mentors for each other's training courses? And we should examine ways by which we can work with the manufacturers to plan our changes. Perhaps we at UNESCO could act as an honest broker and facilitate co-operation between formal education and the private sector - the producers of hardware and educational software. We could as well via the net, promote the co-development of software and open learning system and sharing of materials across countries. Do we need an educational alliance which makes quality educational software available to LDCs as cheaply and freely as some push soap operas and videotapes? How?

We cannot to dismiss all that has gone before - both research and practice. There is a tendency at gatherings like this only to value the new - the cutting edge technology. The traditional technologies and teaching methods can surely be mixed with the new, giving variety and power in the process. And if there is no option of suitable teacher, let alone a variety of technologies available to meet a learner's needs, distance learning can play a very important role in sharing expertise around the world. What then do we know about the optimal combination of teachers and technologies to meet particular educational objectives? How do we bring policies of ministries and institutions relating to personnel and technology together?

It was to explore the rapidly developing possibilities in this domain that UNESCO created its *Learning Without Frontiers* programme, which is now an important element in its *Education for All strategy.* Many potential learners - including the estimated 880 million adult illiterates and 130 million out-of-school children - cannot be reached by conventional means due to constraints of time, space, age and a variety of socio-cultural circumstances. In the framework of Learning Without Frontiers, UNESCO is exploring ways to "reach the unreached" – particularly women and girls - any to make lifelong learning feasible, using the new technologies, often in combination with existing ones.

UNESCO is particularly consemed to ensure that the information revolution does not serve to widen the gap between the haves and the have-nots, between those who are and those who are not connected to the information superhighway, between those who have work and those retrenched and placed on the scrapheap by the market. In this connection, the *Joint Initiative on Distance education of the Nine High-Population Countries,* which UNESCO co-ordinaters, is of particular importance since the countries concerned comprise half the world's population and almost three quarters of its illiterates.

The use of new informations technologies in education is of course dependent on the general level of such technology within a society. UNESCO's Major Programme IV is focused on capacity-building in the developing countries in the fields of communication, information and informatics. Through its International Programme for the Development of Communication (IPDC), General Information Programme (GIP) and Intergovernmental Informatics Programme (IIP), it is applying to these interconnected fields the principle of the "free flow" of informaton. At the same time, its action is focused on the interface with informatics in other fields of its competence: in science, where for example it has recently organized with ICSU a major conference on electronic publishing; in culture, where it is exploring the potential of multimedia technologies for the promotion and sharing of the physical and non-physical heritage; in the crucial field of libraries, where it is promoting computerization and networking processes that are currently calling into question traditional notions of the library. All these diverse actions are clearly highly relevant to the relationship between education and informatics with which this conference is concerned.

I should emphasize here that we are not talking about education for education's. Education is the single most effective means to curb population growth, eradicate poverty, child mortality and foster democracy, peace and sustainable development. Education means empowerment: the individual empowerment that comes from knowledge and an expansion of personal choice; and the collective empowerment that comes from liberating the creative potentials of individuals within society. The new information technologies offer the prospects of multiplying the power of education by revolutionizing delivery systems and placing at the disposal of all a fabulous tool for self-directed lifelong learning. By the same token, they open up possibilities for more active and democratic citizenships and for greater international solidarity based on knowledge and understanding of other peoples and cultures and rapid transfer of scientific and technology knowledge and expertise.

In its recently published report, the International Commission on Education for the 21st Century chaired by Jacques Delors suggested that UNESCO should create an "observatory" to explore and ponder the likely impact of new technologies on human freedom and development and on educational and learning processes in particular. I would support this idea and will be pleased to have your views on the value of such an initiative. You might also care to pronounce on the Commission's suggestion that UNESCO should act as a clearinghouse for information on educational software, and that it might consider a prize or issuing of quality for such software, and encourage the production of software that respects cultural diversity.

Ladies and Gentlemen!

You have a very full agenda, and think I should not any further to the large number of questions that you have consider over the next five days. Personally I would like to promote the co-operative development of multimedia interactive packages on cultural and natural haritage cites. Chidden should learn about their own heritage first, and then about sites of other countries, with the help of multimedia packages. I hope that you will take take away from this conference valuable new ideas, information and contacts and that the end result of your exchanges will be to help harness the potential of the new information technologies more effectively and more equitable to the goal of lifelong education for all.

The original is presented in English

NEW DIRECTION IN EDUCATION

Norio Matsumae

PRESIDENT OF TOKAI UNIVERSITY (JAPAN)

The contents of this speech consist of six parts:

1. At the present turning point of human history, a new concept of human values based on reflection upon traditional concepts should be created for the purpose of discovering a new direction in education.
2. A basic idea on the new target of education to be created in due consideration of Japan's post-war education is discussed.
3. Adequate consideration is given to the past educational vitality in Japan in the course of pursuing the history of education in this country. Particular emphasis is placed on the reality that the tension between national and private schools encouraged the vitalization of education in Japan.
4. Attention is directed to the fact that such a confrontation also helps vitalize society in another way in the recent introduction of advanced information technology into education.
5. The relationship between a highly advanced information-and-communication system and traditional culture, created in certain situations, is crucial and involves some dangers which might lead to suppression of traditional culture. Consideration is given to how education should respond to this problem.
6. Final discussion is made on the advantageous utilization of the current high technology of information in higher education in the next century, with reference to "remote-sensing education" by use of a satellite in Japan. Also, a comment is made about the expected form of universities and their responsibilities in this new age.

Mr. Chairman, I want to express my appreciation for having been given the opportunity to speak at this important meeting of the 2nd UNESCO Congress on Education and Informatics. My talk consists of 6 sections, and I would like to start with what is required as the new direction of education.

1. Required new direction

Most people of the world have had the illusion that the ideal system that they must pursue is to have a nation that offers superiority in terms of political, economic, or military power. They have believed, and have wanted to believe, that such a system offers "happiness" or "life worth living." In September of 1988, with Tufts University, of the United States, presiding, a University Presidents Conference was held in TALLOIRES, France. It was still in the age of East-West confrontation, but we had an experiment of satellite communication between TALLOIRES and Moscow. In that meeting, I made the following proposal: More often than not, a claim for peace starts by promoting fear and suspicion. I regard this as an undesirable method designed to appeal to the aggressive nature of man, and therefore it is important to control our natural aggressive animal nature by means of our intellect. In the contemporary world, frustrations accumulate at highly complex levels, making it impossible for even a simple method of war to bring a solution. Further, more difficult problems that are even harder to solve have developed through the accumulated energy of social, cultural, and ethnic disorder. What is important to realize is that the current situation is like trying to chip off the tip of an iceberg, you only find a more complex body as a result. Along this line of thinking, I think we must realize that the change we face now is one triggered by the breakdown of conventional problem solving methodology that could touch upon a very deep segment of human history.

It is therefore evident that we are required once again to answer the basic question of what education is. Many of our discussions of today on the subject to reevaluate education, however, tend to focus on structural revolution, not to reach the required depth to enlighten our basic question. Furthermore, the majority of such structural changes follow the model system of industrialized nations, whose very sense of values is responsible for the troubled situation of modern society.

If we want to reevaluate educational values for the 21st century, we must evaluate the kind of world and society we are creating and what kind of life we should pursue, rather than ask how changing technology or society would .affect education. Therefore, the precondition to our effort to create a new educational system is the difficult task of clarifying the changing direction of society.

Our basic task remains unchanged: We must foster talents that will ultimately play a leading role when a new society emerges or is about to emerge, even though they are inevitably exposed to the effect of various changes during the process of such change. This is clearly the very critical mission of today's educational system.

When we are determined to offer education for the coming era even at a certain risk, we still cannot escape from the aspects of "life worth living", "spiritual richness", and "human association". These are the values that have been pushed back behind the objectives of seeking growth in a money-conscious society, and thus have remained in the background of educational objective-setting.

Today, the past industrial society's system of pursuing wealth and notoriety is fading; it is being replaced by placing importance on the association between individuals and society, which is ushering in a new social system based on quality of life.

Based on my observation as I have just explained as background, I would like to compare the society of today and one of tomorrow, taking Japan as an example.

2. A society that offers answers, and one that doesn't

Many of you might consider Japan as one of the most successful examples of capitalism, but it is paying the price for collapse of its bubble economy and an international dispute regarding unbalanced trade, due mainly to its having put too much faith in the market mechanism. There, we see a tendency of excessive emphasis on the absolute value of "efficiency" of industrial activities, regarding the value of man only as an effective labor resource. For efficiency of manufacturing, in particular, man's ability needs to be uniform, rejecting differences among individuals as a disturbing element of the manufacturing mechanism.

Labor of uniform quality as a structural component of a so-called vertical society, has also become accepted by labor unions as the basis of assuring equal treatment.

It is true that a uniform quality of labor has made a remarkable contribution toward industrial growth within a capitalistic society, making if possible for individuals to achieve a certain level of success within the Japanese-style vertical society, where there is a reasonable chance to live a stable life, and encouraging them to strive for a goal that they can feel is achievable. Their effort to achieve a definite goal tends to offer them spiritual stability, thus offering them "happiness."

Today, however, we should consider this pattern to have almost entirely collapsed.

In today's Japan, however, the educational revolution is now being moved forward quite energetically, and there has been an effort to try to take a major step to change the direction of basic educational activities.

3. New axis of education

I am not necessarily saying that the Japanese traditional system of education should be regarded as a problem-filled failure.

The Japanese educational system, prior to modernization, or more fittingly prior to Westernization, operated along two solid axes.

One was the educational system seen from the side of power (the Shogunate and/or Feudal Clan), based most typically on the teachings of Confucianism or Chu-tsu, and the other was that seen by the general public, for practical wisdom and knowledge based on the doctrines of Wang Yang-ming.

The system seen by the general public in particular played an important role as an educational function that supported Japanese society. In the latter half of the Edo era from the second half of the 18th century, Western learning, focused on experience and proof, proved useful in passing on new knowledge of Western science and technologies (Dutch medicine and the art of war, for example), as well as the private school system, in which students gathered under famous scholars that had contributed to the modernization of Japanese society. This strong magnetic energy, coming from the two axes of governmental and private educational systems, seems to have been handed over to modern and contemporary Japanese society.

After the Meiji Restoration, the second half of the 19th century, one educational axis was formed, centered around the graduates of imperial universities, as the gateway for success to be national leaders, namely government officials.

On the other hand, private schools, such as Keio Gijuku University founded by Yukichi Fukuzawa, Waseda University of Shigenobu Okuma, and Doshisha University of Yuzuru Niijima, emerged, creating a competing energy of two equal powers in the Japanese educational system. Accordingly, it can safely be said that the relationship between governmental and private educational systems of Japan is quite different from that of other countries.

Under these movements of today's Japanese educational world, we should not lose sight of another new axis being formed. It can be expressed as "tension" between the educational possibility offered by high-level information technologies and the way of education focused on the axis of human association.

4. Education and high-level information technologies

As to the issue of education and high-level information technologies, many of us have suggested, with high expectation, that a new educational pattern is being formulated by means of the progress of high-level information technologies. I for one agree that such a trend is too important to be neglected.

In Japan, "The Interim Report on nationwide propagation of the University of The Air," by Hoso Daigaku Gakuen University, said that 80 million people of age 18 and older can receive lectures from an university of the air, of which it is said that 30% are actually interested in subscribing to such education via broadcast waves. If the communication satellite (CS) is used in addition to the broadcasting satellite (BS), the alternatives and educational media to accommodate learning needs via satellite will be expanded dramatically. Because there are no national boundaries in satellite information, it has indeed been recognized as the media of choice to accommodate global requirements.

It is also important to recognize the concern that, to accept it passively may be to swallow unique cultural methods that have been fostered among local societies and organizations solely by means of dominance; that the new-image culture may force local cultures or special tastes of each home to become homogeneous; and that, though mutual understanding will be promoted through equalization of each of the varying factors based on confrontation and change, it in turn may result in a gradual loss of power to create a unique culture.

This line of thinking leads us to ask what role can education via broadcast waves be expected to play in the entire spectrum of educational objectives?

It is true that the propagation of knowledge is one important factor of school education, but it is not the only one. The ultimate objective of education must be to extract the maximum possibility based on the unique individuality of each person, not to standardize individuals of various kinds. Meantime, high-level information technologies will make it possible not only to use them for knowledge learning, but also to replace the existing curriculum of educational institutions with information via broadcasting media. On January 12 of this year, there was an experiment of distance education between Tokai University and King Mongkut's Institute of Technology Ladkrabang of Thailand, in which we had a session on an engineering experiment, and it proved that, with proper preparation by both parties, distance education, including basic experimentation, via satellite is quite possible.

The value of education is to lead and vitalize individuals toward the direction that best fits each of them, as well as to propagate knowledge. The specific actions that we could take today may be to review the educational system that we have left almost entirely to the care of school education, propagate information and technologies, offer training, and make use of various methods of human development; namely, the propagation of knowledge and technologies via broadcast waves, and reorganization of human association by means of screening into a new form of educational program.

It is possible in the future that various media will replace the university lectures of today. And the university will be required to offer many variations in curriculum, based on the individual needs of the students receiving the information. This is very similar to the prescription offered by medical institutions.

5. Advanced information communication and culture

Today, a new form of information system for the 21st century concerning the various media of the year 2000 has been the focus of active discussion. I would like to touch upon the issue of advanced information communication and culture as my next subject. Japan and many other countries have been used to thinking that broadcast waves crossing national borders represented a problem of territorial violation. In many such countries today, however, effort is being made to try to change for the future by dropping the policy of closing, and establishing a new set of legislation for appropriate information control. An argument that should also be noted is emphasizing the importance of protecting the uniqueness of each culture.

What can definitely be said is that information does not necessarily assure the quality of culture and life, and it should be noted that information of advanced quality in and of itself does not possess any social meaning of any value. In other words, we can say that information "becomes valuable only through the action and thought of a receiving human being."

Regardless of what we think of it, a new generation of communication networks will be developed under international cooperation with high priority, which will most definitely and strongly advance information without boundaries. If we let it progress purely from the standpoint of technological advancement, the risk of squeezing culture to death will inevitably increase. It will become even more dangerous if and when the technology should be built into the method of education.

6. What is required of a university?

I would like to cover the last subject of my speech, what will be required of a university in the coming era. If the use of multimedia should firmly establish itself within college education in the future, it would mean that a substantial part of knowledge propagation of education will be provided by new media. As a result, the mainstream of college education will focus on experimentation, practice, and seminars, while the mass class method, which has symbolized conventional school education, will gradually disappear from the scene of college education, except to reflect the special curriculum of a specific purpose of each school. What will be required of us is to teach the ability to select from and critique/evaluate a huge amount of information, use and digest only that which is useful, and at the same time to acquire new technology to create beneficial information for exchange.

In Japan, the Ministry of Education is now aggressively advancing a project called the *Space Collaboration System,* with a plan to implement the system for operation as of October this year. This is supported by the approval of a governmetit expenditure of 5.2 billion yen in the 2nd supplementary budget of 1995, to be followed by a substantially larger budget in 1996. The system will link 36 national universities and 8 technical colleges, with anticipation of covering private universities within a few years as well. This would mean that the installment cost of satellite terminals can be covered by the large investment subsidy, and the cost of satellite use is considered to be handled exclusively by the "National Institute of Multimedia Education" which is an organization to be mutually shared by private and national universities. Along with this, many research projects are being actively worked on, including "Research on educational exchange among universities using satellites," "Comprehensive research on utilization of academic/educational image and audio materials," "Research and development of internationalization of high-level education by the use of media," "Research on making and directing technique of broadcasting programs on research and development," "Research and development on directing technique and production systems utilizing various media," and the like. What is remarkable is that the importance of software development for educational purposes, more so than that of hardware technology, has been increasingly recognized, and universities are being asked to take the lead in research efforts in this area. I cannot over emphasize the importance of this trend. We will have to take immediate actions to develop producers who can create high-quality information on various educational materials needed.

At any rate, universities from now on will be expected to become gatherings of various people which stimulate interest, offering functional services to experiment, think, discuss, and stock information, and opportunities to develop intellectual and technical abilities. The university will become a place that offers not only the benefit of mutual stimulation, but the opportunity to develop new humanistic energy through various group activities of people.

In this way, universities will have to evolve to the starting point of education. Namely, what is important in education is to "activate people" as its basic goal, offering an atmosphere of mutual stimulation through group living; in other words, giving the actual experience of learning together to achieve education's ultimate objective.

What people will expect of universities through their lifelong association will be for them to function as a place of regeneration of knowledge and spirit, and ultimately a place of "life worth living," where educational practice will evolve to become a serious face-to-face association, as was seen in the world of ancient philosophers and traditional arts. I am convinced that the value and attractiveness of a university will be determined based on these factors, plus the reliability of the group as a whole.

With this point as my summary, I conclude my presentation.

Thank you very much for your attention.

The original is presented in English

Part II

Theme 1

LEARNERS

PLENARY

LEARNERS IN A GLOBAL KNOWLEDGE SPACE: TOWARDS GLOBAL WISDOM

Blagovest Sendov

SPEAKER OF THE BULGARIAN PARLIAMENT

I. INTRODUCTION

At the eve of the 21st century we are facing a dramatic change in the world that might be entitled as Removing the Walls - *both in political and technological sense. The power of the new Communication and Information Technology (CIT) is influencing human life and economy so deeply that makes all of us learners both as individuals and members of (real or virtual) learning communities and learning organizations in a learning society.*

Learners need Information to know, they need Knowledge - to make decisions and act, and Wisdom - to decide, act and take the responsibilities for the consequences of their actions. We should target our education and training towards building an Information Society where minds and technology work and learn together in a global knowledge space. *Global knowledge space - ground where* global wisdom *can grow. Now, one of the most important tasks of UNESCO, European Commission (EC), International Federation for Information Processing (IFIP), and other international organizations is to* seed *global wisdom, to cultivate it and to ensure appropriate political, social and technological climate for its growth.*

The Information Society built upon global information world-wide networks offers new challenges for policy makers, researchers, educators and learners. The European Commission White Paper Teaching and Learning: Towards the Learning Society *approved by the Commission on November* 29, 1995, *states that tomorrow's society will be a society which invests in knowledge, a society of teaching and learning. The Report to UNESCO of the International Commission on Education for the 21st Century:* Learning: The Treasure Within [8] as *well as the fact that the Second International UNESCO Congress* Education and Informatics *and the IFIP World Conference Teleteaching'* 96 Practicing What we Preach, *are held during the European Year of Lifelong Learning (announced on 2 February 1996 by Commissioner Edith Cresson) shows the concern of UNESCO, EC and IFIP in ensuring conditions for a* world-wide *diffusion of a technology driven educational reform. A reform which would let learners all over the globe get access to the world's cultural heritage and to locally unavailable educational services, expertise and resources.*

2. INFORMATION, KNOWLEDGE, AND WISDOM IN THE ERA OF DIGITALIZATION AND COMMUNICATION

The main branches of the Communication and Information Technologies (CIT) deal with storing, processing, transmission, and presentation of information. The notion *information* is as fundamental as the notions *matter* and *energy.* There are purely theoretical and philosophical problems associated with the enormous acceleration of the computer power and the capacity of the telecommunications.

The information itself always uses some material medium, but it is not identical with this carrier. One of the pillars in the progress of information processing are the technologies ensuring high ratio between the unit of information and the amount of matter needed to carry this information. There is a tremendous advance in these technologies, based on deep knowledge of the physical sciences for the structure of the matter. The efforts to develop high performance computers are connected with attempts to reach the ultimate capacity of the human mind. Today computers, parallel computing systems, and telecommunications are the basic instruments for processing and providing of information. They ensure conditions for technology and minds work together, and the ultimate capacity of this synergetic system could be much higher than the capacity of a single mind. To have more clear view for the perspective to reach this goal, we have to know more about the different categories and structures of the information and its representation in the human mind.

Information could have different degrees of structure. Information with lowest level of structure is called data. Knowledge is defined usually as structured information. At the present moment, we are making a tremendous progress in developing instruments for storage, processing, and transmitting of different forms of information, but the advance in defining and understanding different levels of informational structures is not so fast. If we compare the development of information sciences and material sciences, it is obvious that we are only at the beginning of differentiating levels of information structures and related information sciences.

When trying to understand the work of human mind we might successfully employ the informational metaphor. For instance the *Information Processing Theory* [18] and the *Information Pickup Theory* [13] became general theories for human cognition and perception. Some other theories look at the human mind as a computer, processing information. There is nothing wrong to compare the function of the human mind with a computer, but it is wrong to believe that human mind works with the same structures of information as the computer does. A deeper understanding of different levels and categories of information structures will help us to better adapt computers and humans work together.

The received information in the human mind evolves into knowledge. One and the same information builds different information structures (different knowledge) into different human minds. The learning is often identified with memorization. In fact the effective learning is an active process of transforming information into usable and applicable personal knowledge. *Wisdom* is a special quality of information which has not been widely discussed so far. As the knowledge might be expressed by human decisions and actions, the wisdom might be expressed by wise decisions and actions. Wisdom is a higher level of information structure than knowledge and we should include this category info our educational objectives.

The recent advances in the CIT are related with the digital networked multimedia systems. Digital multimedia is the field concerned with the computer-controlled integration of text, graphics, still and moving images, animation, sounds, and any other medium where every type of information can be represented, stored, transmitted, and processed digitally [12]. The digital coding and networking make possible the use of an universal representation of all forms of information, to reproduce this information with low cost and error-free transactions, to ensure unlimited storage, to rapidly transmit any type of information to any user in any time. The main scientific and technology advances that made advent of multimedia systems possible, are *data networking, higher processing power and memory* density of computers, sophisticated *data storage and compression algorithms.* Looking back at the communication and information technology history we could clearly observe that the main attention of researchers and technologists has been gradually moved from hardware to software, next - to human-computer interface, and now - to social issues related to global communication and collaboration.

The school will no longer be the sole nor the most attractive source of information and knowledge [25]. Quick and unhindered acquisition of knowledge in a pleasant atmosphere will be widely provided by TV, Radio, and, hopefully very soon - by means of the *information superhighway.* Internet, video-phone via existing TV, digital and interactive TV, multimedia electronic messaging, electronic conference (asynchronous or on-line), computer-supported cooperative work systems, pay-per-view digital video programmes on demand, full movies on demand, remote group computer games, generalized access to public Internet servers, topical news on demand, teleteaching, teleshopping, telebanking, teleticketting.

Among the most important changes nowadays is the *enormous information overload* of individuals and organizations due the low cost of multimedia information production and distribution and the diversity of distribution channels available. The information overload problem is being transformed to an *information overkill* problem as the filtering of the great volume of information can not be easily made and only small amount of information can be transformed into usable knowledge. The competitiveness of individuals and organizations highly depends on their ability to rapidly transform the information into applicable knowledge, which should be selectively distributed and used for just-in-time decision making and learning. Networked multimedia and hypermedia offer new opportunities for facilitating knowledge acquisition by activating more human senses. According to recently reported data humans retain more than 80 % of the information they are exposed to, if they see, hear, and do at the same time [6]. These opportunities could be provided by a new generation *intelligent and highly interactive multimedia and hypermedia learning environments* built upon *learner centered educational models.* The computer literacy should be extended to a *multimedia literacy* related to the students abilities *for reading, writing, and communicating with digitally encoded materials* - text, graphics, still and moving images, animation, sounds. To make use of the new opportunities offered by the CIT the educators should re-design the educational system as a whole. In a world with powerful instruments of producing and getting access to any kind of information at any time and any place, the content and the structure of the knowledge of the people able to effectively use this information have to be different from the one obtained through today's educational system [25].

3. NEW EDUCATIONAL REFORM - REFLECTIONS ON AN EDUCATIONAL EXPERIMENT

From 1979 to 1991 a large scale educational experiment lounged by the Research Group on Education (RGE) was carried out in twenty nine schools in Bulgaria [22, 27]. The main philosophy was centred around the assumption that due to the advent of mass produced microcomputers the educational system should be reformed as a whole. As a subject of education was considered not simply the student, but a student equipped with a microcomputer and the students capabilities and the machine power would complement each other [26]. The main educational principle was the principle of integration of school subjects. When this principle was applied the students could see the objects and phenomena in the world from many sides and could get better knowledge and understanding of them. They solved many problems by looking for answer in various fields of human knowledge. The students took on the role of researchers, who observed and measured, created and revised hypothesis reaching scientific generalizations and forecast, which were the first steps to formal knowledge.

During the classes different activities were mixed and followed each other, in a mosaic that kept the students interests awake. The students learned by themselves from richly illustrated and aesthetically designed textbooks, used a lot of reference materials, solved problems, designed, drew, played, sang, worked on computers. The textbooks were trying to give systematic information as an alternative of the unordered information coming through many channels and media.

The new task of the school was defined as not to teach only but to teach how to learn by yourself. The students were shown that knowledge was infinite, ever changing, that nobody could possess it totally (including the teacher). Learning was defined as an active process. Another principle applied was the principle of non-explicitness, i.e. the students were not supposed to receive ready made knowledge, but they were stimulated to discover it in the process of satisfying their natural curiosity. The interaction between students and teachers was considered as a way out of the information overload. The teachers and learners were given more degree of freedom, but increasing their responsibility.

Informatics and its integration info all school subjects and activities was a powerful mean for realizing all mentioned principles [20, 27]. Informatics interferes and in this respect *changes the contents of learning* [26, 27]. A *learning environment in informatics was* created as an integrated complex of computer equipment, information resources, educational software, textbooks and other learning materials. Although the computer resources were limited some innovative approaches of school activities were introduced [21], e.g. *working on a project, collaborative learning, dividing students into groups of different size, collective discussions, experimenting in mathematics, filling up a database, language games, publishing a student magazine, students' software house, teaching students in a university laboratory, competitions, a final students' computer performance,* etc.

The described educational experiment might be considered as a model for a computer-driven educational reform. The trial did not change substantially the Bulgarian educational system as a whole because it was not ready for such dramatic change. But it gave rise to several educational initiatives and projects both at school and university settings. An *exploratory learning environment in geometry* [29] and a set of *integrated textbooks on mathematics and informatics* for 8-12 grade for the general educational system was written as well where most of the mentioned principles were applied [28].

Most of the RGE educational principles are even more valid now and the experience gained could guide us when designing *the School of 21st Century.* The main obstacles in fully achieving the RGE educational goals were the constrains imposed by the traditional *print-based schooling system* relying on a common set of fundamental strategies having been successfully applied during the last five-six centuries: using textbooks, grouping children primarily by age, and secondly by ability, dividing curriculum into subjects, packaging the subjects into annual installments, and mapping them onto a sequence of grades the students should *climb up* [16]. The basic unit of school space was (and still is) the classroom, where one teacher taught about 25 student. The basic units of the school time was the school period, school day, and school year.

Nowadays, with the advent of the networked multimedia and hypermedia it is a high time to gradually reform the existing *print-based educational system,* which eventually would reside into a *CIT-based educational system* [16]. During the transition through a *technology enriched learning environment* towards *pedagogical re-engineering of the school* [5,19] the main RGE educational principles might be realized in their full extent:

- As a subject of education we could consider not simply a student equipped with a microcomputer, but a student with an access to the superhighway and being a member of a global cooperatively learning community.
- Instead of integrated textbooks the principle of integration of education would be based on using virtual electronic libraries and subject-oriented clearinghouses containing multimedia resources. In a library learning all educational resource materials will be accessible by students and teachers at any time and any place. The students can learn by themselves from richly illustrated and aesthetically designed, highly interactive and intelligent multimedia and hypermedia based courses, initially complimented by textbooks. They would also learn how to search for and retrieve other relevant reference materials. Learning on a library based subject means that the students should optimize their work by navigating into educational resources and taking decisions what is appropriate and what is not. The subject would include all relevant information which could be found in the local library or in a virtual, networked library.
- Learning to learn and critical thinking are becoming important educational outcomes not only for the best students, but for everyone studying in a CIT-based educational system.
- The interaction between students and teachers, as a way out of the information overload, would be organized both in a face-to-face manner and by using asynchronous and on-line computer conferences.
- Cooperative learning, as an alternative of the competitive learning, would be realized better in a highly interactive (virtual) learning environment comprising computer support cooperative learning systems.
- The working on a project school activity would be accepted as an alternative of the lesson and realized according to the project pedagogy typical for university teaching, but worth to be shifted to a school level now [16]. Networked multimedia communication would enable project teams working together independently of time and space.
- The teachers would be given higher degree of freedom as the networked multimedia would allow them to work together across their classrooms and freely share ideas and experience. They would facilitate students' inquiry, manage their learning process, and help them navigate in a shared global information space.
- The design principles of the learning environment would be based on asynchronous space and time, responsive environments, and virtual reconstruction [16]. By complementing face-to-face and synchronized interactions with a full capacity for asynchronized ones, the physical constraints obstructing one-to-one consultation between a teacher and a student, as well one-to-many and many-to-many type of discussions, can be significantly lowered, and all sorts of new pedagogical groupings may become both feasible and effective. Every student would have her own responsive CIT-based learning environment allowing communication with her peers, teachers, virtual friends, network servers, etc. The virtual reconstruction of school spaces would make possible physically distinct spaces to be joined into virtual auditoriums, workshop rooms, reading rooms, cafes, libraries, where students in different locations can interact as if they were together face-to-face. The virtual reconstruction might even reduce the huge capital investments in school buildings.

4. TOWARDS A PEDAGOGY LEARNER CENTRED

The main principle in the *learner centered pedagogy* is that the learner does not receive ready-made knowledge. He should discover and construct his knowledge which does not mean to reinvent it though. There are several other important characteristics:

• The learner participates in learning objectives formulation and takes the responsibility for his activities. That makes him more motivated, self-directed and looking for personal efficiency.

• Student-teacher relations are democratic ones. The student takes part in formulating the teaching rules and their application (the *contract method)*. The student can even choose her teachers.

• The students take the initiative and they are quite more active compared to the students in a traditional school.

• The students get opportunities to *construct* their knowledge both in the school settings and outside school system. The students obtain new knowledge while solving real problems and transfer their knowledge to other students. They learn autonomously taking the responsibility for their learning and following their individual cognitive styles, interests, preferences. The students *learn how to learn*. The theoretical basis for the constructivist learning are the theories of Bruner and Piaget.

• The teachers are mostly facilitafors, *co-learners,* persons ensuring the right educational resources at the right time, helping students get access to other relevant resources. They also diagnosis the students' problems, and help them any time when needed. The formative evaluation of students' achievements and evaluation based on project outcomes is dominant. The students are also encouraged to self-evaluation of their achievements and outcomes and are enabled to present them. (CIT offer new opportunities for *global student presentations.*) The teachers work both individually and in small groups with the students. They might be assisted *by students-mentors* who would help them and other students in using software tools [23].

• The school is open towards the world. The problems the students solve are formulated either by themselves or by the teacher and come from their everyday life. The students and the teacher cooperatively solve these problems. The project pedagogy based on the theory of John Dewey and William Kilpatrick and empowered by the CIT [16] is considered as an alternative of the lesson-based pedagogy.

• The space, the time, the equipment, and all teaching materials and information resources are used in an extremely flexible way.

• The curriculum and the teaching and learning processes are highly individualized. Different pathways and support for learning are offered to students who can progress with a different speed.

• The system of forming classes by age might be quitted and students in different age might work and study in small groups.

Most of the mentioned principles give rise to some new developments both in educational science and in technology and provide the unique chance to fill in the gap between the scientific studies and the real school practice. Among the most important recently developed learning paradigms and theories, derived or related to information technologies, are: *cognitive flexibility theory* [32], *anchored instruction* [3], *minimalism theory* [17], *Soar* [15], ACT[1], etc.

The project pedagogy, flexible and distance learning, and collaborative learning tend to be widely used in technology-rich university settings. Another tendency is the globalization of higher education and the international collaboration. One example of such initiative is the European Association of Distance Teaching Universities (EADTU), which includes the main distance teaching higher education institutions responsible for over 325,000 students [2]. The Globewide Network Academy (GNA) is one of the most ambitious projects for virtualization of education - it offers thousands of distance education courses and hundreds of programmes deposited by universities from all over the world. The GNA and other virtual educational organizations show the tendency the distance education paradigm to be transformed into a *distributed learning paradigm* [7] which will be based on *knowledge webs* enabling distributed access to experts, archived resources, shared investigations, learning environments. A *mobile learning paradigm* might be elaborated in the near future. The partnership between universities and enterprises in distance learning and training turns universities into a new type of educational and training service providers to broader audience.

Education and training in organizations is area where CIT is widely used. As working needs knowledge and skills, learning becomes an obligatory element of working. The needs, constrains, and technological alternatives of learning support at work differ from those of school learning [11]. For instance as the work situation is not static the workers should adapt themselves to new circumstances and working methods. This means that two separated support systems should be updated continuously - the system for work and the system for learning. The team learning approach supported by a collaboration network (*hypergroup-ware*) is reported as a quite successful strategy [10]. The concepts of *learning while doing, just-in-time* and *just-in-place learning* applied by using Electronic Performance Support Systems (EPSS) and Computer Supported Collaborative Learning (CSCL) systems are dominant in learning at work place, together with the emerging CIT-based flexible and distance learning strategies for corporate and professional training based on the Internet and the Intranet concept.

The direction of the recent changes in CIT based education and training is from computers as teaching machines towards computer-based collaborative (distance) learning environments.

5. MULTIMEDIA AND HYPERMEDIA LEARNING ENVIRONMENTS

One of the main design principles computer-based learning environments is the principle of *interactivity* [30].The implementation of interactivity can be perceived as an art because it requires a comprehensive range of skills, including an understanding of the learner, a deep understanding of software engineering, deeper knowledge about the contemporary instructional design principles, and aesthetically designed multimedia interface. Development of effective interactive learning environments will motivate and engage the learner.

Designing human-computer interface for computer-based learning environments might be based on different concepts and instructional strategies, e.g. *browsing, media integration, metaphors, etc.* For instance browsing (or navigation) allows learners flexibly explore a programme or a data base, but there is a real danger of being lost in the *cyberspace*. The interface design should incorporate a concept how to minimize the risk of loosing orientation while browsing.

The World Wide Web (WWW) is built around three main ideas: physically and geographically distributed documents, unambiguous location of distributed documents, and a uniform interface. Anyone can create a document and include it into the web without any registration mechanism. Especially powerful is the idea of *uniform interface,* because the user should not switch from one interface to another when using different data bases. The idea of uniform interface is central in the Intranet concept - using the Internet concepts and principles in organizations, creating *institutional webs* of information. The next step is adapting the uniform interface according the personal needs of any learner by using *learners modeling* and *intelligent Internet agents* [4].

The openness of the WWW and the opportunity every user to become a miltimedia document author give rise to a new generation computer-supported cooperative learning (CSCL) and computer-supported cooperative work (CSCW) systems, such as: *ComMentor* [24], *CoNote* [6], *Teacher's Curriculum Assistant* and *Remote Exploratorium* [33], *SharedARK* applying the *"what you see is what I think you see"* (WYSIWITYS) interface concept for physically separated users, as an alternative of the *"what you see is what I see"* (WYSIWIS) interface concept [31], *Collaborative and Miltimedia Interactive Learning Environment - CaMILE* [14], etc.

6. EDUCATIONAL POLICY ISSUES

Although most of the educational organizations, businesses, governmental and non governmental organizations, and homes are still far from being wired to the superhighway, even those in the developed countries, the rudiments of the Information Society might be observed. How it would be built depends in a great extent on the efforts of UNESCO, whose primarily goals are to promote development of human resources, reduce the poverty and unemployment, work for better integration of youth in the society, ensure equity in sharing information and knowledge, ensure access to science and technology for all, give anyone chance to receive education or second-chance to be educated, and finally creating a commonly accepted policy of cooperation, cultural and educational exchange, peace and global wisdom. How could these goals be realized against the global tendency of rich getting richer and poor getting poorer?

In the global Information Society there should be mechanisms that channel the information exchange as to prevent countries loosing their cultural identity. One of the main tasks of UNESCO now should be to launch an *Information Ecology Programme* which would aim at preserving the cultural diversify in the world the same way as the environmental protection programmes aim at preserving the biological diversity on the Earth. The issues of technological and especially of cultural portability of educational services, products, resources, and software are matter of highest importance now.

Along with the portability issues we should be aware that a wide educational market appears and each institution or organization providing educational products and services should apply a specific advertising and marketing strategy. Advertising, as we know it from traditional media - TV, newspaper, posters, etc., does not apply if we use Internet. People on the Internet do not like aggressive advertising. Making a Web page a place which is worth to visit again is the best advertisement. It could be achieved by making it highly interactive, providing regularly updated information and curiosity, offering unique events, etc. [9]. There are a number of security issues that have not been completely solved yet: *authentication* of data, people, products, transactions: *site security; privacy; encryption; identity verification,* etc.

Other issues related to Information Ecology is to prevent Internet becoming a weapon of crime and information invasion, a new media for 'bad news'. (The TV and radio keep trying to prove that 'good news is no news'. I would hardly believe in a successful implementation of an Internet service *bad news on demand*).

The distance education and telecommunication offer plenty of educational and training opportunities for people and organizations. However there exists fear that schools and universities and would loose their specific traditions and flavor and their autonomy. There is a tendency of imposing common standards for all educational institutions. As the distance education gives opportunities one professor or tutor to teach thousands students, would it lead to unemployment in universities and schools? No doubt that the distance education and CIT make possible students in geographically distinct places communicate. However there is a real danger for people, who normally communicate face-to-face, to 'switch' to electronic communication mode and loose their human contact.

Before a substantial amount of money and efforts are invested in the CIT-based education, a number of open questions should be answered:

- What are the educational objectives and the educational outcomes expected?
- How can we make possible bridging the gaps between current educational and training practice and the advances of educational information technology?
- How can we prepare university and school teachers as a human infrastructure ensuring effective application CIT in education and training?
- How can we organize locally and internationally produce educational courseware and educational multimedia resource materials?
- How can we assess the impact of the CIT and new educational technology methods on the education and training?
- How can we promote the 'best practice' cases?
- How can we ensure equity in access to CIT for all students and teachers?
- How can we preserve diversity of cultures?

Most of these questions could be answered by the Global UNESCO Project for Introduction of the New Information Technologies in Education: *UNESCO Network of Technology Enriched Schools.*

7. CONCLUSIONS

The educational reform needs synergetic efforts of UNESCO, the EC, governments, local governments, non governmental organizations such as IFIP and International Association for the Evaluation of Educational Achievements (IEA), policy makers, educators, business communities, public interest groups, parents and all citizens. For the countries in transition it is a matter, of crucial importance participation in the EC educational and training initiatives and programmes, such as *Phare* (incl. *Tempus*), *Copernicus, Socrates and Leonardo,* as well as in all UNESCO initiatives and projects. The Second UNESCO Congress "Education and Informatics" being the last congress of the kind during this century, should draw clear direction for world-wide developments leading to a CIT-based education.

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EDUCATION IN THE CONTEXT OF NEW INFORMATION AND COMMUNICATION TECHNOLOGIES

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The problems of education quality have been acutely felt since the moment when the professions that the young people weretrained for had lost the stability characteristic of old crafts. While we can say with some certainty that, in 20 or 30 years from now, practically all areas of economic activity will be directly linked with the use of new technologies, we still have no clear idea of what nearly half of the 21st century professions will be like.

What needs to be done to ensure that future-oriented education is in line with the constantly changing professional situation, particularly in the area of teachers training?

Teachers' and users' training is the decisive factor of the educational system. Due account should also be taken of the features characterizing the use of multimedia educational programmes by school teachers, mentors, and learners.

Below are some ideas (and, possibly, solutions) relating primarily to the educational system.

A. AIMS

In our day, new information and communication technologies (ICT) have come to figure prominently as major tools of every country's strategy of progress, along with the traditional infrastructures (roads network, transport, power engineering). The information structure - *infostructure* - is now the most important factor in the majority of social and economic fields.

Reasonable integration of the new information and communication technologies into the processes of production and administration has given rise to new forms of work organization, management and planning, which can help master the processes of production, operations control, quality control and information transfer and facilitate the process of adaptation to the ongoing evolution of the economic, social and cultural environment.

This evolution is based on digitization of the facts of reality, and this necessarily requires screen display of the models and principles called the *concepts of informatics,* hence the necessity of new professional knowledge and approaches.

These concepts of informatics have been changing concurrently with the evolution undergone by several generations of teaching devices, and have been the cause of various social and cultural changes.

The development of the concepts of information has given rise to four generations of information processing devices which have had a noticeable impact on the organization of work process, people's mentality, organization of the teaching process at school, and therefore on the basic and continuous education, which, from now on, becomes a must due to the rapid technological evolution and the variety of the systems and methods of teaching in the informational environments.

Once we have passed the epoch of automation, integrated systems and specialization of tasks, we enter the epoch of globalization in which the dissemination of information is boundless and availability of knowledge becomes democratic demand and an ethical duty.

The globalization has produced the strategy of competition, encouraged competitiveness, and brought about a new type of management, based on the desire for top quality in all the sectors, as-well as, of recent time, in priority in the provision of educational services. Quality is now the main concern of the client organizations, the institutes of education, and the authorities themselves. Striving to satisfy the demands placed by the present time, the school has given priority to the education oriented to a large extent on the methods directed at development of fundamental intellectual powers in a young person, which express themselves in:

- clear thinking, synthesis and logical deduction, which stimulate the ability for adaptation to new and unexpected situations;
- an inquisitive attitude to culture and science and a great urge for knowledge, instilling in the learners a constant desire to be aware of all the novelties and part to every creative activity;
- development of the emotional and affective traits which are conducive to the development of personality and help the learners grow into balanced, independent and responsible citizens.

B. SCHOOL

New information and communication technologies give rise to new modes of organizing the educational environment at school and new concepts of the teaching process, and to recasting of the roles played by the participants of the educational process.

I. Organizational Evolution of the School

Ancient School

In the course of its entire history, in most countries education has been shaped, in its organizational and practical aspects, under the influence of the authorities and the mode of production existing in this or that country. The first schools and universities were founded in the time of Aristotle and Plato. The basic features of the educational process of those times its humanitarian and multidisciplinary character, which expressed themselves in the method of direct dialogue.

Classical School

In the early Middle Ages, most schools were subordinate to religious authorities and provided an education based primarily on theology, arts, culture, and the manners and customs. Memorization had pride of place in that educational system.

In the Arab world, the scholar Ibn Khaldoun opposed, in the 14th century, the predomination of theological education, based on memorization exercises, in favour of the teaching process oriented on reading, writing and counting exercises, which could open the way to various fields and areas of knowledge. He wrote: "They (the learners) assimilate nothing they can display as useful knowledge." ["Ils (les apprenauts) n'avaient rien acquis d'utile en ce qui touche la faculté de faire valoir leurs connaissances"].

With the appearance of the printing press, the old school system was seriously affected for the first time when it had to part with the hand-written educational materials. The printed book aroused sharp criticism and, in some cases, downright rejection: the book was blamed for ruining the direct contact between the teacher, as monopoly holder of knowledge, and the learners of this knowledge.

Following the important scientific discoveries of the 16th century (Galileo, Newton), the school opened to various scientific trends which had shaped into scientific disciplines before becoming school disciplines.

Since that time, the organizational and educational aspects of education had come to be bounded by a certain specialization of the instructors and school disciplines, which placed certain limits on the multi-subject character of the educational process.

Modern School

Public School

Social changes in the 18th century society and the appearance of the Declaration of Human Rights facilitated the democratization of education and gave rise to the concept of public school. The learners contingent (first at school and subsequently at institutes of higher education) had changed; there was a growing demand for instructors, which had finally surpassed the actual number of teachers turned out by the teacher-training institutions.

National education budgets have increased, with allocations for education coming, in some countries, to a quarter of the entire national budget allocations.

Nearly everywhere, the demand for teaching staff is met by engaging the contingent without proper teacher qualifications, as though teaching is a kind of profession which, given some knowledge of respective subject, could be easily mastered in service.

School of the Industrial Era

As soon as it had encountered the difficulties brought about by the growing numbers of learners and teachers and the increasingly specialized school disciplines, the school voluntarily opened to industrialization. In many countries, school administration and practical activities have become subject to a hierarchy of a kind, which can be explained only by the presence of a fairly complicated legislation, leaving too little room for motivation and creativity.

The system of professional training went through the same changes to become an object of a standard and industrialized approach. The basic motivation for that was the support rendered to the highly valued educational establishments which support guaranteed their graduates an advanced social status. The participants in this educational process acted on their own and very rarely had use for multi-subject practices. The fact that the examination sessions in the in-service training system usually fell on weekly or annual vacations time was the cause of some problems of organizational character, lack of motivation, and a rise in the training costs.

Instruction courses focused on a concrete subject or recommendations concerning practical teaching methods, which some of the teachers saw as prescriptions for their behaviour in class.

II. Evolution of the Pedagogical Personnel and the Concepts of Teaching

Beginning with the times of Socrates and Plato and up to the early 20th century, classroom teaching methods were, for the most part, purely intuitive. The fact did not prevent some of the tutors hired for children in higher layers of society from mastering the skills of teaching and obtaining good, sound results.

As the school became increasingly industrialized, the concept of "pedagogical" more and more often associated with the term "effective". Even as early as in the 16th century, Montaigne stressed the advantage of "intelligent head" ("tête bien faite") over "stuffed head" ("tête bien pleine"). Later Rousseau introduced the concept of the psychology of education, insisting on the necessity of "studying" ("connaître") the learner before conveying him a piece of knowledge. "Begin with studying your students, for there is no doubt that you do not know them at all" ("Commenuz par étudier vos élèves, car assurément, vous ne les connaissez point"), he said.

The Linear Concept

Since the beginning of this century, many so-called behaviourist theories of teaching have arisen in the fields related to cognitive psychology and social science; as a result, we have been able to understand some distinctive features in the development of thinking and cognition. Some notional and conceptual patterns were proposed which, in the final count, lead to an understanding of what prompts the learner to make a conscious choice between either acting and learning or not acting and learning.

The behaviourism school holds that thinking (and cognitive experience) can be shaped by the application of principles of teaching that are so well mastered and polished by practice that the learning process is brought down to short and unconnected elements. The pedagogical effect, in this case, is short-lived.

This concept had undoubtedly revealed a new aspect of teaching, while it could not satisfy the complex demands of reality, as it meant splitting up and even *disintegrating* the educational process, impeded the passing of knowledge, was more tiresome and not stimulating, apart from the fact that such an approach was also incompatible with the multiple-subject system of education.

The Concept of Integrated Constructivism

The intermediary approach gave pride of place to the idea that it is primarily the surrounding environment that develops a child's mind (or mental abilities).

According to Jean Piaget, a child achieves mental growth by constantly interacting with the external environment and learning to understand the world around; he is, therefore, in the focus of educational process, while, also, preserving a certain autonomy of the cognition process, provided that he possesses certain cognitive skills and techniques.

It should be noted that this theory was seen as ambitious, and its practical application in the static cognitive environment was fraught with certain difficulties, which complicated the teachers efforts to obtain good results. However, here is what Ibn Khaldoun had to say about *Abou Bakr Ibn Arabia's* pedagogical theory: "I admit that the system propounded by the Cadi Abou Ibn Bakr is a very good one, but custom opposes its application, while it is the customs that despotically rules us in this life" ("J'avoue que le système proposé par le Cadi Abou Bakr très bon mais les usages s'opposent a son emploi; et les usages neus gouvernent despotiquement dans cette vie").

The appearance of informatics had seemingly shortened the gap between theoretical promises and practical applications. Indeed, when the computer became available at school, a quarter of a century ago, great hopes arose which led to some great disappointments for the reason that the same pedagogical approaches were applied in order to implement even more ambitious goals and to have a go at even more complicated problems. The computer, however, is better suited for adapting didactic to the mode of thinking which operates by association rather than direct, consecutive notions.

The progress of informatics has led to a cardinal change of the concept of human mind. According to Herbert Simon's dictum, in 1975, informatics is an experimental science aimed primarily at describing the models of human mind.

This analogy between the computer and the human mind will get further development at school, bringing the evolution of the concepts of informatics to be reflected in the science of teaching, as well as other areas.

The Concept of Interactive and Dynamic Instruction

ICT evolution have caused an explosive growth of knowledge. Its dynamic character reflected on the goals of school education and impeded the application of the traditional methods of teaching, based upon static organization of the teaching process. In these conditions, there have appeared some abstraction concepts, designed, so to speak, to formalize the perception and reflection of the external world.

ICT evolution was greatly speeded by the appearance of the multimedia facilitates, which allowed to introduce a systems approach to possible pedagogical research, that is, to identify and combine all the components in their dynamic interaction. Instruction is arranged (with a certain degree of autonomy) as navigation in a semantic ocean, which the participants strive to streamline and activate as much as possible with the help of the interaction, association and collaboration approaches. To make the autonomy effective, the appreciation element is fully, and almost really, incorporated in the educational process, giving the participants an opportunity to review and correct their work almost immediately.

The possibility of combining texts, images, animation and sound makes the multimedia facilities highly appealing and works to mobilize all perceptive abilities of the learner, due to the associative power of informational facilities. On the other hand, the combination of multimedia facilities and communications facilities have brought about multimedia computer networks, linking educational establishments to one another and to the outer world, helping the learners to appreciate the meaning of the teaching methods, promoting constructive dialogue with other learners and teachers and allowing the learners to make use of other educational tools. The use of computer facilities in education enriches the educational environment by applying to it a communicative function. Indeed, the distinctive features of the project of computer communications are the multiplicity of subjects and the involvement of the entire body of participants in the educational process. The multiplicity of subjects increases the project's dynamic character. Besides, computerization gives the learners a chance to display all their abilities, inclinations and the attitudes leading to personal success, all of which could be expressed in the formulas "learn to learn" and "learn collaboration". Also, computerization works for bringing young people together and instilling in them the notion of distinctive as common good.

As for the teachers, they have to give some thought to the conditions in which the new concept of the teacher's role could be realized, and to develop the international component of teaching.

III. The Teacher's Role

The teacher's role is necessarily changed in the new conditions, since the teacher has to learn fast adaptation, so as to be able to act as an expert, organizer and, even, partner capable of encouraging the pupils' activity and collaboration and of with due regard taken of their individuality. A teacher of this kind exchanges opinions enters in arguments with his own pupils and even with the pupils of other teachers, striving to stimulate, assess the results and individualize the teaching process; moreover, such a teacher would exercise a free and informal approach, allowing the pupils to work out the manner of the learning process and to choose its content, while he will also preserve some of the teacher's prerogatives of the kind necessary, for example, for resolving conflicts or arguments arising within a group of learners.

The teacher's role, therefore, remains the principal one in the educational process, while ICT serve mainly to complement the methods used to enhance the effectiveness of the teaching/learning process. The teacher monitors this process, assists the learners' efforts, instructs them in concrete academic fields, in fact, the teacher no longer resembles the traditional "teaching teacher" whose function is to pass knowledge to the pupils. The teacher's changed role makes him a group member rather than the monopoly holder of knowledge. In an educational environment, the teacher begins to fill the part of a manager, and, therefore, offers the learners a strategy to suit: assimilation of accumulated experience, control of the learning process, appreciation of the results and a feedback, transfer of knowledge for application in new situations, development of individual skills within a collective of people.

Thus, the teacher becomes a source of knowledge instead of the classroom lessons leader. In this way, the teacher/learners relationship is strengthened. At the same time, emotional ties develop, which are a positive factor in an educational process.

We can also say that the teacher often acts in the way of a performance producer striving to instil in the learners the attitudes and behaviour mode required to help them grow into industrious and responsible citizens in future. The teacher's other concern is working out the strategy and practical measures needed for developing in the learners' an ability to exercise a synthetic and complex approach. The learners, then, will be ready to tackle the arising problems and to profoundly examine the situations brought about by daily life.

We should also stress the importance attaching to teachers' training, since, teachers must be able to handle the technological facilities employed in training and have a good understanding of the projects' dynamics if they want to develop their teaching skills by using new information technologies.

C. PROFESSIONAL TRAINING

Personnel training may be described as supplying the clients (organisations and production units) with the services of fast-operating technologies. Such services comprise a complex of measures, as defined by a contract with the client entity, devised with a view to the specific requirements placed on personnel training in each particular case.

On the whole, the scope of such services is not quite clear yet (particularly as concerns the continuing training system), their areas are inadequately defined, and the possible consequences of respective activities are difficult to appreciate. The evaluation scale, therefore, is designed to ensure the fulfilment of the contract rather than estimate the changes in the professional activities resulting from the provision of these services.

I. The Organizational Framework

The basic and continuous training can assume various forms, depending on the concrete situation. Continuous training can be arranged as a full-time, distance or mixed learning process.

Over many years now, much thought has been applied to the status of the professional training system, and the mutually complementary character of its different levels. Many questions have been asked concerning the necessity of in-service training for the profession which is looked upon as a calling rather than occupation.

In a number of countries, these considerations have given rise to various contradictory measures toward specialized teacher-training courses, which are set up one day and liquidated the next day.

International scientific institutions have voiced their opinions to the effect that the teachers' basic training is inadequate for the demands placed by their profession. The recommendations by issued UNESCO conferences in Montreal (1960) and Tokyo (1972) put stress on the need to set up a system of continuous training which would be up to the level of the educational systems.

In a considerable number of countries, basic training is confined to the framework of specialized institutes of education (general and vocational) isolated from the university system, and is, therefore, oriented too much on preliminary professionalization.

Disciplines of the pedagogical cycle, which comprise psychology, didactic, pedagogy and social science, are studied separately, in a dogmatic, and hence ineffective, way. In actual fact, though, these disciplines are complete educational models, allowing for conceptualizing education, for compiling a schematic description.

That is to say, basic education must necessarily be complemented with in-service training, which turns out to be of vital importance for preserving the educational system at its due level.

Beginning with the 19th century, in the conditions of increasing social democratization, the in-service training had established itself and could lead to a professional career. In-service training schemes were set up everywhere; collective agreements were concluded between labour unions, employers, and authorities. Suitable legislation was adopted, stipulating the right to receive an occupational training, as well as dealing with other related aspects, including taxation, etc. At the same time, registers of professions and jobs classification were drawn up and tied in with respective in-service courses.

The goals thus pursued had more to do with quantity than quality, working on the premises that the more - the better.

That connection between the requireaients of social development and the qualification attained by in-service training placed the latter within strict confines of a school model and thus shaped it into a standard precast form with a hierarchical leadership exercising their own set of values.

Lately, due to the increasing competition in the field and the greater demand for a high quality of professional training, if has been brought to become more in line with the priority needs of educational institutions, while its goals are more oriented on the market situation and human resources than on the cultural needs and the goals of human progress. "The ongoing changes dictate the transfer from the traditional logic, aimed at taking account of the social consequences of professional training, to the economic logic of professional training, that is, to capital investment", while the demand for services in the field of professional training is now better suited to extraordinary rather than foreseeable situations.

Of late, the quality of basic and in-service training has become the main concern of all the participants in the educational process. The new situation has stimulated research into novel techniques of managing the educational process, such as allow to achieve a high standard of professional training, and has necessitated .the development of a new concept of professional training and new strategies of its realization.

II. Professional Training Using ICT

In all the times, the teachers were considered to be a conservative in their attitude to pedagogical practices. They find it very difficult to work with the pupils using the methods other than those used in their own professional training. This has become especially noticeable now that the computer has appeared on the scene as the agent of most changes.

Today, the computer figures ever more prominently in all the social and economic areas and is part to our daily practices. Still, its applications for educational purposes are cardinally different from the application of other techniques and materials, such as the printed matter, for example, or the audio and video services, that is, from those which require splitting the teaching programmes into separate sections which quite often require separate and different skills. The computer, on the opposite, is a multifunctional tool, individual as well as communicative, and its application is based on the conception of integrated activity, and therefore, on the knowledge acquired from many educational subjects.

Thus, the mastering of computer science at the levels of basic and in-service professional training is a necessary prerequisite if future teachers are to become conscious users of the computer services in their out-of-school, school, and after-school activities.

The questions facing us today concern accepting such a strategy of professional training that might be helpful in persuading future teachers that they need to obtain computer facilities and learn to use them as an effective supplementary pedagogical tool. as well as understanding what and how should be taught to future teachers.

The following considerations attempt to approach some of the answers.

1. Mastering ICT for Independent Work

Conscious personal use of computer is impossible without some basic knowledge of its operation, though some people, among those who have failed to appreciate its advantages, still persist in their assertion that it could be easily applied as an educational tool without any special knowledge.

In 1995, following UNESCO's request, IFIP drew up two documents dealing with the use of iformatics for the purposes of secondary and higher education. Both documents contain a realistic and concrete presentation of a certain program and display a flexible approach taking account of the specific features of teaching and in-service training.

Needless to say, the division of areas within this basic knowledge depends on the range and number of the fields they relate to; in future, though, professional training would have to assume a global character and repose on a common foundation.

Moreover, considering the fast and continuous evolution of the computer facilities, this training should be steered clear of the static situations common to them and should instead be focused on the most general basic elements of the functional level which would allow the teachers to act consciously and to stay immune to the winds of time and fashion. Once they have mastered the computer, the teachers will be able to treat it their working tool for personal use, in particular for organizing the work and obtaining access to data bases, as well as for other purposes.

2. Inquisitive Attitude to Culture and Science and the Urge for Knowledge

In the process of training, it is necessary to make use of the possibilities for creative work that the computer has opened up for us and to encourage the teachers' intention to gradually work out the teaching facilities within, the framework of the conceptual approaches to the solution of the arising problems, thanks to which the teachers can develop their intellectual properties. Informatics offers a great deal of useful intellectual conceptions for tasks formalization. It should be pointed out, however, that, as far as formalization is concerned, some conceptions are applicable in a limited number of school disciplines, while other conceptions apply very well to all the disciplines. Thus, algorithmization with its interactive structures, combines well with calculation and programming, while the manipulation of concrete files is applicable to all disciplines.

3. Approaches to the Modelling of Education

The fundamental conceptions of teaching sciences should be used, not as a dogmatic aggregation of data, but as a means for conceptualizing and modelling the educational process; they should be brought forth to the level of concrete teaching situations. Although these conceptions relate to different fields of knowledge, they must be totally coherent in order to obtain general and complex solutions based on a systems approach. The use of these fundamental conceptions guarantees that a future teacher will develop a good ability for adaptation, as any teacher should be ready to overcome certain unexpected pedagogical situations in order to ensure the required final results.

4. Accumulation of Individual Professional Knowledge

A future teacher should possess a knowledge of many subjects so as to be able to teach his own discipline, have a good command of the educational (teacher/learner) process, act as an expert and leader of the learners' training, and be capable of making timely decisions, including in unforeseen circumstances. This kind of individual knowledge can be obtained in the course of various activities exercised jointly with other people, coming from different organizations, and could include joint research and similar activities that promote the exchange of opinions, ideas and experience. Interaction of this kind will help teachers, develop the professional group logic, that is to say, to find realization in shared knowledge, values and activities which bring them together and which can best express the distinctions of their professional ethics. "This kind of self-formation enhances a group's and its members' legitimacy, as well as confirms their distinction from other, nonqualified, persons who offer similar services".

5. Development of Advanced Skills

Steps should be taken to ensure that the teachers can advance their skills pertaining to related fields, such as, for example, documents search, operation of electronic documentation, electronic archiving, statistics, preparation plans. This type of activity is a part of the new social context. Such skills can allow to change the teaching process as such by facilitating its transformation from an individual and isolated act it is now into an open practice of knowledge application.

6. Management of Professional Training with Priority on Quality

The new conditions in which the pre-service and in-service training are carried out exclude the application of traditional methods of management of the training process which are essentially static as they rely on lecture courses and strictly defined and isolated approaches.

New training management patterns must be based on the methods of constant search for better quality and must allow for interaction with the dynamics of the external environment in which operate all the participants in the training process and which provides for the feedback and monitoring instruments that allow to timely respond to any change in the situation. Such models should incorporate:

- flexible patterns of work time distribution and organization of the teaching process;
- indices for appreciation of the quality and effectiveness of the teaching process;
- on-line evaluation possibilities.

This type of management can be also helpful in taking stock of the successes attained in professional training as well as of the steps taken toward its improvement, which steps are designed to meet the learners' demand for the training accommodated to the demands placed by professional improvement as well as by the demands placed by development of professional career and personality of the learners.

RECOMMENDATIONS

The multimedia facilities, combined with other information and communication technologies applicable for educational purposes, help to give a new dimension to professiohal training by creating a significant potential for its development due to the combined efforts of the joint participants in scientific, research and practical activities and to the exercise of control over their effectiveness.

Training (pre-service and in-service) must incorporate the application of novel methods and flexible practices, based on ICT, and comprise the principles of integration, inter-discipline approach, association, dynamism, possibility of interaction, and appreciation in quasi-real time. For this, it is recommended to:

1. Satisfy the demand for multimedia equipment, in order to make ICT available to all and make sure that their application becomes common practice rather than a rare occasion.
2. Promote the proliferation of multimedia educational facilities, as they offer a lot for the pedagogy, as well as for all active participants in the educational system.
3. Accommodate the knowledge acquired in specialized fields and stimulate the collaboration between members of the groups united by common interests.
4. Facilitate the research in new methods of organizing the training process.
5. Promote stable partnership of the "school- school" and "school-organization" types with the purpose of obtaining mutually beneficial results, and seek new technological solutions.
6. Assist the teachers in the reasonable and justified application of informational facilities for the development of some formalization and abstraction paradigms stemming from the concepts of informatics.
7. Develop data and didactic methods banks, award distinctions to the highest achievements, proliferate and monitor them with the help of exhibitions of educational technologies.
8. Work out a conception adequate to a system of professional training based on the application of multimedia facilities and having the results evaluation scale integrated in the training process.

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Commission I

PECULIARITIES OF USING NEW INFORMATION TECHNOLOGIES FOR THE PURPOSES OF SECONDARY AND HIGHER EDUCATION

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Using new information technologies for the purposes of secondary and higher education is one of the most relevant problems arising before the people responsible for organisation of the educational system as well as before the practising teachers of both the higher school and the entire educational system. This is indeed the dictate of the time and people at all levels of the Russian educational system realise that well. I would like to discuss in this paper those stages of education informatisation that we have already come through and those problems which we are up against currently. There is already no need of convincing whoever that the informatisation plays a big role in all spheres of our life and society having completely changed the life style and affecting significantly the formation of modem education.

The Novosibirsk University is young enough. If was established in 1959 and intended for training of researchers for academic institutions, higher education organisations and for industry. The university is formed on the base of the Siberian branch of the Academy of Sciences. When establishing it its founders meant that this organization would be a completely new structure combining the latest methodology and scientific knowledge. A peculiarity of this University is that its students simultaneously work for academic institutions and have an opportunity to acquire the advanced knowledge and familiarise themselves, with the modem developments being run in those institutions in various fields of fundamental science. Another peculiarity of the university consists in great attention being given to selection of students. The procedure of student selection includes not only the traditional entrance examination usual for every university, but also a specially developed system of admission aimed at attraction of the most talented young people. This system includes conducting of special contests at schools, training at summer schools, and preparation of potential students at a well-known in all the country Physics and Mathematics School named after Academician Lavrentyev. In addition to those two important features of the University, there is another one characterising the University faculty. The faculty of the Novosibirsk University is represented by professors and researchers working for the academic institutions and directly involved in research and development in different fields of fundamental science. All this provides for using the latest scientific achievements in the educational process and, what is more important, to accurately and timely evaluate the most promising tendencies in the modern science and technology to ensure the most effective educational process.

In this connection, the importance and integrity of informatization has been appreciated already at the first stages of informatization in advanced spheres of science and technology. At that time the students of the University were taught to apply various computer methods for solving different scientific and research problems. At the same time, we have come to the conclusion that such knowledge should not be a privilege of only professionals in several spheres but has to be available to all members of a future society. The Academician A.P. Ershov was one of the most consistent promoter of the informatics and did a lot for the society to comprehend this phenomenon and its significance for the entire modern society. It was him who put forward a slogan saying "Programming is the second literacy". Though this phrase does nor precisely reflect the informatization phenomenon, at that time it was a mean to make everybody pay their attention to the problem of informatization and its role in a future society.

This apparently played a big role in that the idea of informatization penetrated info all spheres of human activity and that the information technology course was included as a separate discipline in curriculum of both secondary-level and higher education schools. Despite the fact that this slogan arouse numerous polemics and arguments, the relevance of this problem was realised. This resulted in a situation when every school offers its students CIS courses taking which they can get acquainted with the initial knowledge of computer science and with the basic principles of algorithmic-type modelling required to use PC for practically any purpose. This first stage, namely the offering of CIS course at schools and universities, is already successfully implemented. This Congress will discuss the extended computer science training programs proposed by UNESCO for secondary and high schools and universities. Such courses are being offered in schools and universities of practically all countries. This was the first stage of education informatization involving the training in the field of programming languages, algorithmic methods for task solving, and, generally, the understanding of the very concept of informatization.

The next stage of introducing informatization methods to education was directly associated with personal computers. At this stage a completely new situation occurred when within the training process the computers became instrumental not only for studying programming languages and algorithmic methods but for studying fundamental sciences such as physics, mathematics, chemistry, biology, etc. This process that started spontaneously resulted nowadays in various specialised courses on physics, chemistry, biology, and mathematics applying personal computers. The specialists of the Novosibirsk University have developed similar training programs to be used for teaching the standard university courses. These programs recorded on a CD have been brought for demonstration at the Congress exhibition.

On the other hand, the use of computer technology at elementary school was also of great interest for experts in the field of informatics. Special computer-equipped classes have been created on the base of both the Novosibirsk University and the Physics and Mathematics School where the students could study mechanics, chemistry, biology, electrodynamics, etc. taking advantage of all the computer capabilities such as video image, sound- and text-based information, graphs, and others to more thoroughly learn those complicated disciplines. Naturally, at the first stages the use of computer technology for school education was affordable only for some elite schools.

In 1991 the experimental IBM computer-based program called "Pilot Schools" was developed in the former USSR which included a package of measures intended for introduction of new information technologies into standard school education. That was the first stage of introduction of modern computer technologies capable of being used for general school education instead of for special computer science courses based only on studying programming languages and on solving simple problems as more complex ones were beyond the capabilities of low-power computers available at that time. This program had a great impact on the process of education informatization. It provided for a integrated approach to the problem resulted in creation of regional centres where teachers had an opportunity to master the skills necessary for utilisation of computer technologies, to take computer courses, and to get help from the specialists. This important stage of the process started in 1991.

The next step in this direction was another program under the title "Universities of Russia" developed by the State Committee for Higher Education and having a purpose, among other ones, to start employing the latest information technologies in the university education. Within the framework of this program the specialists of a number of Russian universities have developed the computer based courses on mechanics, aerodynamics, mathematics, chemistry combining the possibilities for data visualisation and, subsequently, for deeper perception of those phenomena described . by abstract formulas. However, this experiment had its weaknesses as well. Since each developer used a certain programming language, either Pascal or C, or any other special program, the market became saturated with numerous programs not compatible with each other. That is why the attempt was made to arrange all these programs and to create a well-structured system by making the various developers interact. The universities involved included the Saint Petersburg University, the Moscow University, the Ural University, the Novosibirsk University, the Far East University, and the Altay University. Such co-operation made a start in understanding of how it is possible to employ created software, what role computers and computer programs could play in education, as well as what weaknesses are inherent for such an approach. Currently, new technologies became available allowing for most efficient use of computer-based programs in teaching the sciences and the humanities.

The reality appeared somewhat surprising. If the first computer-based materials were developed for physics, chemistry, etc., then afterwards it turned to be most efficient to use the computer technologies for teaching the humanities, e.g. linguistics and some others. The use of computer software in teaching fundamental sciences is still a complicated problem. The matter is that to create really good learning software with a wide range of operations it is necessary to develop intelligent systems including extended data bases on studied subjects. However, this work is extremely expensive and far beyond the financial capabilities of separate universities.

Another crucial aspect of developing such computer programs is the necessity of providing them not only with educational elements but with those controlling the progress. Such software is also being developed currently. The State Committee for Higher Education has developed a rating system, the Altay University is also developing this kind of programs.

This is the second stage of the process of utilising computer technologies for educational purposes which is also conditioned by further achievements in the field of information technologies such as multimedia technologies, hypertext technologies, and artificial intelligence systems. However, there is still a long way till the moment when the major problems of education such as individualised training, intensification of educational process, and matching the programs with the individual capabilities of each student would be solved. The currently available software programs mostly use dated methods of so called programmed training which follows some certain algorithms and are not capable of learning.

Nevertheless, we can say that presently we are at the third stage of the education informatization process. This stage is associated with an absolutely new effect conditioned by the breakthrough in the sphere of telecommunications. At the pervious Congress the issue of telecommunication networks was discussed either but everybody understood that despite tremendous opportunities, the introduction of telecommunication technologies would brought up a huge number of technical and financial problems and that is why at that time it was just a dream. Nowadays, such a network is already being created in Russia. This network is based on the RUNNET network and connects leading universities which are its regional centres and which, in their turn, create regional telecommunication subnets. Such communications allowed for creation of new technologies in the field of education management and for studying the possibilities for using the network for educational purposes.

First of all I would like to address the issue of distance learning system which is, currently making its start in Russia. There is a system of so called correspondence or remote learning in our country that, however, was never associated with the use of computers. Nowadays, the knowledge updating process is very rapid. In the past the 50 % knowledge update required at least 50 years, now this period is reduced to 5 years. That is why the training and retraining of specialists is one of the key tasks of education, considering, in addition, our new market economy environment. The distance learning system based on computer network would be the best solution for this problem. However, the development of such a system requires creation of extended data and knowledge bases on different subjects. The formation of these databases is just started. A number of universities is also engaged in this work. The Internet allows to approach databases available in other countries. Now the Internet is available for some of our leading universities and the access to it is planned to be provided to 20 more higher education institutions and some schools. In addition, the Internet allows the students from different institutions to work on their joint investigations in the field of sociology, ecology, to conduct experiments and tests, etc.

In conclusion I would like to discuss the dark side of the education informatization process. The matter is that having numerous advantages this process has some disadvantages as well. The advantages of this process include education individualization, a higher level of training, wider, if not boundless, range of information available, new options of education, a possibility for easy communication over large distances, and a simple access to various types of information needed. However, one should not forget about some problems associated with informatization.

First one is a danger of escaping studying real processes and phenomena replacing this with computer models. All physicists realise that it is absolutely impossible to become a physicists without working with real process, without experimenting, etc. That is why the computer modelling alone is not sufficient.

In addition, there is a purely psychological problem of being responsible for one's own actions and decisions. For a person dealing with a PC it is usual to reset a program or a system if something goes wrong. This person is not ready for that kind of responsibility required for working with real processes. Confidence that everything can be started again is being formed from the very childhood. This condescension to one's own mistakes is a very big problem, especially when it has to do with young members of a society.

The next problem is the necessity of realising the limits when using a computer. Every researcher has to see those limits including sometimes insufficient accuracy, a danger of mistakes in a system, limitations of a model selected for testing of a real process. That is why a specialists should know the principles a system is based on. It is a common knowledge that the computation methods are widely used everywhere but it was discovered that the computer computations are irresistant to even small deviations. Thus, small changes in data matrix can result in considerable changes in ranges.

Another problem has to do with a phenomenon of international telecommunication networks. This is the problem of observing moral and legal norms when dealing with such networks, of providing protection for data massives against destruction and for personal and confidential information against illegal access. The significance of this very set of problems has not yet been completely realised in Russia but these days we already experience difficulties when structuring and operating various networks. These problems require combination of efforts of all kinds of experts from psychologists and lawyers to mathematicians.

In conclusion I would like to stress the significance and relevance of such meetings of experts and government officials at the UNESCO Congresses since they allow us to keep up to date and to monitor new trends and problems in the educational sphere as well as to find new roads and approaches to solving of these problems.

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COMPULSORY AND SECONDARY EDUCATION IN SWITZERLAND

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GENERAL POINTS

Due to the federative nature of Switzerland's state system, particularly manifested in the sphere of education, the process of introduction of new information technologies (NIT), at least at its early stage, was largely conditioned by the initiative of individuals. Unlike other countries, in some of which considerable human and financial resources have been involved in the NIT development for many years, a distinctive feature of the accelerated infonnatization of the Swiss education system was that it developed extremely unevenly and sometimes with much delay. Apparently, requirements cannot be the same at all levels, hence the uneven advance.

Analysis of the situation in various sectors of the sphere of education shows that informatics in its different manifestations was substantially developed there, at least in some cantons. Despite numerous gaps and considerable interregional disproportions, today no sector of education can be described as markedly lagging behind in the field under review. At the present stage, an urgent problem consists in the need to eliminate interregional disproportions, further develop successes already achieved and ensure fast adaptation (if necessary and advisable) to new achievements of the information revolution which is developing at a very rapid pace. In these conditions intensified coordination of action on the inter-canton level is very important, including for the future.

SOME INITIAL INFORMATION

Before the early 1980s the application of informatics in education remained to be the concern of individuals and informal groups, above all among the mathematics teachers. Beginning from 1977/78 academic year their effort was institutionalised within a framework of the Days of Didactic Utilisation of Computers which gathered cantonal executives in charge of informatics in education. These events had no official status.

In 1980 the 24 Hours of Informatics for Everybody project introduced compulsory lessons on informatics in high (grammar) schools. In 1981 a financial institution was set up in Vaud Canton to stimulate the teachers' effort in producing software for education purposes. This software was for the most part in BASIC and used in teaching logic and physics which made it possible to simulate dynamically developing processes.

From 1980 to 1987 the work of informatics pioneers was further developed in high schools. In some cantons their effort was legalised whereas in other places project implementation was not as successful. It was a period when relevant structures were formed at the national level. The Swiss Conference of Cantonal *Directors for Public Education (CDIP)* established a NIT Commission and working groups on Compulsory Education and Secondary School II.

In the interval between the first and the third seminars on educational informatics (between 1988 and 1992) the place of basic paradigms of programming, in the sphere of compulsory education was taken by projects of incorporating computer technology into traditional school curricula. The researchers and practical specialists focused on programme packages the use of which also required special training. Supporters of either of the two alternatives, educational programming or teaching software use skills, still coexist with a varying degree of conflict.

THE PLACE OF INFORMATICS IN SCHOOLS

The System of Compulsory Education

In the sphere of compulsory school education, which takes 9 years in Switzerland, the process of introducing informatics in this or that form is either going on or has been completed, in particular in senior grades, in many places. At present most cantons of the country have institutions which ensure informatics presence in the system of compulsory education. However, the process did not always proceed in a uniform manner. At the inter-canton level attention was paid in the first place to the development of fundamental ideas and realisation of general tasks approved by the CDIP in October 1996. The agreed texts were not binding because each canton was granted the right ,to use them in full or in part, depending on the local situation.

The System of Secondary Education

In the secondary school, following a partial revision of the Regulations on Recognition of School Certificates *(L'Ordonnance sur la reconnaissance des sertificats de maturité - ORM)* of 2 June 1986, the necessary conditions appeared for incorporating informatics into school curricula. However, in the new CDIP Regulations (1995) on Recognition of School Certification for high schools, informatics does not figure in the curricula as a separate discipline. It is viewed there as a tool of instruction and as such must be integrated into the education process as a component part of different school disciplines for the purpose of solving the following tasks:

a) Assimilation of knowledge

- Assimilation of basic principles of informatics, in particular those relating to the hardware, software, structure and functioning on information systems.
- Examination of specific and common features inherent in the human intellect and artificial intellect systems.
- Ascertainment of the relationship and differences between the reality and models under consideration, in particular awareness of the latter, for instance, in the process of using process simulation.
- Ability to work in a group (strict and exact definition of the system of distributing general project elements between the group members; the information system has an important role to play here).
- Knowledge of most important effects of informatics' impact on the everyday family and school life, on the sphere of labour and leisure, and of its political significance.

b) Assimilation of practical skills

- Ability to use in practice most widespread application information systems (text processing, computer graphics, tables, data banks, telecommunications, educational software, etc.).
- Ability to determine under what circumstances it is advisable and useful to apply the means of informatics and to choose one's own working tools depending on their characteristics and on the set objectives.
- Ability to analyse problems in terms of structure, relationship and logic (for instance, in the process of interpretation and development of simple algorithms, reading and explanation of a programme, analysis of application software).

c) Formation of abilities:

- of critical attitude to informatics effects;
- responsible (from the humanitarian and social points of view) behaviour in processing and transfer of information,
- account for the ethical aspect of processing and transfer of information.

The working group has already started to work and is planning to draw up a framework curriculum in the field of new information and telecommunication technologies in 1997. A basic document for the group is a UNESCO project of 1994, Informatics for the System of Secondary Education.

Teacher Training

A solution to the problem of informatics study within a framework of the basic programme of training teachers of all levels is within the competence of cantons which, naturally, results in significant inter-canton distinctions in this sphere.

In recent years a great effort has been made in the system of lifelong education in all cantons under the aegis of the Centre for the Advanced Training of Secondary School Teachers (CPS), for instance introductory courses and advanced training programmes were organised.

At present the CPS and the Swiss Centre for Information Technologies in Education (CTIE) arrange consultations on adaptation of the system of continuous training of teachers to the framework curriculum. This concerns assessment of requirements of the teachers who have to integrate new information technologies into their curricula. On the basis of this assessment results the supply of continuous training curricula can be adjusted to the demand starting from 1996.

THE SWISS CENTRE FOR INFORMATION TECHNOLOGIES IN EDUCATION (CITE)

In 1988 the Federal Office for Industry, Arts and Crafts (OFIAMT), jointly with the CDIP, formed the CTIE for nation-wide coordination of activities which involve new information technologies used in education.

The CTIE responsibilities cover all levels of education (compulsory school, senior secondary school, vocational school and specialised school), with the exception of establishments of higher learning.

From 1 January 1996 CDIP responsibilities in the sphere of new information and communication technologies, i.e. management of NIT working groups and all kinds of activity connected with these groups and holding regular nationwide conferences, were transferred to the CTIE.

Acting within the competence transferred to it by the CDIP, the CTIE reorganised the network of cantonal correspondents in the sphere of specialised, compulsory and senior secondary education. The CTIE was also in charge of a seminar for teachers, Internet at Any Price?, on 11 and 12 December 1996.

Information

The CTIE acts as an intermediary in the distribution of information on computer integration into the sphere of education. In association with a number of organisations, it publishes a quarterly journal which informs of opportunities and tendencies in the sphere of information technologies used for educational purposes. It also publishes a bulletin for the system of specialised education.

The CTIE's agency functions also cover Internet (CTIE address: http://agora.unige.ch.ctie).

Documentation

In response to the teachers' software requirements, the CTIE, jointly with a number of other organisations, has set up and is in charge of a programme product library founded on a data base which contains information on approximately one hundred programme products which are of interest to teachers across the country.

Framework agreements

The CTIE is to find a solution to problems related to the school system software copyright. In particular, CTIE would sign framework agreements with the software producer. These agreements provide for acquiring software on terms conforming to the tasks and means of educational establishments.

CTIE address:
21 Erlachstrasse,
Berne 9, 3000.
Telephone: 31 301 20 91,
Fax: 31 301 01 04
E-mail: stib@dial.eunet.ch
Internet address: http://agora.unige.ch.cite

AGORA - A SERVER FOR EDUCATION

Pursuant to the instruction of the National Research

Foundation, the Psychology and Education Department of the Geneva University, in association with the working group on Educational and Teaching Technologies (TECFA), are managing the communication server. At the moment four organisations participate in the implementation of the project: the STIE, the Swiss Centre for Coordinating Research in Education (CSRE), CPS and Research in Education Service (SRED). Jointly with the TECFA they form the "first circle" of AGORA server authors. Other organisations may generate, within the server, their own pages as your partners.

The AGORA server is intended to open a window to the world and promote coordination of educational projects on an international scale. If your country has Education servers, you may inform the AGORA server staff who would include them into the list of partners. Do not forget to do the same in respect of the AGORA server.

Internet address: http://agora.unige.ch.

This address will also open access to other Education services in Switzerland.

The author made use of the following documents:

Education in the sphere of informatics in Switzerland. Report compiled in accordance with Gadient's initiative of 6 June 1985; Bern, October 1987.

Informatics in secondary schools (File 6), Bern: Swiss Conference of Cantonal Directors for Education (CDIP), 1987.

The framework curriculum for secondary schools (File 30), Bern, CDIP, 1987.

Order of the Federal Council/Resolution of the CDIP on recognising high school certificates, Bern, CDIP, 1995.

Research into new information technologies used in education; P. Mendelsohn and P. Germann; the "Educational and teaching technologies" (TECFA) - Psychology and Education Department of the Geneva University, 1995.

The original is presented in French

Discussion

EDUCATION TECHNOLOGY PROJECT IN GEORGIA

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In Georgia Education Technology Project with the IBM Corporation is currently in progress, having started in 1991. The goals of the project are: give to youth and adults throughout the country an opportunity to use an IT for their educational purposes; develop and implement Technology Based Training (TBT) for professional development (especially for education for employment sector); develop arid implement an IT-based administrative, reporting and information management systems for the educational system.

The Republic Centre for the project was founded at the Ministry of Education, having been dedicated in Tbilisi in May 1991 with the participation of representatives firm IBM EMEA Corporation.

The overall mission of the Centre is to guide the strategic effort of what should be done to integrate an IT to the Georgia's educational system for the remainder of this decade.

The Centre will take the lead role in developing the detailed plans that includes hardware, software, networking, functional requirements, system architectural standards and training. At this stage 2 programs are being accomplished, *Pilot Schools and Business Schools*, according to which IBM equipment was delivered, managers, service engineers, instructors were trained. The mission of Pilot Schools program is to implement computer literacy in secondary schools and to provide computer-based educational tools for teaching curriculum subjects. The mission of Business Schools program is to educate youth and adults in free market economy principles and computerized management.

The project's accomplishment in Georgia is organized on the following three structural levels: 1. Republic Centre; 2. Regional Centres; 3. Educational Institutions. This organizational structure makes it possible to define general objectives effectively, to maintain managerial, technological and educational standards and at the same time provide sharing experience between educators end executives for the decentralizing of the project's implementation.

The project enriched the experience in the field of introduction of information technologies in the educational system in Georgia.

In our country, activities in this direction started in 1979. At the Ministry of Education a special organization - Scientific Industrial Teaching Union (SITU) "INFORMATICS" was founded. SITU "INFORMATICS" organizational structure constituents the Main Centre, Centre for Educational Technology, Service Centre, Regional Centres. It numbers over 200 employees, including managerial, technical and educational staff.

At present SITU "INFORMATICS" is a leading organization in Georgia in tile field and major activity areas of the Union are: designing and implementing of information systems for the educational system; designing and implementing of applications for Computer Aided Learning and Computer Based Teaching; providing training service for Information Technology and Computerized Management; designing and publishing text-books and journal on Informatics. Under SITU "INFORMATICS" managerial and instructional guidance students annual competitions on Informatics and international summer computer camps were organized in Georgia. High school students trained at SITU "INFORMATICS" took part at students international competitions on Informatics and in 1990 one student won the competition. At the Union we regularly receive visitors under international partnership programs.

The Republic Centre for the project was founded on the basis of SITU "INFORMATICS", which is managed by the cross-functional team and operates as an integral part of SITU "INFORMATICS" .

The implementation of the first stage of the project was followed by great success - youth and adults involved in this project can use information technologies for the purpose of their educational and professional development.

In the frame of the project we create an organizational mechanism of "change management" which makes it possible to understand what needs doing, apply appropriate resources, be accountable, keep everyone informed, be flexible.

As a complex facility the Republic Centre for project is benefiting executives, technical specialists, teachers, administrators, student technology leaders and a top management involved in the reforming of the Georgia's educational system. The Centre gives all project participants to see, touch and use the implemented components of the project. This exercise gives the project national visibility and at the same time demonstrate possibilities of IT-based methods for problem solving, particularly suitable for making transition to an open society.

According to the project's strategy, originally intended to have been completed by the year 2000, we are willing to develop the project for achieving the following objectives:

- studies based on Pilot Schools and Business Schools programs to be implemented in all regions of Georgia,
- develop and implement the Education Communications Network (ECN) arid get access to the Internet.

Getting access to the Internet is crucial for giving the youth in our country opportunity to use information technologies for their activities in the information technology age and to benefit from the collective knowledge of the planet.

The Internet is to play an important role in solving educational problems in Georgia, particularly in overlooking or newly creating text-books, curriculum programs, instructional materials. Using the Internet services we are planning to take part in selected international communication projects to support the education and get access to diversity of educational and decision support information.

We are planning to connect workstations within the Main Center, Regional Centers and Pilot Schools into LANs and install links to the Internet provider. The components and tasks include the design and implementation of the ECN from the Main Center to Regional Centers and Pilot Schools. We arc planning to provide for students from Regional Centers and Pilot School;, with practical knowledge of the ECN operations and to train specialists, educators and students from Regional Centers and Pilot Schools to become competent the Internet/E-mail users. For this purpose regular introductory workshops for specialists and educators "Internet /E-mail in Education" will be orginized at the Main Center.

We look at the development of the ECN, using Regional Centers' facilities, as an efficient tool for solving problems of the population, who are more than others cut from updated information and educational sources.

The ECN will provide for users from Pilot Schools the possibility to interface with each other for working together on common projects, designing and implementing educational software, publishing textbooks and instructional materials.

The Government of Georgia supports the project, because the introduction of information technologies into the education system is crucial for the development of our country.

The original is presented in English

CAN THE EDUCATION SAVE THE WORLD ?

Predrag Pale

DEPUTY MINISTER OF SCIENCE, MINISTRY OF SCIENCE AND TECHNOLOGY OF REPUBLIC OF CROATIA

ABSTRACT

Human society as we know if is heavily knowledge based. Information technology (IT) is a revolutionary step in development of the mankind, changing the way we live and work, changing our future. Education is key element in preparation for the world we live in and the world of tomorrow. Education is being transformed under influence of IT. High speed of penetration of IT in everyday's lives, ifs unprecedented speed of change and enforceable implications on our future pose a significant problem. Situation is created in which great power is "at the fingertip" of a vast number of non-professional individuals and their every act of misuse or merely a mistake amplifies, multiplies and spreads around the world in a fraction of time in which a handful of officials in charge of privacy and security can hardly notice a problem, certainly not understand or solve it. This indicates that information and legal technology can not efficiently countermeasure those problems and threats. Another, global approach is required. It is suggested that only education, and thorough re-examination and redefinition of fundamental values of our civilisation might offer a solution to this rapidly growing problem threatening to bring end to the world, at least the world as we know it.

THE KNOWLEDGE

The human kind has reached the point in which it completely conquered the nature. It can produce sufficient food to feed the entire population, it can prepare shelter that can resist flood, fire, wind, earthquake and other natural threats. It can live in the highest and deepest, coldest and hottest places, even in the space. It can transmit its perceptions or ideas to just any place in the world and store the entire knowledge of the race for eternity. It can fight most of deadly diseases and has no other natural enemy. The only threat that is shadowing it comes from its own members: people and groups they form.

This achievement, unknown for any other living species, has been done by only one technique and only one methodology: conservation of knowledge and educational process.

Being able to store knowledge and ideas and thus save them from fading away or changing with disappearance of the living person enables each generation to make a new step avoiding most mistakes of ancestors.

Being able to communicate findings, ideas and experience enables cooperation and team work in order to achieve goals beyond capabilities of a single individual.

The modem world is getting increasingly complex even from the aspect of a common citizen. In order to survive, the knowledge rather than physical properties of an individual have the key role. Even more, it is no longer sufficient to reach certain level of education, permanent, lifelong education is required. In the future it will be even more the case. Worse, the speed of changes in the world that surrounds us and the required speed of acquiring new knowledge is challenging the limits of human brain. Therefore, our ability to consume necessary information and adopt the knowledge will determine our chance of survival. This is equally true for each individual as the society in general.

THE INFORMATION TECHNOLOGY

The most important milestones in development of human society are technological changes which influenced the way we store and disseminate our knowledge. The invention of writing, printing machines and telecommunications are the most important milestones in the history. The latest milestone is still not finished (nor it will ever be). It is the information technology (IT). It encompasses the means to store, search and process information and knowledge and the means to disseminate them to just any place in the world (and beyond).

The key properties of IT which enforce changes in almost every type of human activity are the ability of individual to send any information, idea or experience to any number of other individuals anywhere in the world without intermediary as well as to acquire any information.

The benefits of IT are so powerful that no one and no activity can resist it. It is penetrating even the most conservative circles or professions and the speed with which it happens is accelerating.

Thus, we are creating the world which will be dominated by information and everything that exists will exist in this Cyberspace first. Some things will not even exist in material world.

However, the greatest influence of all is in the field of education.

THE EDUCATION

Education is the process of adopting the knowledge and experience of ancestors. At least this was until recently. Today, ever growing importance in education gains the need to acquire the knowledge and experience of contemporary people.

Traditional role of teacher as the information giver and skills trainer is fading away. Today, the stress is on teaching students the way of reasoning.

IT makes it possible to create educational software which will give us the picture and voice of a human teacher, his knowledge, experience and skills. This will be not only the best expert in the filed he or she teaches but he will be the one that presents his knowledge in the way most suitable for the exact student. Student will be able to choose the depth and course of educational process and the teacher will be able to examine the student and to repeat some subjects or even take another approach, of explanation based on mistakes the student made. Finally, the student will be able to measure the level of his newly acquired knowledge against other people in the world. Student will be able to repeat or continue the educational session at any level or course he or she might find necessary or interesting at any point of time. The courseware will be continuously modified and updated according to the latest achievements and findings.

The role of human teachers will shift towards taking care of student as a whole person, choosing and recommending the most suitable courseware and leading discussions and providing help in the matters not covered by auto-educational courseware.

Thus, we can expect that educational process and technology will be thoroughly changed in the future. How soon will this happen is difficult to predict. It has already started, but the main problem is the speed with which teachers can adopt new technologies and their new roles.

In the same time, today's educational systems have to teach us how to use new IT and implement it in our lives and work. Even more, it has to teach us some new fundamental values, ethics and behaviour to prepare us for the Cyberworld.

THE DANGER

The change of the world as we know it has begun and nothing can stop it. There are huge benefits of it: saving of energy and materials of all kinds and thus reduction of pollution, the best service and solutions for individuals world-wide, faster exchange of everything between humans, greater influence of individuals to developments and actions of society and many more.

However, there are problems, too. There are two main directions of problems: speed of change of IT and bringing the great power to the large number of individuals.

IT is generating new services and sub-technologies every few hours. Existing ones are continuously modified and updated. Applications are numerous. The market economy requires products to be delivered to users as soon as possible. It is impossible to wait for products to be extensively and thoroughly tested and verified. Thus the world (and cyberworld) are full of products which have numerous flaws, bugs, side effects, undocumented features and untested options. The combinations of products create even greater reliability and security problems in environments where they are used. Therefore, it is impossible to create safe and secure, highly reliable systems. At least it is impossible for the most of applications. Secure islands are possible to create at very high cost of maintenance and incompatibility with ever-changing surroundings.

The specific property of IT is that its nature is to try to reach as many individuals as possible and to be used by them. Simultaneously they (people) are mutually interconnected and in possession of mental amplifier: the PC. This enables them to let their idea be executed by much faster device (a PC) and multiplied over the network. The consequence is that the results or side-effects of such use or misuse will spread throughout the world (not only the cyberworld) in fractions of time required by other people to comprehend what is happening. This simply means that a handful of authorities (system administrators, police, army, intelligence etc.) has no chance of detecting and comprehending "attack" and then finding and performing countermeasures. Especially, the number of attackers is several orders of magnitude higher than the number of defenders. The key problem is that the attackers have all time they need to invent the attack strategy and mechanism. However, when they launch the attack, the defenders have to compete with the speed of computers and the network to respond.

This situation is further complicated with the fact that it is very difficult to differentiate "good guys" from "bad guys" and legal from illegal. Since new services and applications reach users with enormous speed, they rarely have the chance to study them, their side effects and ethics of their usage. Therefore, a "good guy" with innocent intentions might find out that he did unrecoverable damage to somebody somewhere without even knowing it might happen.

This is the real and threatening danger. Everybody is potential attacker and every action is potentially dangerous. It is obvious that this problem cannot be solved by information or legal technology. It is not possible to define what is legal, and even if it were, it is not possible to effectively enforce the laws. As well, it is not possible to make majority of systems safe.

The order to find a solution the best would be if we would imagine that perfect telepathy is possible today: everybody can read everybody's mind and send him any message even against the recipients will.

THE SOLUTION

Obviously, there is no solution to this problem. At least not in the western civilisation as we know it. IT will bring an end to the civilisation. The only remaining question is whether human kind will find a way to survive.

There is a possibility. The legal and information technology cannot help in the world in which I can do whatever I wish if it is not forbidden or if they cannot catch me. The world in which I will survive if only I can outperform the competition. The problem is in fundamental values of our society. It is based on competition.

The only solution for survival of human race is in change of its fundamental values. Shifting towards co-operation, not competition. Understanding that if I want to survive, I have to co-operate and help others to survive as well. Understanding that I am the one to take care about my own actions so that they do not harm anybody.

This shift can only be accomplished by changing the educational system. Education has to prepare our children and us, adults, for cyberworld and for this danger. It has to teach us not only how to master new IT, but especially how to behave and how to cooperate. There are new rules, and they are gathered around a single word: co-operation.

It is difficult to say whether it is possible to achieve this change and whether there is hope. Unfortunately, there is not much time left for the action.

However, the major step will be made if we understand that it is not the question of morality, ethics, code of honour or similar humanistic value. It is the question of survival.

The original is presented in English

TOMORROW' 98: COMPUTERIZATION OF THE EDUCATIONAL SYSTEM

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PROGRAM FOR COMPUTERIZATION OF THE EDUCATIONAL SYSTEM

The program for the computerization of Israel's education system, a five year plan, is being run by the Science & Technology department of the Ministry of Education. The program, whose goal is to computerize the entire school system by 1998, has made considerable inroads since its start in 1994. Today, the results of its applications are becoming renown world wide.

RATIONALE

The program is based on reports submitted to the Ministry of Education and Culture, and has been run by the Ministry, the National Lottery and local authorities since 1994. The complete program was designed in wake of the "Tomorrow '98" report, which discusses the need for science and technology studies at all age of Israel's entire educational system. This report on the computerization program contains very important recommendations which integrate a number of subjects related to science and technology studies, as well as science and technology as a subject in itself.

The implementation portion of the computerization program based on the concept that the school system must be computerized with a ratio of one computer station for every ten students, as compared to previous years. This is a multi-perspective program which includes, not merely the insertion of isolated aspects into the school system, but a complete program, "computerization basket" which includes material and equipment, the creation of computer software and courseware, and a pedagogical format which ensures the assimilation of computerization within the schools as an integral part of the teaching and learning process, and not as a separate entity.

GOALS

One of the main goals of the computerization program deals with the creation of a learning environment rich in technology, very different from that we have known until now. This environment is intended to narrow the gap between the school and the outside world. Earlier technological infrastructures included very traditional teaching methods, which, in most cases, consisted of chalk and blackboard, plus a few other rudimentary teaching aids.

We believe that by changing the learning environment, we improve the effectiveness of the teaching and learning process. We are trying to change this process to allow each student to reach very high levels in accordance with his abilities, in order to find his greatest potential. Through the use of data banks, the participation of various groups of students and teachers via computer links, and the use of computerized tools, we can improve the effectiveness of teaching and learning. The moment we change our teaching methods, the moment we change the role of teacher from a possessor of knowledge to a guide to knowledge, from one familiar with sources of information to one able to integrate the various disciplines, we actually raise the professional level of the teacher, and change his image and status, both in the eyes of the students, and in the eyes of teacher himself.

PROGRAM ASSIMILATION FROM A MULTI-PERSPECTIVE APPROACH

As I have pointed out, the system's program is different from that we have known in the past two decades. An integrate computerization basket that includes hardware and an entire range of basic equipment necessary, both for the purpose of in-class study, and for the purpose of communication with information centres or external groups. Software and courseware adapted to the curriculum in all the various disciplines of the school system; and guidance, in other words, counsellors and instructors within the pedagogical format to help teachers, principals, coordinators and students assimilate the computer as part of the teaching and learning process.

The program consist of a multiperspective approach which deals with four areas.

The first is the physical infrastructure - the computer labs, as well as the concept behind the construction of the lab in one form or another, the distribution of computers within the classroom, or within the lab, so that the largest number of computers is available whenever a group of students is present. In addition to the lab, there is the communication infrastructure, through which students are able to access data banks and contact information centres, other study groups or teachers.

The second area is technological infrastructure. By this we mean the hardware, whose technical specifications are redetermined each year in light of changes made during the school year while adapting the software to the curriculum.

The third area is the infrastructure of pedagogical support, in other words, the training of the teaching and education staff so they are able to use the computer as a base in their teaching processes; training co-ordinators to help assimilate the program within the school, and a pedagogical support system within the various disciplines of those entering the computerization program.

The forth area is the content infrastructure, which must be adapted to the curriculum, to the study programs which integrate to the use of computers to develop teaching methods different from those we were used to until the advent of the computer as an integral part of the teaching and learning process.

PROCESS OF EDUCATIONAL ASSIMILATION

One of the most difficult, but important, stages in the area of the infrastructure format is a process of educational assimilation. Many countries are now dealing with the issue of bringing the computer into the classroom; in most cases, the program include the hardware, and, in some of the better cases, software and courseware, so as to make the computer an integral part of the teaching process.

The next part of the program is the multi-perspective approach, and the most difficult to implement, is the guidance, pedagogical and educational aspect. Israel's educational system has invested most of it resources in this particular area.

THE STAFF AND THE PEDAGOGICAL SUPPORT SYSTEM

In order to begin the process of assimilating the computerization program, we need to prepare the teaching staff and the support systems of those schools participating in the program.

The personnel which introduces these and other programs into the school must be trained within the educational system, teachers who had certain professional training in integrating the computer into the teaching process. We train these groups of teachers in the processes of guidance, giving them a wide foundation in the field of computerization, and the integration of computers within the various disciplines in the teaching process.

The computer counsellor assigned to a school entering the computerization program. This counsellor guides the school in creating its own computerisation program.

Israel's educational system is still a centralized system. The general concept is dictated to the school, but the school has the right, and perhaps he obligation, to create its own computerization program. The school principal and teaching stuff are those who know the student population, the teachers, the general school credo, and the specific programs best. Together with the counsellor, the practical expert in computerization, they create the school's program.

When the school's computerization program is ready, and has received the approval of the school's computer counsellor, the school can then begin implementation of the program. The program includes the purchase of equipment, software and courseware through the local authorities, as well as the computer guidance training program for teachers, the principal and the entire teaching staff.

The second stage is the training of the teaching staff in various fields of knowledge, necessary, as these teachers had specialized in certain specific disciplines. In the various courses, the can learn how to integrate the computer into their own specific fields. Later, after the computerization program in their school is complete, and the computer counsellor has finished the first stage of guidance, the are the ones to instruct the teachers in other disciplines how to use computer in different fields of knowledge, and how to integrate the various disciplines.

SEMINARS

The third stage consists of seminars for principals, co-ordinators and teachers. The Israeli education system believes that the basic training of teachers in the teaching seminaries, or in the universities, ensures the continuation of a thriving process of education.

We believe that the educational system must change according to need, and that the teachers and principals must, at all times, participate in a wide range of seminars. Only thus can they successfully advance the system, and, of course, themselves.

Computer counsellors are placed to the schools in order to help the teachers. Along wilh the external counsellors, we believe that the each school must have et least one computer co-ordinator, whose role is to be responsible for the infrastructure, allocate computer hours, and organize the general seminars. In the end, this counsellor mast be familiar with all the school's program, and which parts of them can be integrated into the teaching process.

Teachers in the various disciplines participate in a very wide series of seminars, whose format is built according to stages.

The first stage is familiarity with the computer itself. In the more advanced stages, the teachers learn all the programs and courseware related to their field. At an even more advanced stage, they integrate their fields with other disciplines and learn techniques in using data banks, and in conducting dialogue with other groups via the computer, so as to bridge the gaps between different schools, information centres and seminars.

GUIDANCE AND INSTRUCTION CENTRES

The Ministry of Education is not satisfied merely with schools seminars. It believes that the counsellors, principals and teachers need a centre where they can continue the process of training, where they can receive support and guidance, so that any difficulty or new idea can first be examined or tested in the centre, under the supervision of professionals.

These centres are the co-ordinating and operative branch of the program; they implement it by helping formulate programs for the schools, together with the computer counsellor and teaching staff. The centre provides the school with ongoing guidance, expertise, familiarity with new tools, and pedagogical counselling according to each schools specific needs.

DISTRIBUTION OF GUIDANCE AND LEARNING CENTRES

Today, Israel has more than 30 such centres in different parts of country.

DEVELOPMENT OF CURRICULUM AND LEARNING MATERIALS

One of the main goals of computerization program is creation of an environment rich in technology by adapting the curriculum and integrating it with computer. The curriculum is adapted so that the computer is used as a learning aid. Data banks are developed in the different disciplines.

COMPUTER COMMUNICATIONS IN EDUCATION

The educational system supports projects and initiatives which integrate computer communications in teaching, as well as projects which use Internet in educational programs. It is currently supporting a project which uses various methods of computer communications, in conjunction with Israel's telephone company.

PEDAGOGICAL INITIATIVES

So far we have discussed a state program in a centralized educational system, with the option of developing local programs according to the real needs of the school, or of the student population. We encourage different groups to propose pedagogical initiatives, and we test them in various sites within the school system. Most of the initiatives include the integration of new computer communications technology in the teaching process, and experience in teaching methods which use multimedia. In addition to those initiatives which have reached us, we have set up "demonstrations islands" within model schools.

Today the program has 10 models schools, which, along with physical and technological infrastructures, receive all the necessary resources and teaching staff before the initiative is incorporated into the entire school system.

CONTROL AND ASSESSMENT

Each stage in the process of assimilation is accompanied by overall control and assessment, broken down into three stages.

The first stage is control and aid, which includes the support of various authorities in buying equipment and software, in the creation of computer programs, and in reviewing the content of these programs in terms of concept.

The second stage deals with design assessment, including an evaluation of the process of assimilation: examining model schools, guidance courses, and school groups participating in the program.

The third stage deals with assessment conclusions, the assessment of the computerisation program in general, and an examination of the returns within the school system as a result of the program's assimilation.

SCOPE OF APPLICATION

At the present, our greatest achievement has been at the junior high school level, with average ratio of one computer station per every 12 students. The junior high school level has shown the most progress, with a one to ten ratio having been achieved among the majority of the students.

BUDGET

The Ministry of Education has increased its budget tremendously for the computerization program between 1994 and 1996, with a current budget of 80,3 million shekels this year alone. The other contributors to the project, the National Lottery and local authorities, have basically maintained the same budgets for the projects over the past three years.

PROBLEMS AND DIFFICULTIES IN THE PROGRAM

In wake of the rapid technological developments, large gaps between different schools can occur in terms of updating programs and equipment. Therefore, we prefer a slower rate of assimilation, while at the same time, continuing to update equipment and teaching aids.

The computerization program is new, and includes different teaching methods than those used today. Many more hours are required to train a professional and experienced staff, both to train additional teachers and instructors, and to transfer the material to the students.

Because of complexity of the process of assimilating the computerization program, which includes purchasing equipment, training personnel, and supervising the various processes, the rate of assimilation has been slower than anticipated.

FUTURE EMPHASIS

Here is our plan for the next two years of the program. First is the massive development of curriculum, data banks and computer communications to meet the needs of the schools. We also plan to expand computer activities in the elementary and secondary schools, as well as expand the number of initiatives and experiments. Additional model schools will be added to the program, and the guidance and supervisory system will be reinforced.

The original is presented in English

Discussion

COURSE «INFORMATIONAL CULTURE» IN RUSSIAN SCHOOLS

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Two excellent ideas - the idea of trough continuous education and the idea of early informatic learning - were declared practically simultaneously during up standing of national school informatics [1]. This fact not casual, since both ideas bears on unite fundamental thesis: the main goal of obligatory course of informatics in mass general education school is formation in whole young generation of the country of thinking style, adequate to requirements of complimentary information society.

The idea of early study of informatics develops in our country by two different ways:

• as permanent tendency, according to which the lower threshold of the informational education beginning evolutionally decreases from setting, accepted earlier (in 1985) by the government, concerning the place of informatics in the high forms of secondary school;

• as developing courses starting from bottom, from the primary school (and even from pre-school institutions). The idea of through continuous education, based on the information technologies, becomes now the main orientation in the school teaching organization. The educational system, going for beyond the frames and covering most of school disciplines, is called to form in young generation;

• fundamental knowledge about information, informational processes and models;

• applied skills concerning application of informatics methods and means in different spheres of activity;

• capability to utilize modem information technologies in everyday (educational) activity (search, processing, analysis of information, communications);

• world-conseption view of unit informational pattern of contemporary world.

Such system would be called here "informational education".

The idea of continuous informational education of schoolchildren, appearing more and more actual, finds its practical way of realizing in the active initiatives of regions, which even few years ago were impossible. These ways are open, due to formations in the last time the following prerequisites:

• the most significant one ought to consider the pedagogical prerequisites; since 1985 the teachers have stored a great experience of work in school informatics field, which has principally changed the phsyhological climate in school, formed around school computers, informatics class-rooms, school computer applications;

• in comparison with 1985 year the technological provision of school informatics has changed dramatically; currently in the country practically there are no regions, in which computerized school are absent; the necessity of utilization becomes determining factor in the management of school training process;

• complex of program-methodical prerequisites present a great fund of software and original methodical materials and didactic systems, developed during last decade;

• administrative prerequisites consist the fact, that among the management workers of educational system, plenipotentiary to accept responsible decisions, there appears more and more persons, who comprehend not only managerial, but also didactic possibilities of informatics and computer techniques;

• finally, to set of organizing prerequisites one might add the freedom, presented last years to educational institutes in the field of their time utilization; in particular, we mean so called "regional hour", which the school has right to use according to its own opinion for some problem study, which is most actual for the region.

At such prerequisites the problem of continuous informational education realization may be set and decided in the condition of individual industrial developed region. Such conditions were formed, in particular, in Samarskiy region [2]. Here from the set of regional hour, which In framework of school education is equal to 360-550 hours, there was formed course "Informational culture", called to teach the trainer how to live in the informational society: to be able to plan his own activities, to be able to informatize his activities (including in the first turn the intellectual one), finding each time the most effective tool, to master the skills of typical complementary informational system utilization.

The course has module structure, where each module is interrelated with one of the study years in framework of school education from the first up to eleven form. The module consists of software on the informational carriers, supplied by users instructions, book for schoolchildren (textbook) and book for teacher (collection of methodical comments for each lesson. Some presentation about the course content one can obtain from the following list of its main modules (as for primary school modules the annotation data are presented).

• *First form - Computer is your friend.* Elemental introduction into communication practice with computer. Computer at the lessons of Russian language and mathematics.

The easiest trainers of keyboard and mouse interface. Exercises on direct and backward calculation, the number composition and easiest arithmetics.

• *Second form. Computer sharpness (multitudes, signs and order).* First presentations about multitudes, submultitudes and elements. Appropriateness and other. Classification and constriction. Computer at the lessons of mathematics and Russian language. Games and exercises on classification, memory training and construction.

• *Third and fourth form.* Follow me, robot! Algorithm round us. Computer models.

The ideas of command and algorithm are considered and discussed in detail. The instrumentarium of computer lessons in mathematics is actively used. The idea about users and management methods. Recognition of appropriateness and investigation of algorithms, method of "black box". General scheme of user's investigation. Propedevtic of management structures. Solution of combinator problems and user's construction.

• *Fifth form. Computer and word.* Textual editor: dictations, compositions, wall adders, books.

• *Sixth form. Computer - art instrument.* Graphical editor, computer opening day. Editing of musical information.

• *Seventh form. Elements of programming (on the base of performer Cockroach and Cherepashka Logo).* Procedures, parameters, recursions.

• *Eight form. Informational storages.* Data banks and electron tables.

• *Ninth form. The information coding.* Methods of presentation, storage end delivering of information.

• *Tenth form. Informational models.* Typical applied problems of informatics.

• *Eleven form. Informational technologies.* Expert systems, knowledge bases, table editional systems, communications.

The intersubject connections play a significant role in the course. It's important to show, that in everyday educational activity most actual are knowledge and skills, obtained by learners in the course of informational culture. That is why in the lessons on the course children fulfil exercises on their native language on the computer screens, are introduced to with diverse ecological situations, decide on the computers mathematical tasks from school book of problems. The consequence of basic position of the course in school becomes the development of set of original text-books for children and methodic manuals for the teacher one of the most difficult part of the project "Informational culture".

All the teacher's manuals on the course are edited in the form of methodic comments for each lesson. Module structure, variableness of curriculum and open character of software, included into the course, opens for the teacher, who is searching, the ways of construction of his own lessons, if he would be solid with the main directions and goals of the course.

The books for learners, differ by age peculiarities in each module, may be referred to different genres. For example, manual for first form children is a book-coloring, with which children work in the class-room and at home. The book for the second form present a textbook, in which there were collected either computer of noncomputer logic and combinator tasks. The textbook for third-fourth form may be called as a book for reading (mainly for reading at home).

The main component of each computerized course is its software. In total the course "Informational culture" includes more than 90 programs of different volume and complicity. Computer is included in most of lessons. Though computer studies are not selfgoals, nevertheless in the primary school there are no computerless lessons. Later on, beginning from the eight form, in curriculum there would appear certain lessons, which may be carried out beyond the informatics classroom, while in the eleven form the share of noncomputer study comes up to 20 %.

The methodics of training is primary for arbitrary educational program system, whole its software is secondary. In the course "Informational culture" either assignment or forming of programs, or their successivity are subordinated to one aim - to provide the effective didactic instrumentarium for solution of the main course problems. The base of the educational software consists of program performator's system, each of which is foreseen for the formation, training and fixation of this or that skill. In the younger forms the most of programs-performers are clothed in the form of developing games: in the primary school the game form of activity maintain a vast significance for children. At the same time from the game arsenal battles, killers, vampires are completely eliminated.

In the program of the course the page-by-page reading of the text from the screen is practically absent. A large set of graphical files-illustrations is connected with each problem. A lot of screen pictures are animated. Some programs have sound (musical) following. Most of programs are multifunctional, thus fulfilling in the course several different pedagogical tasks.

At the diversity of programs the designers of software tried to minimize the number of interfaces of different types. This requirement was fulfilled at least inside each individual module. The unity of interface allows to minimize the efforts on mastering of keyboard skills, to focus the learners attention on significant features of the problem, to promote the unity of requirements to knowledge and skills of the learners.

The lesson of informational culture for kiddy as well as every other lesson in the primary school uses a lot of forms: conversation, questioning, games and performances, concourses, opening days and even concerts. However each of traditional forms of the lesson carrying out, apart from its individual aim, which is foreseen by the lesson plan, presents a preparation to combination study moment - computer exercise or laboratory work.

For teacher-user (and first of all for the most nonprepared teacher of primary school) it's important, that most of programs, included into software of the course, are open: the user is able to form data, he needs (the exercises, proof texts, individual conditions etc) by build into the system means, which does not require the capability to program, using some program language.

Program means of the course were prepared for the IBM PC computers. The definite type of the computer doubtless presents a principle technical limitation. The base of selection of this or that type were such contradictional requirements as prevalence, from one side, so workability, adequate to typical industrial contemporary problems, solved with the help of computers, from the other hand. One may surely tell, that antiquated national computers *"Корвет"* and *"УК-НЦ"*, in great quantity present in russian school, don't meet the second of mentioned requirements, whole powerful *Mac* one can't yet refer to widespread in schools.

However, the configuration spectra of school in formic class-rooms with IBM PC machines is quite wide. The course project was forced to orient on modest configurations in order it might be realized practically on all IBM-computers (in particular, on the computers of well known russian-american project "Pilot schools"). The programs may work either in the network or without network, with winchester disks on the learning computers or without them. Most of the programs are tuned on different apportionment of keyboards.

The teacher-user (and mainly most nonprepared teachers of primary school) is completely "screened" from configuration peculiarities of school informatic classroom.

Organizational problems of the course introducing are sufficiently sophisticated. The idea of "enter point" leads to rational solution. The academic year is equal to the enter point, beginning from which one may study the course with no damage of its main concepts and goals.

Base enter. The first enter point - first form.

This is natural start of the course, which, probably, afterworlds would be modified, if in the considered continuous course would be included children, who have been acquainted with computer in the framework of pre-school bringing up.

Temporary (additional) enter point in the second form is intended to make easier the organizing problems, connected, from the one hand, with widespread inculcation of the course in schools of large region, while, from the other hand, with significant term gap between the beginning of study in the first form and transition to secondary, school (fifth form). The schoolchildren from the second form, starting to the study, would meet the problem to overcome relatively not so much supplying of missed skills. The problem becomes easier due to the fact, that great work towards mastering of literacy, which is carried out with the help of computers in the pupils of first form, here practically is not necessary: the contingent of the second form are mostly, as a rule, pupils, who are able to read the text-books. Most of the programs, requiring the perception of textual information, may work in the second form module without additional adaptation.

The second enter point - the fifth form.

Children start to the introduce to informational culture directly from the text processing - the main form of computer information process in the contemporary world. The necessary ideas concerning algorithm, performer, command, system of commands may be supplied a little bit later, on the next circle of didactic spiral.

In organization plane the fifth form present a special and very appropriate enter point. In the connection with the transition to secondary school with its multisubject education it's appears a possibility to charge the leading of the course to the most ready category of teachers - professional in informatics teachers.

The third enter point - the ninth form.

The beforehand requirements to learners, which come to the ninth form from the point of view of their readiness to accept the course "Informational structure": minimum experience of work with computer, acquaintance with keyboard; experience with program composing of 10-20 line length on arbitrary language. These requirements may be eliminated through carrying out of several primary lessons in the ninth form.

The introducing of the course according to the scheme, close to the described here, started from 1994-1995 academic year in several school of Samara region. Till the autumn of 1995 all the program and methodic works on this course were finished. In Samara there has been stored an experience of teacher's training to teach the course in school. Since 1995-1996 the course started to be used in several other regions of the country.

The course program, contents and methodics of training had accepted approval and support of Ministry of education of Russia Federation: the textbooks and manuals on the course have been included into federal complect since September, 1996. This means the recommendation of this course for schools from the level of Ministry, as well as governmental support of it inculcation. The leading national methodic journal "Informatics and Education" has expressed a great attention to the course. Since 1995 the journal regularly publicates the materials on the course.

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PEDAGOGICAL ENGINEERING AS THE WAY OF THE INTRODUCTION OF NEW TECHNOLOGIES

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A great number of prophets proclaimed a hundred years ago that our system of education would suffer a great shock. Jim Clarke, president of «Netscape Communications» who knows well which way the wind blows, speaking at the forum on the problems of information highways on 1 February last year organized by the French government said, «The most significant impulse which Internet has on our human society will be revealed in the field of education. Within the period of ten years such traditional educational means as books and notebooks will be replaced by interactive tutoring in on-line mode». Thereby he echoed Thomas Edison who said the same many years ago. As a matter of fact, the inventor of phonograph, the outstanding popularizer of new educational technologies proclaimed 83 years ago, back in 1913, «Books will soon become obsolete and will leave educational institutions. Children will study by eyes. All sciences, all fields of human knowledge can be taught by films. Our school system will be completely transformed in ten years' time». Topical character and the recurrence of such declarations are disturbing. It testified to the role played by various prophets and dealers during the whole history of educational technologies from the time they were originated. It is characteristic that these prophecies have never been realized anywhere up to now. Now, as never before, it is essential to bear this in mind and approach these problems with sobriety and humility: not to make such bold predictions even now, in the age of ever increasing complexity and further spreading of network technologies.

LESSONS OF HISTORY

Actually the history of educational technologies testifies of a peculiar pendulum-like movement, periods of enchantment and disappointment following each other. It was a very true observation by Larry Cuben, professor of Stanford University. We believe that it is true not only for America but for France as well, aod probably for the whole civilized world. Everything begins with the first stage, that is delight in connection with perspectives, which a new technology opens for us. It gives a lot of chances for the prophets who urge various executives to experiment in the field. This first stage when researches at universities (at least in the USA) are conducted, which are the evidence of the interest on the part of the educational system to innovations (and they usually state that the results are not worse than when traditional methods are used) is followed sooner or later by a second stage, the stage of disappointment when the objections of the teachers, their complaints about unsolved technical problems, and the difficulty to adapt school curricula to the new technology are heard even more often. The situation is gradually becoming worse and disturbing reports which inform that the new technology cannot find wide application multiply. Then the critical statements against wasting money, organizational miscalculations and the conservatism of the teachers begin to appear. And at last the new technological miracle is buried in oblivion. There is no need to give concrete examples, each of us can present a list of such impressive examples.

The history of educational technologies shows the importance of such factor as management of time, rates of introduction. The rates of introduction of technologies into the process of teaching are just like in forestry, i.e. very slow. But the rates of technological innovations testify, on the contrary, to the increasing acceleration of these processes, about a sharp reduction of time between the development of a new sample and the emerging of the serial product on the counters. This inconsistency between two time scales requires of us to take into account a multitude of new factors, such as the syndrome of engineering scheduled to become obsolete very quickly, in particular. Thus, the institute of advanced, exemplary educational institutions/establishments, equipped in the best technological way are canceled once and for all. Now it is the time for long-range planning of the development of technological park, the constant search for coherence, for the ways how best to combine new computer and multimedia means.

Those who neglect lessons of the past are apt to make the same mistakes. The main idea which arises from all the accumulated experience is as follows: the introduction of the equipment only gives no result, at least it is not enough, it has never been enough and, probably, will never be enough to ensure its application. There is no need to give examples to prove this statement, as well. Any successful strategy requires one to take into account the whole complex of problems, connected not only with equipment, with technology, but with the whole sphere where this technology is introduced and it is assumed that the process of its introduction into the given system of education is understood very broadly. It is absolutely necessary to organize special services to introduce this technology in such a way to ensure their application by the teachers.

It is necessary to underline that any policy in the field based on the considerable increase of expenses is unreal. In this case one should take into account an unfavorable economic situation and the amount of sums already allocated by state budgets for education in the majority of countries all over the world. From now on we should speak about redistribution of the fund to increase the efficiency of their application. Considerable funds have been invested in new technologies by the state practically in all countries of the world the resources of economics being taken into account. But there the lack of coordination insufficiency of control and - if should be said plainly - non-professional approach can be seen.

THE TEACHER AS THE FOCUS OF IMPLEMENTATION

It also becomes quite clear from the history of the development of educational technologies that in France as well as in Europe and the United States the teacher definitely plays the leading role when new technologies are introduced in education. The last report by Software Publisher Association giving the results of a survey of the efficiency of new technologies at schools in 1995-96 states the same. The statement of the fact causes surprise in the first place. Why so little attention was paid to the human factor, why there was so little concern about how to create conditions for psychological adaptation of teachers to this new technology? But at the same time these conditions are crucial for its introduction. One can recall that long before modern photocopiers appeared such «unfriendly» machine as hectograph was used in schools on a large scale simply because it turned out to be an efficient means to meet an important need.

It is the teacher who should be put in the center of any reforms. It is not necessary to frighten him with prospective shocks and revolutions in his customary professional field. It is necessary simply to help him to perform better his usual job. To a certain extent the same approach should be used as wll orgware was first introduced enterprises. When ten years ago it was introduced at enterprises and in offices, nobody declared that due to such means as the text editor, computer mouse or tabulator the jobs done by the secretary, commercial agent or engineer would be different. On the contrary, it was explained that these new means would allow them to do their jobs faster and more efficiently and would free them from boring routine work. In ten years we will be able to assess properly this strategy: it has given impressive results in the sphere of labour organization. Why not adopt the same strategy in the field of education? This is the essence of French and Canadian project «Computerized school» offered by the Ministry of Education of Quebec in 1993. The coordinator on the French side is The National Center of Pedagogical Documentation.

When developing this perspective strategy it is important to understand that the main thing is to offer to the teacher such new means in his professional activities which he could monitor himself, which he could manage to such a degree as to be able to prepare for the lessons better both at school and at home, to illustrate the theme better or to make a better presentation. These new tools should help him to save time, to ensure an individual approach to different students under the conditions of (mass) schools where mixed abilities classes grow in number. It is very important to check up the hypothesis that the best strategy of introduction is a gradual transition from individual mastering of technology and programs by the teacher to the application of the new arsenal of computer and telecommunication technologies in the classroom, instead of rushing at once from the very beginning to introduce the most complicated and interactive technologies and to realize the global projects. Our main problem now is to increase efficiency. One should be aware of the danger of supertechnocrates who try to push their innovations at any cost, let us remember that our professional goal is education, not technological achievements.

Moreover, let us remember that taking into account the large scale of education, the situation of mass communication under which the teaching at schools is conducted, only serial equipment is to be widely introduced, not unique equipment which is the object of dreams of many people. There are no specific technical means of teaching besides perhaps the equipment used in lingaphone rooms. This mass-purpose equipment is simply used for specific teaching purposes. The matter is, that professional requirements to be met by this equipment are very high. They are much higher as compared with usual home appliances because of big pressures on the equipment, the activity of the students, etc. It is better to take a concrete example. Let us compare local computer networks with other computer equipment at schools and enterprises.

In offices and at enterprises this technology proved very efficient. In this case the part of equipment should be uniform at the given enterprise, the number of programs be limited and although each worker can adapt in the best way his working place to his specific job all the elements of the system should be adapted for centralizes management mass servicing and repairs. All the structure is set up and the calculations are made taking into account the factors of economic organization.

The situation is just the contrary at school: the park of equipment is all mixed, program libraries and multimedia means are all different and inflated, various categories of users work on computers, the management of the system and maintenance service are organized poorly, very often non-professionally. The failure of the equipment has different consequences. At an enterprise or in an office this can only result in the waste of time, but for the teacher giving a lesson the failure may have other consequences, the break down (?) of a lesson.

The operation of serial equipment in severe school conditions makes us face the problem of servicing: it is necessary that special gangs (teams, stuff) should be created for the purpose.

PEDAGOGICAL ENGINEERING AND THE POLICY OF COMMON SENSE

Irrespective of deep conceptual differences, underlying national systems of education, it should be mentioned that the accumulated experience of informatization in the field of education multiplies the number of negative invariant situations everywhere: there is too much likeness in miscalculations of information, and it seems to be connected with the very nature of new technologies. It means that the problem of their introduction should be treated seriously if we want to avoid failures.

In view of the above considered factors, The National Center of Pedagogical Documentation, in particular, was reorganized by the decree of the French government in 1992 and the role of this federation of national education institutions, spread all over the country, has been specified. Three tasks where set for the center. The first two tasks are traditional, that is the accumulation and distribution of documentation (and, in particularly, stocking of departamental and regional funds), and also issuing of materials on every possible carrier - paper and paperless, including multimedia means and educational TV programs (every year the National Center of Pedagogical Documentation makes together with Channel 5, educational channel on TV, programs lasting 200 hours which makes about one seventh of the total volume of the programs, produced by the Channel). However, the third task set for the Center is new and it has to do with pedagogical engineering. I have the honor to be the first director in charge of this trend.

The decree, published in «Official Journal» (*«Journal officiel de la République Française* is an official organ printing new state documents of the French Republic) on 11 September 1992 reads, «pedagogical engineering deals with research, development, designing, maintenance of work and evaluation of the efficiency of educational tools». But to explain what pedagogical engineering is one should broaden this official definition.

Pedagogical engineering is far from being regarded as a new theory in education, which is called upon to replace behaviorism or cognitive; psychology. Pedagogical engineering is characterized by pragmatical approach to the above-stated problems, the same as in engineering designing in general. Pedagogical engineering approach these problems taking into consideration all specific conditions ('context') in which they are originated and solved, the specific character of the educational field, it considers technical means of education 'in earnest', that is within the framework of their functions, as the teachers tools, not his substitutes. It includes in the range of the problems which it is to solve such as the training of students to use new information and. communication technologies in their future jobs ('practical' life).

This new task set for the Center should be formulated and solved in view of the three main aspects.

1. *Global approach:* consideration of the problems of new information and communication technologies taking into account all the 'context' of their implementation means that one should take into account the whole complex of parameters in the area into which they are to be introduced, i.e. pedagogical, technical, economic, ergonomic and organizational aspects; it means selection and coordination of such necessary functions as technological monitoring, examination, informing, consultation and support. What I am talking about is the working out of a long-term policy in the area.
2. *Maintenance:* one should proceed not from the projects made by technologists but from the needs of the users, i.e. teachers; this is the specific character of our approach to pedagogical engineering which necessitates to give preference to such projects and technologies which increase the efficiency of the teacher's labour, help him to save time and reduce the expenses or help to ensure an individual approach to his students, and thus to make them to focus of teaching and learning. It is the most difficult thing now, though it is the most important.
3. *Partnership:* The National Center of Pedagogical Documentation and its branches do not seek to monopolize the area. On the contrary, we aim at the development of the partnership with any organization to mobilize all resources both within national and international frameworks which becomes especially important under the conditions of globalization of the market of the given technologies.

This approach makes it necessary for us to devote special attention to such function as distribution of information (first and foremost printed materials), which is the basis of our work. In addition to such well-known sources as our technical reports, informative letters, on-line data bank and, of late, our service in the Web, *«Dossiers de l'ingenierie éducative»* («Proceedings of Pedagogical Engineering») issued to popularize new technical tools and to help teachers to make their choise. Their circulation usually amounts to 16,000 copies, and they are distributed free of charge through the network of regional centers of pedagogical documentation; they are dispatched to local government bodies responsible for the technical equipment of educational institutions, to administrative boards of universities, to appropriate departments of educational districts and to educational establishments. In such brief description pedagogical engineering may appear to have no original approach but simply a set of obvious things at the common sense level. We do not really reject common sense but I would like to remind with connection with reproaches in being banal, how often the reluctance to global approach in solving the problems of the area under consideration resulted in failures. In the same way, the combination of pragmatism with long-term planning often makes one wonder how great will be the effect of this approach? May be, it should be imaginary.

It is best to demonstrate the significance of the global approach, taking into account the area of introduction and the successful combination of various methods of introduction by way of illustrating the development of such area as museumography (though we speak here about the area which is not as extensive or as complicated as education, and this points to the fact how limited these comparisons are). In old days, the function of museums was confined to that of exibiting the works of art. This often led to the situation when an unbelievable number of treasures of art were piled up in one hall, which can be seen at the moment in the Chantilly Museum, whose expositions have not been reorganized according to new approaches and which has remained following the will of the greatest grantor of the museum's collections Duke d'Aumale 'the museum of museums' of the 19th century. But if you happen to visit d'Orsay Museum or the Sainsbury wing of the National Gallery in London, you would be able to appreciate the contribution made by modern museumography in the organization of exposition space, its lighting, you will see that the expositions in which different trends in art are compared are presented in a few fashion, that the routes of the visitors have changed as well as the rhythm of excursions, the whole system of documental maintenance has changed (the work of the documentation centers, book stalls is different now, there have appeared audiovisual documents, etc.). So, the changes should take place in the area of educational technologies: we too often simply «transmitted» them to schools. This is the range of transformations taking place now, this is the way followed by the National Center of Pedagogical Documentation which does not lose sight of pragmatical points.

Let us remain realists: we do not ignore the obvious fact that new information and communication technologies have found a rather limited application in teaching and learning, exept in the area of technical and vocational training, where a considerable park of computers is accumulated (it sometimes consists of hundreds of computers in lycées graduated for universities and technical colleges, and for jobs in the sphere of services). However, in the whole in all developed countries the results of numerous past attempts to introduce new information and communication technologies in the process of teaching and learning (which passes the stages of general enthusiasm about a new 'miracle' and then the stage of oblivion) show that these new technological means which have changed the society, are left outside the area of education. Does it ensure that the situation will be the same in the future?

THE REVENGE OF THE PROPHETS?

Recently a new phenomenon has emerged which makes our forecasts optimistic. For the first time in the history of educational technologies (in any case, as far as mass purpose technologies are concerned which are suitable for teaching any subject, instead of means of narrow application, such as photos or tape recorders) the tools used in the classroom are the same as those which any teacher has or will have at home. The industry of new information and communication technologies is now developing according to the laws of mass demand. If one compares these two facts - the new situation (which is developing rapidly in the direction of using even greater variety of new means in the classroom such as videos for example and others) and the task of improving the quality of education and the efficiency of teaching (about which we spoke earlier) the main line in the development of educational technologies becomes clear, that is to use new tools to help teachers. I think it is necessary to be quite definite in this respect: this very function of new information and communication technologies as teachers' tools and not their substitutes should be given primary importance.

These are the same technologies with the help of which modern community produces and organizes the production of its main riches. And the teaching tools seamed to have become for the first time in the history of mankind the same as the means of production.

From this fact, from all-penetrating integration of tools, from the fact, that the modern change to the digital data in all areas - from education and science to industry, from the general spreading and availability of computer nets and information channels which solves the problem of access to any type of resources the question arises: is it time to look in a new fashion at the statements of the technological prophets which I quoted in the beginning of my speech? Is it not too thoughtless now to treat them with irony especially if we know who made them? Shall we understand these propheses in a new way now? Here is the last quotation - it is also «untimely» prophesy in the spirit of later and well-known prophesy made by Vanevar Bush in 1945 about the appearing of the hypertext. It will make my question clearer. Back in 1912 Edward Thorndike one of the most outstanding American theorists in psychology of education who greatly influenced Skinner and cognitive psychology wrote: «If some technical miracle had given us an opportunity to organize tutoring by books so that the access to the next page would be possible only in the case of the right answer it would make a great variety of educational work which needs the teacher's presence to be tutored only by written materials. Such books should be developed on many subjects with material presented on separate sheets or organized so that the student would not face any difficulties besides the cases of improper usage of the book» .

Today the technological miracle has become reality. At last the means we need are available. Hence a new question is it possible that our predecessors and prophets who despite their mistakes were competent, earnest, firm and who sought the unity of pedagogical art - is it possible that they have made only one mistake namely they were right too early? Maybe their only mistake was that they relied on technologies which were not «ripe», «incomplete» technologies which were unable to fully realize many times revived dream about a technical means which would be simple, available and controllable by the teacher, adapting easily to various conditions and the specific character of subject teaching? How could imperfect tools of that time to satisfy that everlasting need in the means which would make possible on the one hand to organize knowledge resources and make them available and, on the other hand, to take into account every unique teaching situation? In other words were the educational technologies which we have been using up to now - from glass diapositives to educational computer programs of early nineties - and which our predecessors tried to introduce in education, were they not them just unsuccessful and untimely forerunners of what we have got only now?

It may be too early to give a positive answer. In terms of the science these doubts are justified and helpful, they are the pledge of future development but the similarity of the processes in various countries needs a thorough investigation and may discover at some stage of development steady signs of what was predicted long ago namely the renovation of educational process organization and the role of the teacher, and the dynamic redistribution of the roles played by information, experience and knowledge.

The epoch of educational technologies seems to have come at last. However it is clear that without our purposefulness and determination to reconstruct this process on the basis of a global approach, without realization that the help to the teacher must be given the top priority, all our efforts will be in vain just as it was in the past. Now as never before an engineer and pedagogical approach is necessary provide and make it easier the real implementation info the educational process of new information and communication technologies.

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The original is presented in French

THE "NEURONE - STUDENT" IN AN RECONFIGURED EDUCATION SYSTEM

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I would first like to thank you for the choice of the problem of education technology as a subject for the given Commission and for inviting me as a speaker.

It was risky on your part to invite me in this quality since I am neither a technologist nor an educator, but largely an administrator, who dared to have an opinion of her own on the subject — in fact, I am the head of the Teleuniversity, an organization specializing in distance teaching based on the virtual campus concept.

Based on this experience, I am going to discuss the student and the strategy of cooperation in the new communication and information technologies in the education. Let us assume that there is nothing unequivocal in the concept of the student — this concept is equally applicable to the new kindergarten child and to a mature individual attending a university. In relation to the new information and communication technologies, too, this concept is heterogeneous and varies in a wide range, depending on the level of contact of the individual with the equipment available to an education organization, and, more often, beyond it.

In order to clearly outline the subject, I shall focus on the student in contact, or the one, who needs to come in contact with the new communication technologies. This beginning would make if possible for me to illustrate the «Darwinian» evolution of the technophilic student, who at the end of the study process, is somewhat reminiscent of a neuron. Subsequently I shall attempt to state the requirements and the potential of the changes that were introduced into the educational system by this "neurone-student", and also the necessary solutions that are to be envisaged for these changes not to be regarded as problematic.

1. THE ADVENT OF THE "NEURONE-STUDENT"

I shall show the evolution of the student, a graduate from a common school, who faces in his scientific world with the new information and communication technologies as exemplified by fours stages:

1. Origin: *traditional school*

In this traditional school, the relationships between the student, the passive components and the teacher are natural or using the paper or a black or green or white blackboard.

We all have passed through such a school and many of our children also attend it.

2. Transitional Phase: *a Class with Technical Equipment*

The relations in such a school are almost similar to the former one, but there appears a modern and accessible technical equipment in it, as the electronic panel and a printer.

This is the outlook classes in industrial countries are increasingly assuming. At the same time a typical student has an outlet to the world thanks to TV and an Internet subscription.

3. Advanced Phase: *the Class is Connected to the World*

Such classes are few because they are expensive and the teaching aid requirements are high. It seems to open a window to the world thanks to informatics means associated with large networks.

4. Final Stage: *Virtual Open Class*

I so far refer to this model as final because I am unable to predict the future. The physical characteristics in this model disappear and the teacher/student interface and student/student interface has been completely implemented thanks to the multimedia dialog means of distance communication. The distance between the participants is no longer of any consequence, and synchronous and asynchronous use of such means permits overcoming the schedule requirement.

In this world the student is no longer indifferent or passive component, but rather an intelligent component involved in his learning thanks to the choice of and access to different data bases. This regime, which better suits an adult student since it implies a capacity to differentiate and independence, should not be excluded for younger people, who actually use it at home. Conversely, it should be applied at school, gradually developing in the student the ability to independently guide his education. Gradually, the habit of independence makes it possible for him to develop himself all his life, and, consequently, to meet the challenges of the world wfth confidence. However, I am sure that it would be difficult for him to follow the traditional education system along this line — in fact, the logic of development questions its very existence. The effect from the advent of a "neurone-student" is, in fact, impressive but can be controlled.

II. THE EFFECT OF THIS ADVENT ON THE EDUCATION SYSTEM

This advent involves great possibilities and new requirements, and the problems it involves contain solutions.

1. Giddy Opportunities

Today everybody is well aware that new information and communication technologies open up new horizons for the solution to the problems of mass education both in industrial countries, experiencing economic and social crisis, and in underdeveloped countries, which have *overcome external problems.*

In fact, the new information and excommunication technologies:

- eliminate the limitations associated with distance;
- eliminate the need to construct material facilities;
- eliminate the problems associated with the need for time arrangements (the need for coincidence of events);
- *make the teaching process accessible to large numbers* of people, and, hence, make it possible to save the resources of teachers;
- make possible exchanges between communities and cultures, eliminating isolation.

Nowadays these opportunities are only outline, but is everybody aware of the new requirements that they entail?

2. New Requirements

This is now the question of the world which we shall have to transform using new methods; as to the new ethic standards and the new steps to be overcome, they are not only high, but also numerous:

- it is primarily necessary to have efficient equipment;
- it is necessary to have access to communication infrastructures connected to the world with a speed sufficient for active interaction;
- it is necessary to create portable educational tools conforming to various cognitive styles and different cultures;
- it is necessary to have human resources capable of implementing a study course and to lend it a technological and informative form and to train teachers for such course, to develop a virtual community. So far such fundamental assessments are only rare in the market;
- it is necessary to remove the territorial framework of institutions and develop a new management system *focused on the mobility of the content of knowledge rather* than of the students;
- it is necessary to develop a new policy and new systems for quality control and fixation of the results attained;
- it is necessary to resolve the language problems in order to avoid the Babylon Tower syndrome or its opposite — «the imperialism of a single linguistic monopoly».

It is *necessary, necessary, necessary...* there are too many requirements for a single community to tackle these problems alone. At the time when the economy is becoming global, it is necessary to make the very education global. The avenues of informatics are calling for that.

3. Global solutions

The present meeting is an interesting form of entry into the epoch of increasing cooperation in education. We should be thankful to the new information and communication technologies for making us act. Here and everywhere we shall have to:

- collect our local experience to get ready to the great challenges of 1996–2000;
- to agree that although the time of these solutions is today it is impossible to do everything within a day, that each modest step in this direction can improve the global situation;
- to try to determine a minimum of common values so that to take advantage of the phenomenon of information main avenues; to think of the legalization of the rights and liabilities of the «surfers»;
- to make an inventory of our educational data bases and our technological means to develop an exchange market instead of relying on an autarchic development;
- to attract the attention of financial circles and industrial enterprises to join efforts in providing respective *infrastructures,* equipment, teaching *programs,* management software, and most importantly study programs. You know that a multimedia course may cost from \$100 to 400000;
- promote the development of our education institutions so that they would provide scientific standards to the study courses. This is all the more important that our "neurone-*student" is quite independent;*
- finally, and most importantly, we must train teachers in case we want to have the slightest chance for the creation of a future - the new teachers will have to develop new institutions, new educational approaches and new systems.

The final piece of advice that I would like to give to those *for whom the system to be created is new* is to rely on those who already have the experience of virtualization, i.e. specialists in distance education.

CONCLUSION

The future is inseparable from the present and beautiful. Teaching is not the only requirement to be met in our changing world, but it is one of the most important to it.

If we are to gain from the new information and communication technologies, if we are to create good conditions for the birth of a Neurone - Student, if we need migration more than revolution, we should go into all this together and immediately.

Our means are limited everywhere, and, hence, we should think over our objectives well enough — it is better to invest in neurons than in neutrons.

NB. This text could be well illustrated by the supplemented documents obtained in the LICEF Center of the Teleuniversity. It describes the structure and the method of the existence of some virtual campus using new communication technologies.

The original is presented in French

EVALUATION OF TECHNOLOGY-BASED LEARNING: A SOCIAL SCIENCE APPROACH TO QUALITY ASSURANCE IN EDUCATION

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ABSTRACT

Some problems of evaluation methods that are commonly used in laic attempt to assure file quality of interactive educational media are outlined. The authors present their heuristic model of the learning process as the basis for an altemative approach. It has the advantage of bringing the social aim and situation of the learning process into focus. This model leads to a qualitative approach to software evaluate in which also helps to define appropriate and creative settings for the use of the software.

1. PROBLEMS OF EDUCATIONAL SOFTWARE EVALUATION

The problem of quality in interactive educational media has accompanied the field since its beginnings. Numerous researchers tried to define criteria of software quality and to compile catalogues from them (see [Doll, 1987], [Thome, 1989], among others). The idea was to translate these catalogues into checklists that could be of practical use for teachers and trainers in judging educational media.

Checklists have the advantage of being cheap and simple to use: no software users (= learners) are needed. But this is also their disadvantage: they cannot make predictions on the context, that is, the specific target group, learning goals, situations etc., in which the software can be more or less usable. Whale they are left to check are those aspects that can be tested and judged without context. These are, however, mostly those questions that can be applied to any kind of software, i.e. whether it is robust, error-free, well-designed, well documented, easy to learn and user-friendly. The specific character of educational media has to remain outside this method.

Empirical methods of evaluation, on the other hand, are costly and time-consuming. They are applied to only a few selected cases of software (often those program developed by the researchers themselves). One well-known method is based on the comparison of groups of learners. One group works with media support, while the reference group - which has to be comparable in age and gender distribution, prior knowledge etc. - works without software support - with books, classroom teaching etc. The comparison (most of the time by standard tests) of bolt groups is supposed to reveal the difference that results from the use of interactive media - be it positive or negative.

For all its complexity, this method has its pitfalls, too. What can be tested objectively is the memory of the contents learned. However, this amounts to an implicit reduction of learning to the mere reproduction of facts. Furthermore, test groups would be. strictly speaking, only really comparable if both traditional and technology supported teaching were completely identical in contents, goals and methods. But if new media are used in this way, they rightly provoke the question what. in these circumstances, is "new" in them.

The problem with both methods is that they reduce the learning process to a number of individual factors: lists of criteria consider the software without the learners, and comparative studies, while considering the learners, treat them as isolated receptacles of knowledge. Learning with software is, however, a social process in at least two ways' first, it takes place in a certain social situation (in the classroom, at work, at home) and is motivated by it. Secondly, any relevant learning process has as its goal the ability to cope with the social situation (professional or everyday tasks, etc.). The evaluation of interactive media then has to satisfy three conditions:

1. It has to take into account the social situation in which the media are used, and must not be limited to the media themselves.
2. It has to take into account the goal of dealing with complex social situations and must not limit itself to the isolated individual learner.
3. It must take into account the specific forms of interaction between the learner and society. These interactions range from the passive reception of static knowledge to the active design of complex, dynamic situations that characterizes the "expert".

These requirements eliminate evaluation methods that can only pick out single factors. At the same time, they make an "objective" discussion of media quality difficult. In what follows, we will first outline a heuristic learning model that can be used to define and to design learning situations on the basis of these three conditions. We will then try to propose an evaluation procedure where the concept of absolute quality is replaced by relative values. These values are defined and determined in discourse - with the software, with the situation, and with the scientific community.

2. A MODEL OF THE LEARNING PROCESS

The model that we propose is inspired by the work of Dreyfus and Dreyfus [Dreyfus and Dreyfus, 1987] who studied the learning process from novice to expert:

1. A novice who does not know anything of the subject he/she is approaching has to start with faking in the facts and rules of it. The application of them to the novice's practice or exercise of the field has to be automatic: the novice cannot decide on which rules to apply and learns them as context-free. Practice is thus limited to imitation, to exercise.
2. The beginner can start to learn the context of the rules, i.e. hat there are different rules to apply in different cases. The practice becomes more varied and more adapted to individual cases, but it is still impossible to act autonomously in the field.
3. At the third stage, the competent person grasps all

the relevant rules and facts of the field and is, for the first time, able to bring his/her own judgment to each case. This is the stage of learning that is often characterized by the lam "problem solving": the conscious and often laborious decision-making process based on the vast repertoire of facts and rules available to the learner.

4. Contrary to most learning theories, this approach, however, does not stop here and does not consider competence to be the final goal of learning. The four stage is called fluency and is characterized by the progress of the learner from the step by step analysis and solving of the situation to the holistic perception of the gestalt of the situation. Just like the situation, its solution also starts to present itself as a holistic pattern or gestalt together with the problem.
5. This ability of gestalt perception is brought to perfection by the expert, the final stage in the learning process. An expert identifies him/herself with the complex real-life situation in which he/she is bound to act. The "art" of the expert consists not in solving problems, but in constructing them out of the amorphous complexity of life. This act of creating the problem already contains its solution.

Most theories of learning stop - as we mentioned above - at the level of competence. Traditional Artificial Intelligence research with its focus on the representation of facts and rules and on problem solving [Baumgartner and Payr 1995 a] I has no small part in this narrowing of our perspective on learning. Practitioners and those who are concerned with their education, like Donald Schoen ([Schoen, 1983]; [Schoen, 1987]) have never been satisfied with this view. Schoen's concept of the "practitioner", for example, shows close similarity to the "expert" characterized above, and his writings about the education of practitioners that have inspired so many educationalists offer an account not only of what it means to be a practitioner, but also of what it could mean to "teach" them.

The problem that we saw was the gap between the view of beginners through to competent learners and the view of experts-to-be: There did not seem to be a hint of how learners pass from one level to the other, nor a unified picture of the strategies required for educating experts or practitioners. Out of this need, we developed the heuristic cube model [Fig. 1] that combines the (meta)contents of learning with the goals of the learner and the learning strategies (see [Baumgartner, 1991], [Baumgartner, 1992], [Baumgartner, 1993], [Baumgartner, 1995], [Baumgartner and Payr 1994], [Baumgartner and Payr, 1995]).

Learning Contents

From left to right, the cube diagram shows learning contents on the level, i.e. not the "subject", but the task of the learner in a certain stage and situation. This dimension offers a fine-grained differentiation of the coarse subject description fig. "equations with two variables"). For example: Should the learners be able to solve the equations given a certain method, should they also be able to choose the adequate method, or should they even be able to extract the equations from an observation or a verbal description? In the first case, the contents of the learning process are context-free rules (like rules for transformation of equations). In the second case, they learn context-sensitive rules, i.e. they have to decide which rules are Loa be applied in what case. The third level (problem solving) deals with solving given systems of equations. On the more advanced levels, the learners first will have to construct the problem themselves out of a complex, real-life situation, before solving it.

Goals of Learning

From bottom to top, the cube represents goals of learning in their order of complexity. This dimension characterizes the types and possibilities of interaction between the learners and the "world" (society, nature). It is based on the experience that novices cannot successfully deduce a solvable problem from a complex real-life situation.

This approach to goals of learning can easily be misunderstood as the reincarnation of traditional, hierarchic notions of learning, where novices had to progress slowly and painfully from rote learning of facts to mindless drill in order to finally be found "worthy" of more complex tasks. This is certainly not what we mean here: rather, this dimension reflects the common experience of learners in which they spontaneously choose those strategies of interaction with the subject that protect them from an overload of complexity. A novice of the language in a foreign country (= complex real-life situation) limits herself, in a first step, to grasping isolated words or idioms in the flow of speech of the natives. Only later will she be able to perceive and analyze longer parts of speech.

Teaching Strategies

From the front to the rear, the cube model shows three different teaching strategies. This dimension attempts to outline the role of the teacher, but also that of the educational media: Are they "teachers" (= explaining, demonstrating), "tutors" (= observing, correcting) or "coaches" (= accompanying, participating)?

Learning Goals and Educational Media

Beside the goals of learning, we put a certain type of educational software. This typology is quite traditional in itself, but, integrated into the general model of learning, it is a starting point for classifying software according to the types of educational interaction it allows, and not only according to design criteria, as is often done. This typology of educational media is done here for only one dimension of the "cube", but could be done equally well for the others. Doublessly, there is an affinity between a certain goal, certain contents and a certain educational strategy. For example, we cannot easily imagine how a learner can master complex situations (contents) without acting him/herself (goal) in a situation where the role of the teacher is that of a participating coach (strategy). But what we want to underline by listing all the possible varieties that can lead the learner from novice to expert is that each sensible combination can be justified in a certain learning situation. Contrary to researchers and developers who are mainly concerned with "interesting" cases of educational media and therefore prefer complex media (simulation, games, microworlds) to seemingly "old" and primitive media (tutorials, practice, presentation), we try to express, in this model, that each type and use of media can be justified and adequate, provided that their use is adapted to the situation - the current goals and contents and the appropriate teaching strategy.

It is therefore also important not to lose sight of the "final" goal of the learner, that is, to become an expert or at least a fluent practitioner in the field. This holistic view of the learning process helps to avoid the risk of a narrow and biased view of learning that is often to be seen, especially in the field of educational technology where the (restricted) potential of media often prompts an equally restricted view of learning.

3. EVALUATING BY GENERATING QUESTIONS

The relevance of this model for the evaluation of educational media lies in the support it gives to the teacher or evaluator in defining the learning situation from the viewpoint of the level that the learners have already reached. By applying it to classes of educational software, it also provides a first orientation not only on the type of media to use, but also on the type of use that could or should be made of this software: most modern educational software packages are complex enough to allow different types of use, e.g. as a pre-defined problem to solve or as an open scenario more or less restricted by pre-set parameters.

To pass from this static analysis of given situations and software functionality's toward a more dynamic approach to evaluation and didactic integration, we suggest a procedure in the form of so-called "generative" questions, as they are used in qualitative social research methods like "grounded theory" ([Glaser and Strauss, 1967], [Strauss, 1987]). These are questions that open up the problem space, draw attention to the problematic points and make solutions comparable. The "generated" concepts can be compared to the criteria that are used in check-lists. But. instead of being pre-defined, these criteria are developed in the context of the given means (media) and ends of the learning situation.

As generative questions address the specific situation, they are not fully predictable. We will try here to define five families of such potential questions. This presentation can neither be complete nor equally relevant for each case:

1. Questions on the relation between different levels of complexity, e.g.: How does the way in which rules are learned prepare the learner for the task of problem solving?
2. Questions concerning one level of complexity: How is complexity increased inside orfe level? How can complexity be reduced?
3. Questions on (implicit) meta-strategies; How does the software support the acquisition of strategies to control the situation? How does the software help the learner to develop learning strategies (like diagnosis, planning, observation etc.)?
4. Questions concerning teaching strategies: Which methods are used to support the construction of mental models, the learner's on activities, or her growing involvement and responsibility?
5. Questions on the social situation: How' is the social context integrated? How does the software prepare the step from virtual to real world? Are there slots for social activities, teacher intervention, and integration of other media?

The aim of the generative questions is to uncover the didactic strategies that underlie the educational medium. In this sense, they are instruments of evaluation or of comparison of different media. At the same time, however, these questions reveal what the medium cannot bring to the learning situation and whit must be looked for elsewhere. Educational media, however sophisticated, play only a small part in the complex learning process. The main part - be it the transition to real-life complexity, be it the background of facts and rules - is left to either to the learner or to the designer of the learning process to provide. In this sense, these questions can help them both to put educational media into perspective and to find in them the clues to create a learning situation that is oriented toward the overall goal of educating experts.

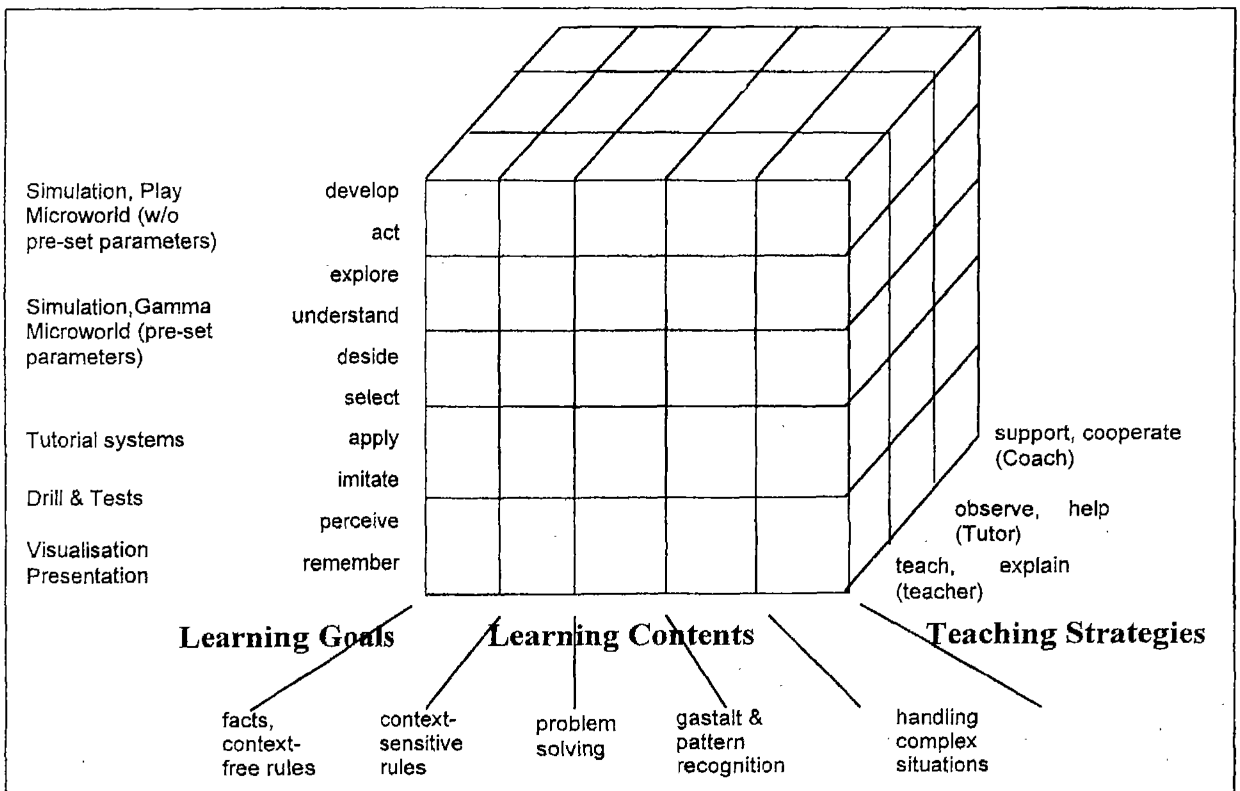

Figure 1. The cube model – a heuristics for defining educatuional (software) situations

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The original is presented in English

Discussion

INFORMATICS IN SCHOOL OVER LAST TEN YEARS

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The intensive development of computer technology started in fifties of the current centenary has basically effected on all spheres of science, political and social-economic life of society. Powerful computers revealed a capacity not only for accumulating and processing information. They also aided in creating communication facilities which made the information accessible at any point on the globe. As a result the modern society has been assigned a metaphorical title of "the information society".

And though informatization history is lasting not for centuries but years, in contrast to mathematics or philosophy, the impressive success of informatization has attracted a great interest of the society. The first computers were constructed about fifty years ago (United States, 1944 - 46). This anniversary is supposed be celebrated within the II International Congress UNESCO that will take place in Moscow. As for wide computer using in Russian schools it has begun since 1985 - 86 e.g. ten years ago.

Since the moment of first computers appearance the educational tasks were defined as follows:

- Preparation of specialists for qualified operating with the computers (professional learning).
- Training of the population for living and working and living under new conditions (general education).
- Using of computers and information technologies capacities for the sake of higher learning efficiency (the development of the educational system itself).

The wide range educational system informatization in Russia started when a new discipline called "Basic Informatics and Computer science" had been introduced into the school program. (At the same time the first computers started delivering to educational structures).

The first steps of educational system informatization in Russia were initiated by the prominent scientists - academicians A. Ershov, Ye. Velikhov, N. Krasovsky, V. Melnikov, who created the concept of educational system informatization in Russia. Besides among these scientists there were the leaders of the technology division - F. Peregudov, V. Afanasiev, M. Leontieva, A. Uvarov. The efforts of these people pushed the process educational system informatization in Russia and to determine most directions of the process in the long run.

The educational reform of 1991 is aimed at the principal transformation of the whole educational system in Russia. If in 1984 the informatization was one of the reform goals, now the reform itself cannot be put forward without informatization.

Regional and municipal accents on the education, the independence increase of educational structures, the new possibilities for choice - all these factors multiplied the number of information users which has included the pupils and his parents on one side and high state authorities on the other side.

New demands concerning operative and direct access to the information resources have also grown. It is related both to the information which is necessary for governing educational system in democratic society and at the same time to "learning" information which is needed for provision of high-quality education for all Russia citizens, independently of place their living.

For the sake of solving this problem Program of education informatization has started in 1994. The program was aimed at complex development of the informatization and meant the agreed cooperation of federal, regional and local level educational structures. In this process the tasks settled within each level are not duplicated but correspond to their competence.

Federal level of the Program includes : elaboration of federal standards in the field of the education informatization, creating a normative basis for development of educational informatization; the methodical provision of federal component for the informatics learning course; supporting for promising directions of educational informatization, providing basic conditions for creation of the unified educational and information space in Russian Federation.

In relation to the regional level the Program offers a complex approach to the creating of the informatization regional programs, a circle of first-priority problems to be solved is marked, the consequence of actions is denoted; a list of structures which could realize the regional programs is recommended, interaction ways of these and analogical structures are indicated.

Among the most important educational informatization programs there are following positions: elaboration of regional standards and other normative documents, providing educational informatization system implementation in the region; learning and methodical provision of educational informatization system regional component; educational structures equipment (with exception for those are related to the federal level) with computers and with other informatization means with computers and with other informatization means, maintaining computer's equipment; training programs for lecturers staff based on the regional Institutes for Teacher Development and Informatization centres; creating regional networks; accumulation of pedagogical information. By now the regional educational informatization programs in more than 50 subjects of Russian Federation.

In 1995 an idea of interregional cooperation offered by the above mentioned program was pushed forward. Thanks to the active attitude of Primorsky Area People Education Department, the "Agrement on Coordination of Ministry of Education of the Russian Federation and East Siberia and Far East regions Joint Activity in the education informafization field". This document assumes the creating of informarization programs for education in all regions, signed the agreeement, coordination of the activity, partnership inthe course of different progects implementation. The Agreement is supposed to be a base for analogical agreements between the Ministry and other Russian Federation regions.

The equipment of schools is realized mainly within the framework of regional informatization programms.

In Russian Federation there are about 35000 schools. Among them there are complete secondary schools, which are equipped with the computers first of all.

At present most of institutions of general secondary education and institutions of primery vocational education are provided with computer science cabinets. Annually the computer fleet is filled up with about twenty thousands of computers.

It should be marked that for the last years only up-to-date computer equipment has been delivered (mostly it was *IBM*-compatible technique). *Mac*-type computers have been installed in some (approximately 500) schools as well.

In spite of the fact, that the most popular way of using computer technique is still computer classes, in some secondary schools the transition to creating unified information space inside schools starts being realised. The process of school "media-libraries" creating is taking place in some schools.

In pedagogical institutes and Institutes for Teacher Development not only teachers but engineers, working in the branch, take their training courses. Special standarts of pedagogical education are directed at the preparation both of informatization teachers and teachers of traditional school disciplines (whose second qualification is informatics teaching).

At present the learning structure elaborated within the Program is fully provided with educational supplies and leaning softwares. Regretfully a shortage of methodical supplies does not allow varying the process of learning.

The work on creating telecommunication network is one of the most significant directions. In some areas of Russia special network centres were created. Centres in Barnaul and Perm should be specially marked. Practically all the pedagogical universities started using the networks.

An "Inform-education" network has been widespread, which is based upon the transmission of information along TV channels. This network counts up to 100 users in 40 regions of Russia. Since1995 all the documents of the Ministry of Education of the Russian Federation have been transmitted through this network.

Since 1994 e-mail is used for the performance of all-Russian olimpiads.

The data banks of different content have been created. For example, the pedagogical data bank, elaborated in Institute for Teacher Development was acquired in 49 regions of Russian Federation. Practically in all regions taking part in the Informatization Program there were realized databases including statistics on methodical, staff, technological state within educational structures.

Informatization and international cooperation are closely related. The information infrastructure of Russian Federation is a part of world one and joining of any school to educational telecommunication networks in Russia is a chance to become a part of world education space.

Practically all international projects in the education area have something to do with informatization.

The realization of joint projects by schools-partners from different countries is becoming more popular. The e-mail information exchange between them has involved more than 2 000 Russian schools. Besides Russian pupils are rather successful in the international informatics olimpiads.

Nevertheless the number of international projects on "Informatics and Education" is not great. Among these projects the competition of school manuals supervised by International Fondation "Cultural Initiative" (Soros Fondation) is worth mentioning. In the course of competition 150 manuals on informatics and software have been considered (half of the works were awarded with grants and is being prepared for publishing) .

We hope that in the nearest future number of international projects on informatics will considerably grows. The UNESCO Congress in Moscow is a contributionary factor for this process. Moreover it looks promising that before the Congress a number of projects, offered by Russian Federation has been supported by UNESCO and is to be carried out with the participation of this respected organization.

The original is presented in Russian

IT SUPPORTED CURRICULUM CONTROL IN HUNGARY

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SUMMARY

There is a convergence in the development of curriculum control in different countries. Countries previously dictating curricula to their schools relax their strict central curriculum control whereas countries where there was no national curriculum control before introduce national curricula. For more effective communication about the goals, objectives and contents of teaming between parties interested in education, a new multilevel curriculum control system, as well as a standard curriculum model is proposed.

The proposed curriculum control system recognizes the distinction between long term and short term, central and local planning. It recognizes the role of the national government, school authority, school, teacher and even the student in influencing the curriculum.

The Profit curriculum is a hypertext database, a project plan and a curriculum document. It is based on the hierarchical structure of long term and short term study units. By this method core curricula, model curricula and local curricula can be described within the same framework allowing referencing between different levels of curriculum control. The refinement and adoption of the curriculum framework as well as the computer aided curriculum development system is proposed to be one of the priority areas of regional and global collaboration to harmonize and improve the different national education systems.

INTRODUCTION

Although, curriculum is a fuzzy concept, curricula exist in abundance. Curricula are developed and implemented on the on the personal level (by parents and students), on the class level (by the teacher), on the school and on the local educational authority level as well as on the national level. We expect that some parts of the curricula might soon be developed on the intemational level. It is essential that curricula are harmonized across subjects, school types and school systems to make a maximum use of teaching and teaming time to the benefit of the student and of society. To be able to effectively harmonize curricula, we need a common curriculum framework and, preferably, a tool supporting and enforcing its application. The Profile curriculum framework and software is an attempt at providing these.

CURRENT TRENDS IN CURRICULUM CONTROL

European integration trends as well as the common concern for the quality and equivalence of education have led to convergence between the various models of content and quality control. In recent years national curricula have been issued in countries where none before (like England or the Netherlands). There is an effort to develop methodology and technology for standardizing examinations in countries where the curriculum was the means of national quality control rather than a state examination system (e.g. in Sweden).

Finally, there is a clear trend of internationalization both of curricula and of examination systems. An example of the former is the Threshold Level Foreign language curriculum frame, which guides curriculum development and textbook writing all over Europe today. An example of the latter is the International Baccalaureate, the international recognition of certain language examinations, and the informal and formal co-operation between agencies commissioned to provide national secondary examinations (like the Cambridge Examination Syndicate and Cito, or Cito and National Institute of Public Education in Hungary).

On the other hand, tendencies for standardization and internationalization are balanced by a stronger claim for local control in the content of education. Parents' leagues, associations for the freedom of education, regional authorities, and the schools themselves insist that those concerned must have a right to choose an education that is suitable to them.

THE TRANSITION IN HUNGARY

The development of a new system of content and quality control was started already in 1988. Work on a new type of national curriculum started in 1988 by a group of educational researchers, curriculum experts and teachers. This first attempt resulted in the "Green Book" (Báthory et al., 1992) containing attainment targets and desired attainment levels at two key stages of education (Grade 6 and 10). The Green Book raised controversial political feelings, mainly because the authors decided not to touch the issues of values in education. It was felt that the fundamental change in the political setup and in the view of education would require a declaration of basic values, principles and goals of education to guide curriculum planners. It was argued that on the national level only Curriculum Guidelines are needed stating general principles of education and that frame curricula and/or a variety of elaborated curricula for the various school types should specify the content and objectives of teaching. The political debate behind this argument was how far the former uniformity of the Grades 5-8 curriculum should give way to the separatist efforts of new secondary school types like the 8-year *gimnázium* or the 6-year gimnázium. The dangers of a growing selectivity of the system are certainly not to be underestimated but, and that was pointed out in the debate too, selectivity of the system covertly exists as it was shown in a series of national and international achievement studies. The debate was — at least temporarily — cooled down by a comprising curriculum control model laid out in the new Act on Public Education. The Act establishes the legal framework of curriculum control. The government approved the National Curriculum at the end of 1995. As a consequence all schools have to adapt or develop their local curricula confirming to the National Curriculum until 1998.

The allocation of responsibilities for planning education is shown in Table 1. On the national level general principles of education, content areas, and attainment targets are specified. Attempt is being made to define desired attainment levels at key stages of education (Grades 4, 6, 8, 10). For the various secondary level school types model curricula are being developed, which answer the specific needs of different groups of students. Model curricula are being developed for secondary schools with varying vocational lines, for academic secondary schools of various length, for special education purposes, etc. The attainment levels at key stages will serve harmonizing purposes to keep writers of model curricula from too ambitious plans. Contrary to the detailed curricula of the 1980-ies, model curricula will have to leave room for local (school level) planning and they will also have to keep the system flexible allowing children to change school type without great difficulty at least until the age of 14. Model curricula are licensed by the Ministry of Education according to the Act on Public Education. On the third level, schools are required to have their own detailed curricula (programmes of studies), which they can either develop themselves on the basis of a model curriculum or which they can jointly develop with or take from other schools.

A national examination system with elements of standardization will also have to be developed according to the Act on Public Education. Thus the state is responsible for harmonizing curricula between school types on the secondary level and for quality control of public education via the examination system. Local authorities are responsible for controlling school level curriculum development. The schools are responsible for planning their own work and implementing their plans.

Since planning on the school level was nor part of the duties of the teaching staff during the past fifty years, it is main concern how schools will is their own planning. The problem is so much the greater that state organized curriculum development work also followed a trend of subject matter chauvinism in the last decades and the expertise in general planning of education has become meagre. The result was an overloaded curriculum and verbalism at the expense of experiential and activity based learning. Compartmentalized teacher training enhanced (and still is enhancing) the unfavourable effects of competition between subjects and a lack of co-operation between teachers. To change this trend is the major task of educational policy and state supported development in the coming years.

Table 1

Allocation of Responsibilities Concerning Content and Quality Control in the 1993 Education Act in Hungary

Task	National Level	Local (School Authority) Level	School Level
Content Planning (curriculum development and curriculum control)	National Curriculum (guidelines for planners and attainment targets at key stages (Grades 4, 6, 8, 10). Quality control of model curricula for basic school types. Methodological support to local development Projects for translating new content into curricula	Reviewing and authorizing school level curricula (pedagogical program). Development of model curricula (particularly in the case of Church maintained school systems)	Development or selection and adoption of the school curriculum (teaching program). Selection of textbooks from the textbook market
Implementation	National Education Institute, Teachers training, Postgraduate training, "training of trainers"	County Pedagogical Institutes, Teacher adviser network, support of local innovation, curriculum information	Teaching, Innovation
Evaluation	Development and maintenance of the national examination system. National assessment of educational achievement in key subjects. Research on the conditions of learning (input-output relationships). Educational statistics	Evaluation of the local school system from the point of view of the local labour market. Analysis and evaluation of publicly available data concerning the local school system. Evaluation of cost-effectiveness of education in the local area	Evaluation of pupils' progress. Certification. Evaluation of the work of the teaching staff. (Self-assessment). Evaluation of feedback from students and examination results about the school curriculum (pedagogical program)

THE PROFIL COMPUTER AIDED CURRICULUM DEVELOPMENT SYSTEM AND THE PROFIL SOFTWARE TOOL

The threat of a curriculum chaos as a reaction to the curriculum dictature inspired curriculum theorists and researchers in informatics to find new technologies of keeping change under control. From 1990 onwards several development projects were initiated by specialists of the Hungarian software firm Mentor Informatika, school managers, and curriculum specialists. The projects were co-financed by the Ministry of Labour and the Ministry of Culture and Education to develop a standardized system of curriculum description and to develop the framework of a curriculum database. The idea was that standardization of the *form of curriculum description* is a necessary condition of modular planning. Modular planning, on the other hand, is the only way of keeping planning costs reasonable and still meet the varied needs in education. It was also viewed that standardization of curriculum design would also facilitate communication and co-operation between subjects specialists, curriculum theorists and teachers in the course of planning. By analogy, the standard format of curriculum description was meant to serve the same purpose as technical drawing in designing a building or a machine. A third — long term — goal behind the projects was to lay the foundation for a future curriculum database to facilitate the dissemination of curriculum information and the results of curriculum innovation by electronic means. The requirement that schools have their own curriculum document emphasizes the need of standardizing curriculum format and of setting up a curriculum database which can be used as a resource center for schools planning their own curricula. The result of the development work is the Profil Computer Aided Curriculum System and the Profil Software — a versatile and easy to use tool for recording, browsing, analysing, editing, reviewing, and modifying curricula. Co-operating with Ms Word, Ms Project and Ms Excel the Profil software can produce charts and tables mapping the learning modules, creating projects plans, timetables, showing pre-conditional relationships and cross-referencing possibilities between study units in the curriculum. In a pilot project carried out in 1993 it was shown that any existing curriculum which has a sufficient professional skills can use the software even if ho or she has not had any practice in using computers.

The Profit Curriculum Framework

What is if?	Profil describes the curriculum as a structured plan of education and instruction. On any level, a curriculum can be characterized by the aims, objectives, entry requirements, content, assessment methods, and the resources of teaching (i.e. teacher qualifications, specific learning environment, textbooks, etc.).		
Curriculum Modules	Structured curricula are described as interrelated networks of curriculum modules within and between levels of curriculum control. In the Profil framework the modules are classified in three major categories and eleven types:		
	Study modules	Assessment modules	Other units
	curricula (study schemes) grades (levels) subjects (study areas) topics (themes) subtopics (study units) lessons (classes)	exams and tests	books equipment partners: schools, institutes, publishers, etc. trades

The necessary equipment, textbooks and other resources can be specified for study modules and assessment modules. A register of schools, job families and trades completes the database.

The Standard Structure of Study and Assessment Modules	*The study and assessment categories comprise seven distinct module types. These module types describe the curricula on different levels of abstraction. The module types have a common frame of description. They are all described by their main attributes as follows*	
	Attribute	Description
	Aims and Goals	The rationale of the module's existence, the reason why the student wants to cover the study module or why the teacher thinks the module is important for the student
	Objectives	The expected learning outcomes, i.e. the knowledge and skills the student can hope to acquire as a consequence of the education and training described under the attribute *contents.* Objectives refer to envisaged performance as far as it can be predicted in advance. Normally it specifies what under what circumstances to what extent the student might be able to perform after having completed the study module
	Prerequisites	The knowledge, attitudes, and skills the student is assumed to possess before entering the current module. The modules of a well designed curriculum usually build on one another. The entry conditions can be described as free text, or by pointing at exams, tests, or other study modules to be covered before the module
	Content	The material to be covered, the activities to be carried out, the task to be performed in order to reach the target formulated under *objectives.* The content can be structured according to the specific discipline or according to the activities and tasks to be performed. The different structures can be cross-referenced using textual pointers. Content can be described as free text or by pointing at lower level (more detailed) study modules as parts of the module in question (e.g. topics of a subject). The description of content can specify how the module contributes to achieving the more general aims of education (such as creativity or cooperativity) or specific attainment targets (such as reading or writing skills, etc.)
	Assessment and Evaluation	Description of the procedure designed to assess how far the objectives of the module have been reached. Assessment methods, criteria, examples of performance levels can be described as free text, or reference can be made to examination modules within the Profil database
	Resources	The resources needed to complete the study module. Data such as minimum and maximum group size, number of teachers required, classrooms, labs, equipment, textbooks are entered here. Resource data help the school administration to plan teacher and room allocations as well as to order textbooks, etc.
	Identification	Study modules are labelled with the name, version, character, structure and study time of the module. Identification data help the school administration to plan the overall study scheme of the student groups with various needs and study background

THE PROFIL SOFTWARE

The Functions of the Profil Sotfware

- entering the curriculum into the computer, storing it in a database, accessing the database (database view);
- analysis of curricula (project and cross reference view);
- curriculum publication (publication).

Database *view.* By help of the Profil software curricula can be entered into a computer, stored in a database and browsed. Moving around in the database is as easy as searching in the ERIC database. Navigation buttons help the reader to move between levels in the hierarchy, within the same level of the unit hierarchy, and between attributes within a unit. When moving between units, the selected attribute remains the same. Thus, if one selects the "objectives" attribute, it is possible to move around (up and down or between) "sister units" under the same "parent units" to compare objectives.

Project and cross reference view. The analysis of curricula is based on database extracts generated by the Profil software. Analysis of unit structure and interconnections can reveal inconsistencies in planning (like lack of referencing insufficient coordination between subjects). Analysis of topic coordination may give ideas of how information in one subject can be immediately applied in another subject or how activities in one subject can serve objectives of another.

Publication. The curriculum or part of it can be arranged into a standard format curriculum document. Database extracts generated by the Profil software are automatically fed to the word processing program (Ms Word) to produce a standard format printed curriculum document.

The original is presented in English

Part III
Theme 2

TEACHERS

PLENARY

NEW INFORMATION TECHNOLOGY AND TEACHERS

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The rapid development of information and communication are changing our society, life, as well as education. "The information society" characterized by "information highway" is coming soon. The traditional education model and the system based on teacher-center become obviously unsuitable for such a change. This is a problem to which all of us who are working in the field of education must face.

In this report, we would like to say something about teachers and new information technologies (NIT) in reference with the practice in China.

TEACHERS TRAINING USING NIT

Background

China is a developing country and has a very vast population. According to statistics, in the end of '80th. there were about 5.5 million of primary and 2.4 million of junior middle school teachers. Among them about 38.2 % of teachers were unqualified (Table 1). About 2.7 million 6-12 years old children were unable to go to school in the same period and about 1.4 million qualified teachers will retired during the next ten years. In a word, there were about 5 million of qualified primary and secondary school teachers being lacking.

Meanwhile, there were 262 higher level teacher colleges, 1056 secondary level teacher training schools, by means of such traditional way only about 0.2 million primary school teachers and 0.13 junior middle school teachers could be available each year. In addition, the in-service teachers could not be trained stopping their work. It is obviously far from satisfactory (See Table 2).

The practice of Radio & TV University of China (RTVU), which established in 1979, showed it's unquestionable success in its early stage. About 1.5 million college graduates poured out in 8 years only, which is about 1/2 of the graduates from about 2000 other adult colleges in China.

Inspired by such an unprecedented success in the history of education, the Chinese government decided to use NIT to train teachers to carry out the nine-year Compulsory Education.

Satellite TV Teacher Training in China

China TV Teachers College (CTVTC) was found in July 1987, for speeding up the step of primary and secondary school teachers training.

CTVTC is responsible for:

- Providing the in-service training for the primary and junior middle school teachers and upgrading their education level.

Table 1

Numbers of Schools, Students & Teachers in Schools

	1988		1995	
	Primary Schools	Junior Middle Schools	Primary Schools	Junior Middle Schools
Numbers of Schools	793 261	88 290	668 685	77 742
Numbers of Graduates	19 303 408	11 572 264	19 615 233	11 572 264
Numbers of Enrolment	125 357 811	40 155 430	131 951 477	46 578 202
Numbers of Teachers	5 501 300	2 402 742	5 664 057	2 783 721

** From : Educational Statistics Yearbook of China, 1988 & 1995*

Table 2

Numbers of Graduates for School Teachers in 1988

	Higher level Teachers College	*Secondary Level Teacher School*	*Notice*
Numbers of Schools	262	1056	Total: 1318
Normal Course Higher Level	48 913	—	For senior middle school teachers
Short-Cycle Course Higher Level	130 207	—	For junior middle school teachers
Secondary Level	—	203 518	For primary school teachers
Subtotal	179 382	204 574	Total: 382 638

From : Educational Statistics Yearbook of China, 1988

• Providing the continuing education for primary and secondary school teachers.

• Providing the in-service training for schoolmasters and upgrading their managerial level.

CTVTC is in charge of the organization and production of training materials. The registration and teaching management is handled by the local government. The works, such as teaching organization, students' administration, exams, and granting certificate are carried out by the local regular and adult teacher training colleges and schools. The students learn through TV mainly and get the face to face guide from tutors. They will get diplomas if they passed the examination worked out by the China Examination Center.

There is a national network of satellite TV normal education in China. Two sets of educational programs are transmitted through the Chinese communication satellite. Their down-frequencies are 3880 and 3840 MHz. The third special channel (its down-frequency is 3800 MHz) for educational TV program by satellite start working in March 1995. it covered the whole area of China (including HongKong and Taiwan), Japan, Korea, India and other near by regions.

CTVTC provides courses in a wide range of subjects at both higher and secondary levels. Up to now, about 156 subjects, 12000 hours visual teaching programs have been produced. There are totally 16.6 million copies of textbook for 211 courses (see Table 3).

Most of the TV lecturers, who are mainly from regular normal universities and colleges, are famous in China and have a rich experience for teaching. Some foreign professors and excellent teachers from primary and secondary schools were invited to be TV lecturers too.

The Result

CTVTC has offered 360,000 graduated students since its establishment. Meanwhile, about 2 million in-service school teachers and 1.0 million schoolmasters have watched the TV courses of continuing education.

GTVTC checks the quality of TV normal education through exam each year. According to the statistics of 90,000 graduated students in 10 provinces about the course of "Fundamental of Nature Science", 73.1 percent of the students passed the exam, and 22.6 percent of the students scored the excellent marks. About 14,000 students from nine provinces took the exam of "Chinese ancient literature", 84.8 percent passed the exam, and 38,9 percent got the excellent marks. Table 4 shows another example of sample survey, and Table 5 gives the comparison of 1988 and 1995.

The survey of the graduated students indicates that the students have made great progress in specific professional knowledge and teaching ability. Most of the graduates have become the main force in their schools.

The Chinese satellite TV normal education is an open education system, and plays an important role for spreading Nine-Year Compulsory Education. CTVTC, which only has 35 staffs and a small budget, has provided a good training service with the aid of TV and local adult teacher colleges/schools. It shows the NIT

Table 3. Teaching Materials Organized by CTVTC (1987-1995)

	TV Training Programs		Printing Teaching Materials	
	Courses	Hours	Courses	Volumes
Training for Primary School Teachers	16	1 155	16	1.17 Million
Training for Secondary School Teachers	130	>8000	183	13.4 Million
Post training for Primary & Secondary Schoolmasters	10	517	12	2.00 Million
Continuing Education for Secondary School Teachers	—	1450	—	—
Continuing Education for Primary School Teachers	—	572	—	—
Total	156	12000	211	16. 57 Million

From "China Television Teachers College", 1995

Table 4 Sample Survey of Examination for Graduates in CTVTC (1990)

Courses of Examination	Level of Middle School	Numbers of Cities	Numbers of Sample	Rate of Pass (%)	Rally of Good (%)
Fundamental of Nature Science	Senior	10	90000	73. 1	22. 6
China Ancient Literature	Junior	9	14000	84. 8	38. 9
Mathematics Analysis	Junior	7	1600	81. 7	54. 1

Date from the Survey of 26 counties' education organized by Pekin Office of the United Nations Children Foundation

Table 5 Breakdown of Full-time School Teachers by Education Attainment

Education Attainment	1988		1995	
	Primary Schools	Junior Middle Schools	Primary Schools	Junior Middle Schools
Completion of Specialized Higher Education	2169953	855 627	4160755	1924362
Completion of Specialized Secondary Education		1435703		650 031
Completion of General Secondary Education & Below	3331347	111412	1 503 302	209 328
Qualified Rate	42. 47 %	35. 61 %	73. 46 %	69. 13 %
Subtotal	5501300	2 402 742	5 664 057	2 783 721
Total	7904042 (38. 27%)		8447778 (72. 03%)	

From "Educational Statistics Yearbook of China", 1988 & 1995 has a powerful activity in education.

THE INFLUENCE ON TEACHERS OF NIT

The alteration of education model

Tracing back to the history of human education, we can see that the earliest educational function was displayed by parents transmitting knowledge by means of speech to the own children in their families. With the development of productive forces and the emerge of written languages and especially the printing technology, the duty of education diverts to specific professional teachers from family, and Education as a sort of occupation stands off from other social activities.

In the 19th century, the developments of postal service career make education spreading outside the campus — so called "correspondence education".

The development of electronics technology in 20th century causes many new educational media and methods (slide projectors, recorders, videos, films, etc.). These new media are widely used in classroom teaching, which raises regular education efficiency greatly, and enriches the content of teaching. Such model is named as "Audio-visual Education" in China.

The even larger changing caused by using electronic media and communication technology provided new methods for correspondence education, and the distance education came into being. Nowadays, distance education is no complement of regular education yet, but an independent education model. Its effect is not only expanding education scale, but also accelerating the changing of education ideas and concepts.

The way of information exchange has been changed by NIT. New education ideas and concepts are reflected through these aspects listed below.

The whole life of humanity is no longer simply divided into two periods (being educated and doing contributions). The concept of lifelong education has been admitted widely. The practice shows that the traditional school can not undertake the task of lifelong education. To fulfil such a need there must be a large education system and the use of modern communication means. This is just where the function of the distance education lies.

The transform from teacher-center to student-center has been accelerated. People are no longer satisfied by getting knowledge from school passively. They hope they can get flexible learning opportunities and can choose the subjects, time schedule and study place according to their own will. The way of "students accepting what the teachers offer" is replaced by "teachers giving what the students want".

The distance education satisfies the demand of society more easily. Various styles of education (diploma education, continue education, professional education, certificate education, post training, preservice and in-service training...) are being formed. International cooperation and exchange of education in a world scale are becoming promoted. Educational resources are shared by more learners, even beyond over the border of countries.

Distance education makes full use of electronic and communication technology (radio, television, computer, microwave, satellite, optical cable, etc.). Technology and education are combined tightly much more than before.

The process of teaching and learning is separated into two relatively independent parts by using new educational media. The production of teaching materials has been vested with some industry features. The role of teachers has been changed too.

Because of the separation of teachers and students, a serious and difficult problem is formed for the distance education — the lack of teaching feedback and moral exchange between teachers and students. In some countries people make a great deal of effort using telephone, fax, optical cable visual communication, etc. But not until the of computer and its network technology (which will be mentioned more in details in the following) greatly developed, the possibility to solve such a problem had ever been foreseen.

The change of the teachers role

In traditional education, the teaching activity of teachers is an individual action basically. Teachers prepare their lectures individually, and give their lectures in classroom face to face with their students. They can adjust the contents and pace of teaching according to the response of students.

In distance education the teaching process of teachers has been put into the teaching media when using the audio visual and computer technologies. Students get the knowledge from the teaching materials mainly. The use of teaching materials is separated from the design and production of them.

In the practice of The Radio & TV University of China (RTVU) we are aware of the above change.

In the beginning of the establishment of RTVU, we only simply moved the teacher's lecture to the TV screens basically with the traditional model so that the advantage of multimedia teaching could not be realized in such a way.

When we tried to improve our teaching materials we found that there was no common language between the teachers who did not understand the educational technology and the program directors who were unfamiliar with teaching. The directors could not make any good educational program without a good program scripts, even if they were skilful at the production. It needs a kind of person who can coordinate with this. So a kind of new teacher so called "Course Coordinator" (CC) was taking place in RTVU.

CC is a key person in the multi-media education. Firstly, he is the organizer of a course group, and has to deal with various departments and people. He must take part in the whole process, from planing to evaluation. Secondly, he is the designer of multi-media teaching materials. He needs to rewrite the lecturers' scripts into the program scripts, which can be used in program production. Obviously, he must understand both teaching and technology and must be good at both organization and management. It is a very high requirement (see Appendix 2).

For training our teachers to fit into the requirements, in 1989 the RTVU cooperated with NHK of Japan producing a set of multi-media training materials called "Audio-Visual Training Package" which is specifically for training teachers and production staffs how to make the visual teaching programs better. This package includes a 450 page textbook and 14 visual programs. With this package, RTVU has organized training programs for CC and technicians and has rotten a good result. The quality of visual teaching programs has been improved obviously now.

One kind of the teachers is lecturers who are in charge of teaching contents. They also have to study more about the rule of distance education and new technologies; otherwise they can not make good lectures in visual programs.

The other are tutors who give the guidance and constancy directly to learners and assist CC with evaluations. Such a function is different from that of the tutor in regular schools too. For the student-centered system, most of students are not studying in classrooms. They have their own schedules and requirements which

Table 6

Influence of Information on Education

	Industry Society	Information Society
Teaching Objects	Registered Student	Anybody
Teaching Target	Ability of Master & Use Knowledge	Ability of Search, Analysis & Use
Study Period	Study Age (6-25)	All Life
Study Place	In Schools	Anywhere, In Home & Office
Study Planning	From Teachers	From Student Partly
Study Process	Synchronous & Orderly	Asynchronous & Orderlies
Relations Between Teacher and Student	Authority & Instructor	Tutor, Guilders & Friend
Relations Among Students	Competitor	Competitor & Friend
Management of Study	Administration & Organization	Service & Organization

tutors have to follow.

In regular and adult universities and schools there are more and more teachers working just like those in RTVU. It is believed that the role of teachers would change more and more in the future too.

Face to Next Century

Distance education separates teachers and students, while the computer being them together with the network.

We are facing a growing flood of data. The digital technology will provide more powerful tools for learning and representation and communication of knowledge. The Internet allows for information to be transferred for the benefit of all levels of education. The learners can accept information resources and study from TV and computer screen in any isolated areas of the world.

Along with the development of information and communication technology characterized by computer a new education model is being formed now.

By the computer multimedia and network, learners could make contact with any person at whatever place, who has a computer connecting with the Internet at any time. They could see each other on their screens and could exchange ideas in conversations in real time. The whole process of study can be saved as a file and can be sent back to the study center by the Internet. It means that teachers can get immediately not only the response, but also the evaluation from learners which would be more objective than that from guestionnaires.

Another difference between new model and distance education is that the computer hypermedia can provide a great range of various interactions means. And yet the educational information organized by such hypermedia as a net structure which could be similar to the form of human brain. Such a function is an unprecedented one.

To differentiate the new forms of education from the distance education, it seems a new terminology is necessary. Considering that people study mainly through computer screens, which do not display the true world, but only images, and all the characters, pictures and sounds are made up of digital information, namely the imitation of the true world only, here I think it is no harm in naming the new model (apparently near by, in fact far away) as "Virtual Education".

In virtual education, the abilities of searching, selecting, indexing, using and evaluating information become more important. More and more learners would study in families through computer and TV. Teachers have to develop such abilities before teaching and have to be fit into the model of individual studying. They must be guides, consultants, and friends of learners.

All of these would accelerate the change of education, which has been done by distance education. This change must include the following aspects at least.

- **Individualization** — study would enter families. More and more people will learn individually. Students would be given a greatest freedom of learning.
- **Socialization** — the scale of learning would be enlarged greatly. The right of being educated regarded as one of human rights would become more and more practicable.
- **Lifespanness** — people would study for their whole live. The continuing education and lifelong education would be an important part of society.
- **Diversity** — virtual education, distance education and conventional education would be complemented each other. Various forms of education (diploma education, continuing education, professional and vocational training, pre-service and in-service training, etc.) and various options of means (video, radio, television, the Internet, etc.) would be working together. People will have more opportunities and more choices of learning.
- **Informatization** — those who own information would own everything. Computer and the Internet would be the main means for getting information. So to master computers would be the basic skill of every person.
- **Modernization** — the combination of education and technology has never been so tightly joined as today. All kinds of signals (text, picture, video, sound movie, etc.) would be put together by the computer multimedia technology. It would make the process of education more vivid and more efficiently.
- **Internationalization** — cooperation in education would be spreading greatly. Through the computer network, education resources would be shared by more and more people in great many fields. Learners, teachers and others could have real-time exchange in a world scale.

Along with these changes, the education in information society would be bound to be greatly different from that in the industry society (see Table 6). I think the followings are necessary for teachers to get ready in the future at least.

- To be suitable to the student-centered education system.
- To make teaching materials using NIT with the idea of the student-center.
- To learn the education technologies and to use them to improve education quality and efficiency.
- To study to be a designer and organizer of production of audio-visual teaching program and computer assistant instruction software.

The rapid development of NIT provides for us a very encouraging future in terms of education. However, the technology, no matter how advanced it might be, can not replaced the human brain. The aims of education are not only to give learners knowledge, but also to teach them how to be a human being. We had better be aware, at the same, of the danger of the lack of direct interpersonal exchange when advanced technologies are used widely for education, as this exchange has been cherished a valuable part of education. Therefore, when using NIT for education, the role of direct moral exchange must be emphasized for education.

APPENDIX I

Some Names of TV Columns for Teacher Continuing Education

1. "Friends of Primary School Teachers"
"One Lesson in One Week"
"Window of Education Reform"
"New Teaching Materials"
"Experiences from Famous Teachers"
"Research and Exploration"
"Solving the Problems"
2. "Friends of Secondary School Teachers"
"Teaching Demonstration"
"Teaching Methods"
"Political and Historical Views"
"New Knowledge of Subject"
"Theory and Research"
"Foreign Language Teaching"
"Basic Skill Training"
3. "Schoolmasters"
"Research of School Management"
"Schoolmasters Learning Law" "Excellent Schoolmasters" "Special School Views"
"Moral Education Garden"

APPENDIX 2

Duties of Course coordinator in RTVU

1. *To take part in the policy and planing of courses.*
2. *To organize the draft of teaching outline and design of multi-media teaching materials.*
3. *To choose lecturer, chief editor of textbook, director of program and to set up course group.*
4. *To rewrite the script of audio-visual teaching programs.*
5. *To assists director completing camera script and program production.*
6. *To organize the examination and revise of teaching materials.*
7. *To organize the training of tutors and evaluation of teaching materials.*

The original is presented in English

THE TEACHER IN THE CONTEXT OF NATIONAL AND REGIONAL PROSPECTS FOR INFORMATIZATION OF EDUCATION

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THE BEGINNING

Large-scale introduction of informatics in Russia's secondary schools began 12 years ago under the ideological leadership and practical management of the late Andrei Ershov. The following years showed that the basic conceptual decisions passed at that time still lie within the mainstream of «school informatics». Take, for instance, the UNESCO-IFIP recommendations disseminated by this Congress.

It was stated at the very beginning that there exist three trends in school informatics: mathematical informatics; the study of information technologies; and the application of information technologies in the teaching of other subjects on the secondary school curriculum.

HISTORY

In the next ten years, mathematical informatics and information technologies were brought together in a single discipline, «Fundamentals of Informatics and Computer Sciences». The application of information technologies in the teaching of other disciplines proved a job for the few enthusiasts.

As the information industry advanced, several generations of computers succeeded each other. But they usually stayed locked up in the «informatics classrooms» equipped with a certain mandatory number of machines and in the closed local networks. Most informatics teachers were former computer programmers who acted out a variety of roles, from a magician easily able to send a letter to your former pupil in Arizona absolutely free of charge or produce an elegant invitation to a school-leaving ball, to sorcerer who, sitting behind steel doors equipped with combination locks, summons ventrilogistic Internet spirits through a window to the other world twinkling with green DOS cablegrams, or bewitches children with computer games or, God forbid, C++ coding. To obtain a computer for their own use (for the sake of prestige and to facilitate the writing of instructions), school principals resorted to a variety of modes of action, including ones punishable under criminal and administrative Law. As a parallel process, Soviet and Russian schools cultivated a set of «technical» subjects and modules which included sewing and cooking for girls and metalworking for boys, technical drawing, practical training at the so-called teaching production centers, etc. Although such subjects may have had their uses, the gap between the methods and substance of teaching, on the one hand, and the life outside the school walls, on the other, was widening.

CHANGES

We are standing on the brink or radical reforms.

The Federal Law «On Education» introduces two «informatics fields» to be covered by secondary school courses in Russia: «Mathematics and Informatics» and «Technology» (among the adjacent fields, «Natural Sciences»). Information technologies are taught within the framework of the latter course, and mathematical informatics - within the former. The constructionist educational paradigm, which in many countries is occupying an expanding place in the serious projects designed to introduce information technologies into secondary education, is becoming a practical philosophy of many Russian teachers of informatics and is influencing other subjects on the secondary school curricula. The most distinguished representative of constructionism in world computer education is, of course, Seymour Papert, a pupil of Piaget and himself head of a major scientific school. Papert is known and respected in Russia, he spends a great deal of time in Moscow and St. Petersburg. One can get an idea of his educational philosophy from L.B. Pereverzev's article in the magazine *Informatika i obrazovanie (Informatics and Education)*, nos. 4-5, 1995. A breakthrough occurred when a group of researchers working in academic, university, and defense science set up the Institute of New Educational Technologies (INET). The Institute, which is headed by E.I. Bulin-Sokolova, a linguist and teacher, enjoys decisive support from the Moscow public education bodies and has already become an internationally important center for the development and introduction of the constructionist approach to educational technologies. INET researchers and teachers are involved in drafting training materials and in joint projects with colleagues in the United States, Czechia and Italy, to name but three countries.

THE ABSTRACT AND THE MATERIAL

Mathematical informatics, which can be called mathematics of the finite, is rapidly gaining in importance among the other divisions of this discipline; the teaching of mathematics is likely to follow this trends, which has come into being as a response to the challenge of the time. The study of mathematical informatics helps make a wide use of the environments of material, graphic, and linguistic objects, as well as of their computer images. One of the more advanced environments of this kind is LEGO. The three-dimensional world filled with LEGO objects helps master search algorithms and theoretical-multiple operations. The world of a robot or a turtle, or the world of string knots and the world of cooking effectively help shape the basic ideas regarding the modes of construction and descriptions of algorithmic processes. Going over the options or breaking up a problem into subproblems in a geometrical puzzle consisting of wooden parts or in a board game is mastered as a mode of activity in the real-life and then in the computer world.

This is one of the lines of integration of material and information technologies, in which material objects not only have direct roles and wills but are also symbols of abstract mathematical objects. Adjacent to this field is the use of the linguistic reality of the native tongue into which a child is immersed and of the other human languages, which are figuring more and more prominently in our life, as an environment of analysis, study and solution of problems of interest to the pupil and of project implementation. The methods used fuse the natural scientific, the mathematical, and the linguistic approaches to the study of life. Along with informatics teachers, these approaches are implemented in many schools by primary school, domestic science, and art teachers. The main properties of this approach are described in the manual «Mathematics and Language», which is used in hundreds of schools.

EDUCATIONAL TECHNOLOGIES

The other development trend of the «Technology» field integrates material and intellectual technologies. There appears a real and regular opportunity to master, within this educational field, technologies that are immediately applicable in other subjects on the school curricula. These technologies (the study of most of them comprises a «material» and an information part) include: information collection, including measurement; data recording; search for information (including via telecommunications); simulating; displaying; learning mechanical skills.

Educational activity in many subjects in the «Technology» educational field naturally assumes the form of experimental design and research. The key constructionist object environment are meccano games. A universal meccano game introducing the child to the sphere of material construction/design is LEGO, and to the sphere of computer construction – Logo. The most widespread computer educational product, Logo (adapted by INET for Russian schools), is extremely popular in the country. The latest Logo versions used in Russian secondary schools is MicroWorlds. This universal creative environment of technical design is best suited for modeling mathematical and informatics worlds and at the same time - this is very important - for the design work which results in real, albeit simple, multimedia products. INET has recently completed work on «wordless» Logo - *Pervologo* («Primary Logo»), a version which is connected with MicroWorlds and has a wonderful quality: children can use it before they can read and write and even before they have learnt the ABC.

Information support of the natural scientific and mathematical subjects is executed by the design programs of the «Living Geometry» series, which is the most impressive example of computer support of a whole discipline on the secondary school curriculum. INET has developed thousands of scripts for «Living Geometry» adapted to the basic geometry textbooks used in Russian schools. «Living Physics» has also proved its usefulness in the schools of Moscow and some other regions. Although we started with «screen» designing, in the teaching of the natural scientific disciplines computer design in computerized laboratories is of at least equal importance. Suffice it to recollect one of their most efficient uses, when the computer screen shows the chart of the movement (along one axis is enough) of an object held in the pupil's hand. There emerges a direct link between physical movement and a mathematical chart.

TEACHING ENVIRONMENTS

The key to the use of a computerized laboratory is not the range of various gauges and not quickness of action but the priority given in the teacher's educational doctrine to the scientific result of an experiment obtained independently by the student, and the procedure of processing and analyzing this result. Of course, of great value are the most «open» versions of such laboratories, where a student is able to do a great deal of constructing himself.

Despite their importance in the teaching of some subjects and «literal» implementation of constructionist ideas, design/programs are not the most widely applied teaching software. Even more popular are the various editors used to build the structures described in the next section and to present knowledge in a form intelligible to the others. The students have an opportunity to enter primary information in text, sound and visual form with the help of input devices, among which the «digital chamber» is perhaps the most commonly used one. Within the framework of the «Moscow Studies» project, which will be described below, the children interview their family, friends and old city residents, and then decipher, edit and make synopses of the texts. It is easy to see the difference between this type of creative activity and ordinary dictation or writing out an account of some story. Perhaps the most important software educational environment the secondary school needs is the simplest editor that would integrate the possibilities of databases, multimedia and Internet (hypertext format and telecommunication access). Of some use for Russian schools are computer exercisers and training programs. Among the latter the most important ones are those that teach typing: they ensure an efficient use of much of the other software. Many teachers are themselves fond of developing exercisers. Interesting results were achieved this year by A.Z. Bessmertny, one of Moscow's oldest and best-known teachers of English, who is working in hypertext environment.

Since in the secondary school, there is no definite boundary between administration and teaching, the former's condition is also a factor determining the near-term prospects of the introduction of new information technologies into secondary education. A high level of informatics and competent and democratic decision-making are only a few possible results of the use of up-to-date technologies.

A school's valeological parameters - objective assessment of the students' state of health - are considered by the high-tech computerized complex.

A major property of the secondary school teaching environment created by the new information technologies is the students' access to huge blocks of information in place of dissected information contained in most school textbooks. It is made possible by computer encyclopaedias and other information sources on compact discs or in telecommunication networks. We are currently in the process of transition from an informatics class to a school information environment incorporated into the global information space and integrating the information environments of the various school subjects, teachers and students.

NEW STRUCTURES OF HUMAN KNOWLEDGE AND LEARNING

Exploration of an educational field is ceasing to be a predetermined process of building of a linear organized structure of consecutively mastered - learnt and reproduced - fragments. It is turning into construction by students of an information network of knowledge, in which the substance increasingly moves from the peaks of the network to links among the peaks and conditions of application of some body of knowledge. Building a network is a non-determined process, which gives the student more options and unfolds in the global information network, Internet. The structures of the knowledge under consideration used to exist as our ideas about the world long before the advent of computers. However, it is information technologies that are probably the means which supports the progress of these structures, just as book-printing and television made an impact on certain structures and modes of intellectual activity.

The most natural field where these structures and learnt are the projects that merge information technologies with school subjects. The first project a student comes in contact with at school is the «Notebook»: the newcomer tells the computer (with the teacher's assistance, if need be) all about him/herself and soon gets access to information about all the children in the class. This information is contained, in particular, in a printout - the individual notebook. Together with the name-cards clipped on to the child's lapel, these notebooks constitute elements of information culture and information space created by the children themselves and identifying the child in the world around him/her. (You realize, of course, that in our project the notebook is the prototype of Internet). The project starts with a child's self-identification in his/her class and grows into activity aimed at incorporation into the hyperstructure of individual and collective information space of expanding fragments of the surrounding world in the past, present and future - the family, the nearest geographic space, the city, the Universe. The level of city merits special analysis. Moscow is changing at an extremely fast pace. History in the great variety of its manifestations is being made before our very eyes. To make an imprint of the world and people's ideas about it is a worthy research task, which the children accomplish with the help of a tape recorder, a video camera and a computer. There emerges a mosaic of individual information spaces united into a single hyperstructure accessible to all through Internet, the Great Integrator.

THE TEACHER

The role of the teacher in the emerging educational situation is changing and gaining in importance. At the crucial moments of the educational process, the teacher ceases to be a person who knows the right answers to all questions and evaluates the students' performance, and finds himself playing the role chosen for himself by the scientist and offered by us to the students. This is the role of a person who has forever retained a baby's wish to discover what the World is like. Our teacher does not stand alone. He is a part of the community. The technologies intended for use in the process of teaching are learnt by students in classes in which two teachers, the client and the author of the technologies, take part.

Personal contacts among teachers from different schools take place at the weekly sessions of the Technology Culb at INET. Telecommunications naturally involve teachers, their students and scientists into a never-ending virtual conversation. Russian teachers gain access to the ideas and work of INET researchers who have to do with secondary education; Internet offers an incomparably larger number of professionals a chance to share their knowledge with children and teachers and, most important, involve the latter into the endless process of learning.

DEVELOPMENT PRACTICE

Unlike the educational systems of most countries, the Moscow educational system has been lucky: for over 10 years, it has been headed by the same talented teacher and administrator L.P. Kezina. In the past year, the funding of education was much more scarce that in the preceding ones (although still much better than in most regions of the country). Apart from the adverse consequences, this fact obliged us to make yet another thorough revision of the development strategy of the information space of Moscow education. Our conclusion appears trivial enough, but no less important for all that: we should introduce new information technologies neither at the poorest nor at the wealthiest (in this sense) schools, and not everywhere equally, but where such technologies can do the most good, that is, the schools whose «near-term development zone» would benefit the most from the use of such technologies. One of the means of identifying a school's «near-term development zone» (in the sense referred to above) is this school's submitting an «application» for the relevant equipment. The need to fill out such an application would launch a discussion of the school's goals and the role of more advanced information technologies in achieving these goals. It turned out that even this fairly simple action substantially reduces competition among schools. Apart from the plans for the future, subject to examination are also the current status of the school and its past successes or failures. An example of evaluation parameter is the «keyboard index» - the teachers' skill in entering a text into a computer. Of course, even more attention is paid to the schools that have achieved results using their current modest equipment. An wonderful example of this kind is Moscow School #161, where O.G. Kutukova taught high-level informatics to her pupils and implemented really beautiful projects using just one class of machine, BK-0010.

This presentation leaves no room for describing all the significant results and trends in the progress of informatics in Moscow's secondary schools. Details of this subject can be obtained from the server of the Moscow Committee for Education.

The original is presented in Russian

Commission I

LESSONS FROM EXPERIENCE WITH COMPUTER IMPLEMENTATION

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INTRODUCTION: THE CYCLE REPEATS ITSELF?

For over a decade, countries and regions around the world have pursued various initiatives to stimulate and support the use of computers in their educational systems. These initiatives have taken many different forms in different countries, some focusing on strategic support for hardware - and software - related programs, some on strategies more directly focused on curricular and instructional aspects of computers, some (fewer) on strategies for the school manager, and others (many) on different approaches to teacher education and support. Regardless of the focus or scope of the initiative, it appears that one type of result consistently occurs: a result that acknowledges the teacher as the key figure in the eventual success or lack of success of any computers-in-education initative.

The wave of social and technological developments that stimulated interest in computers in schools in the late 1970s and early 1980s appears to now be paralleled by a similar surge of interest in educational aspects of telematics. Throughout the world, the use of wide-area network capabilities for communication and access to new forms of information engagement is stimulating a wave of initiatives with respect to telematics in schools, particularly telematics via the Internet and applications such as e-mail and the World Wide Web. This wave could be seen as an iteration of the "computers in education" wave of 10 to 15 years earlier.

What did we learn from the first wave? To what extent can we expect the patterns and results of the first wave to reappear in a second wave, this time focused on the computer network rather than just the computer? What might we do more efficiently and effectively the second-time-around in terms of responding to a computer-related innovation at the strategic and policy-related levels?

These are the questions addressed in this paper. The conclusions that will be drawn are:

In critical ways, the "Internet in education" is a second iteration of the "computers in education" phenonmenon of the 1980s.

In many critical ways, we can expect the same sorts of implementation results; however the unique characteristics of the World Wide Web, coupled with differences in society compared to a decade earlier, suggest that certain breakthroughs in implementation success will occur in this second wave.

The experiences of the field and of decision makers with respect to computers in education in the 1980s present an interesting legacy with respect to networking in education, in some aspects positive and in others a burden.

SKETCHING THE ITERATION: FROM COMPUTERS IN EDUCATION TO COMPUTER NETWORK APPLICATIONS IN EDUCATION

In the 1960s, research initiatives began relating to the use of computers for educational purposes and the study of computer science (called by different names in different countries) became established as academic and professional domains. By the 1970s there was already considerable experience with the development of computer-based learning systems; for example, Prof. Jef Moonen in The Netherlands used the PLATO environment to create a complex mainframe-based system to support the learning of statistics at the university level that is still in use today (in an evolved version, of course).

With regard to teachers and schools, however, the breakthrough came through the impetus of a social and technological phenonmenon: the personal computer. In 1979 and 1980 in particular, an explosive synergy occurred: the personal computer afforded personal control, allowing the individual to work independently of mainframe computers. Society saw this as a revolutionary, romantic and powerful new opportunity; education was pushed by the same energies. Computers could revolutionize education, could even revolutionalize the process of cognitive development of the child, and in more practical terms, could bring new competitive possibilities to schools. Concurrently, there were fears as well: computers would replace the teacher and would distort the social development of children at the same time as they would disenfranchise large groups (such as girls) from status and success.

It is interesting to compare the start of the computers-in-education wave of the early 1980s with the "information highway" wave of the mid 1990s. My argument is that we are now experiencing a second iteration of what we experienced before. Here are some major points of similarity:

The computers-in-education wave did not occur in a vacuum, either technologically or in terms of educational experience. As noted earlier, computers had been studied and used in education in many ways prior to the "personal computer" breakthrough of the late 1970s. But the personal computer provided the "trigger event" to unleash the first wave of broadscale educational activity. Similarly, networks, including the Internet, have been in use in educational settings for many years, before the trigger event of the World Wide Web (WWW), has unleashed the second wave of broadscale social expectation. The trigger event idea is critical; a trigger event is rather like a break in a dam. Much water must be accumulated behind the dam wall before the pressure to erupt becomes inexorable, and then when the breakthrough occurs, the flood cannot be stopped.

Push Factors	Computers in Education, 1980	The Information Highway and Education, 1996
Technological Breakthrough	-the microcomputer	-public access to the Internet and the WWW
Social Response	-we must have a computer, in our homes, in our schools...	-we must be able to get on the Internet, in our homes, in our schools...
Social Vision	-personal computers will revolutionize society and will create powerful new opportunities for those who can handle them	-the information highway will revolutionize society and will create powerful new opportunities for those who can handle it
Commercial Push	-a vast new market for goods and services	-a vast new market for goods and services
Social Expectation	-schools must not be left behind; all students must be computer literate	-schools must not be left behind; all students must have "driving licenses for the information highway"
Vagueness	-metaphors and predictions are strong; results are anecdotal	- metaphors and predictions are strong; results are anecdotal
Pioneers show the promise	-both in theory and practice, there are impressive ideas and examples of how the computer can enrich and re-engineer education	-both in theory and practice, there are impressive ideas and examples of how the WWW and other network environments can enrich and re-engineer education
Educational decision makers must and do respond	-every school must get computers; funding must be found; new initiatives are needed; policy and strategy are needed...	-every school must be able to access the Internet; funding must be found; new initiatives are needed; policy and strategy are needed...
The overall movement is unstoppable	-computers are pervasive throughout society	-interconnectivity via computer networks is pervasive throughout society
The rich will get richer...	-an incentive, and a fear	-an incentive and a fear

WHAT HAS HAPPENED IN THE FIRST WAVE?

We all know the story of the past 15-20 years with respect to computers in education and how these early hopes and fears have worked their way out in practice; however, each of us may see the results through a different optic and with different interpretations. The old adage of seeing a cup as half-filled or half-empty relates to our interpretation efforts. There are many different reports and analyses of what the results of the first wave of computers-in-education may be, and there have been a number of attempts to synthesize these results at the international level. In a new book, "Children and Computers in School" (Collis, Knezek, Lai, Miyashita, Pelgrum, Plomp, & Sakamoto, 1996), three of the largest and most carefully controlled of these international comparative investigations are further synthesized. Conclusions such as the following 11 points seem to be justified when one looks at the international picture. To a certain extent I offer these as my own interpretation, and of course my view of the cup may seem half-full or half-empty to others.

1. Into the system:

Computers are present in educational institutions throughout the world, with computer rooms as standard as a school library or cafeteria. Every educational jurisdiction spends money in a regular way on some aspect of its computer provision. Computer-literacy courses or modules of some sort have become standard practice. Teacher education includes some acknowledgement of the need to prepare teachers for the use of computers in education. Students have some level of functional skills with computers. Many educational professionals have their identities and job definitions related to computers.

2. First-level problems affect everyone:

So-called "first-level problems" confront every step of computer use in schools, by teachers, by students. These problems are the same throughout the world. Individuals fight with them, at great cost of time and energy, until gradually an institutional response removes some of the personal burden. Computers do not work; software crashes, software is too difficult to install or understand, software is too expensive; there is no way a teacher can have a computer on his desk in the classroom (there may not even be an electrical plug anywhere near his desk even if he had a computer and had a place to set it); there is no projection device so that students can see what the teacher might want to demonstrate, computers are fixed in the computer room and not accessible when and where the teacher can manage their use by his students; there are not enough computers, the computers are too old, too slow, too limited in memory; the teacher does not have time or a place to work personally with a computer, the teacher has no time...

3. Second-level problems are also persistent:

Gradually, first-level problems are reduced (never eliminated) through a combination of personal efforts on the part of committed teachers, and institutional and system-wide responses. But a more challenging level of problems remains. These second-level problems are also familiar throughout the world: teachers do not see how to integrate computers into their instruction; teachers and decision makers are not convinced of the payoff of computer use on the real markers of school achievement-student examination results: no matter what approach to teacher inservice is attempted, it is not enough; no matter how hard we try, software is not good enough or appropriate enough.

4. Good things are happening...

Throughout the world there are countless examples of good experiences with computers in individual lessons and with individual teachers and students. The results of these good experiences are elusive to measure with tests or to demonstrate in terms of any changes on broadscale educational output, but those involved know that, quality instructional moments are occurring.

5. Diffusion is difficult:

The good things that are happening are related to special people or situations and do not diffuse much into mainstream practice.

Good teachers are associated with good examples of computer use. There is no evidence that the computer use made these teachers into good teachers. A good teacher sees possibilities in a powerful technology, sees a way to realize them in his own situation, and has the energy and persistence to implement them usually at cost to himself. In contrast to the more-idiosyncratic success stories, substantial, long-term, expensive initiatives are needed to sustain computer use among the mainstream of teachers. Diffusion into practice has not yet much occurred.

6. Different policy and strategies come to similar ends

The above patterns seem to occur regardless of what policy or strategy has been employed.

There are many different models for regional or national support of computers in education, ranging from indifference to highly integrated. Yet the above five results seem to repeatedly emerge. There are differences related to policy to be sure, but at a broad level the results seem to be similar. There are computers in schools, it is difficult to use them, it is even more difficult to see how to use them in instructional practice, some teachers do find a way and are associated with interesting and probably important learning experiences, diffusion into mainstream and meaningful practice is difficult and does not much occur. That so many different national policies and strategies, at so many different levels of cost and activity, generally lead to the same result, is in itself an important observation.

7. Cost-effectiveness is not demonstrated

There is no broadscale evidence, yet, to equate the amount of money (indirect and direct) which has been spent on computers in education with a corresponding payoff in terms of educational outputs. We do not seem to be able to say that a country's expenditures and efforts with computers in education have resulted in noticable, sustainable system-wide differences in student achievement.

8. Not to fear...

We can be comforted that many of the fears expressed at the start of the first computer wave have not materialized. Computers have not replaced teachers; computers have not made the school obsolete; computers in schools have not turned children into anti-social problem cases, students generally have little "computer anxiety" and assimilate some level of computer-use skills, enough to function in their societies, through social osmosis regardless of our concerns with curriculum or instructional units for computer literacy. "Keyboarding" does not have to be taught. The life of the school goes on....

9. Not to gain...

With the exception of a handful of large companies (I have read that eight US companies have nearly 50 % of the world market of the world market in educational software), little or no money is being made from educational software. The software that is pervasive in schools is that which is pervasive in society as a whole, or is provided by a particular local initiative. Despite the success of the eight large companies, a market for educational software does not really exist unless propped up by funding. Creating educational software that is portable among countries so that the market for its use is increased has rarely occurred. Once national or regional initiatives supporting the dissemination of locally-made software packages are finished, the locally made packages do not further disperse (although they may continue to be used in pockets of local settings).

10. From subsidized exploration to... it's withdrawal

The computers-in-education wave was fueled by enthusiasm, by predictions and visions, and by the simple need to be involved in it. But throughout the world, the broadscale initiatives that were established as special national programs or special collaborations can no longer expect to receive the funding support that was available a decade earlier. There is a pendulum effect of a sort: ministries and decision makers are saying "Ok, good, we had a big project, the project succeeded in putting x computers in x schools, providing x hours of training for x teachers, supporting the production of x pieces of educational software with accompanying instructional materials, and funding x research and evaluation projects from our university partners. We learned much from this project, good. But now the special project must be over. Funding is scarce; other special projects demand our attention. If you want more money, show us the facts, the data, the results. We cannot afford to finance more exploratory and preparatory studies...".

And teachers are saying, "Ok, I tried it, but it didn't really work for me, so don't expect me to respond again to the next workshop or project. I really must get back to my real work...".

An the school administrator is saying, "Fine, we have a computer room, it is always filled, Teacher x does a good job in there, so let us now turn our attention to other things. We certainly don't need. days off for teacher workshops about computers in education; we did that..."

11. The teacher is the critical variable in computer use in the school setting, but not the critical variable in the student's computer use outside the school

Whatever is done or not done by policy makers, researchers, teacher educators, and vendors, the teacher is the critical variable in the use and impact of computers with his students in his classroom. Conversely, what students do with computers outside of the classroom context, in their homes and in society more broadly, does not seem much related to what they do in school or to what their teachers do or not do.

Must or Should We Re-Invent the Wheel? Lessons from Past Experience and Their Application to Telematics in Education

Given these 11 conclusions about the first wave of computers in education, what are my predictions about the second wave, relating to wide-area networks in education? I will repeat the 11 conclusions and follow each with a comment and a suggestion. These are my own views, presented for debate.

Results from the First Wave	Implications for the Second Wave
1	2
1. Into the system:	We can expect expect access to the Internet (or whatever it evolves to) to be as common in schools as having a telephone number or a computer room. We can predict that students and teachers will be as familiar with the WWW (and its evolution) and with e-mail as they now are with faxes and word processing and automatic money machines and pincodes. *Lessons from the first wave?* Economies of scale can help this process of system-wide presence, but the technology will change so quickly as will the social pervasiveness of the technology, that only the most strategic decisions relating to infrastructure access and cost reduction need be the focus of policy and strategy. We do not need to teach Internet literacy...(although wisdom is a different matter).
2. First-level problems affect everyone:	Schools will find it very difficult to offer useful amounts of Internet access to students or teachers. Classrooms will have no network connection, school networks will not easily adapt to Internet connectivity, server connections will crash and having a teacher in the school technically able to solve Internet-related problems will be very difficult. Costs and security issues will increase compared to stand-alone computer use. *Lessons from the first wave?* Anyone advocating any form of Internet use should walk through each step of access problems with a classroom teacher in the actual classroom setting. A three-partner discussion, between the teacher, the school decision maker and a representative of the regional or national strategic team, must occur so that "little problems" such as no printer access in the classroom and no projection device are given respect and attention.
3. Second-level problems are also persistent	Identifying educationally relevant uses of the WWW that teachers can see as applicable and to their own needs and feasible in their own situations needs careful attention. A major possibility for such idenification is the fact that the WWW provides access to resources not available in the school through a single user interface and a single sort of search tool. But the fact that "everything is available" will not necessarily mean the teacher sees or accepts the usefulness of "everything" in her practice, especially as "everything" implies junk as well as quality. *Lessons from the first wave?* Look for one convincing application of the Internet that is solidly useful in the particular school or teacher culture. Build on this, show it in practice, get evidence to convince teachers that this particular application is "worth it", and then do all possible to make it easy for them to make use of the application itself.
4. Good things are happening...	Very good things are happening, particularly with respect to applying the functionalities of the WWW in learning settings. The fact that WWW functionalities can be used in an "intranet" context (that is, within the school's own local area network"), means that their value does not have to involve access to the Internet with the cost and quality control issues that entails. *Lessons from the first wave?* Look for examples of "good things" and support the teachers involved. Give them time and opportunity, and recognition. They are the pioneers; they may also be the only ones to really exploit the medium in the short-term, so use limited funds to support them rather than to try and engage everyone.

5. Diffusion is difficult:	Some teachers will make good and powerful use .of network opportunities, but we can expect that most will not, at least in the near future. ***Lessons from the first wave?*** Similar to Point 4 above, it does not seem to pay off to attempt to provide across-the-board inservice in terms of payoff in practice. The "trigger event" strategy (Point #3), coupled with reduction of first-level access frustrations (Point #2), and support of one's creative pioneers (Point #4) will probably be more effective than national plans for "Internet skills for teachers" or expectations of system-wide implementation or expectations of vaguely understood goals such as "being a citizen of the global community".
6. Different policy and strategies come to similar ends	When a flood has begun, it.will continue. Thus social pushes for access to and use of the Internet, the WWW, and their follow-ups are occurring regardless of what policy or strategy is chosen for the schools. ***Lessons from the first wave?*** Decision makers need not invest substantial effort looking for a "best approach" or policy; a powerful idea will find its way. Look for the local-relevant "trigger event", reduce the most frustrating access problems, support your good and creative teachers; this can be done with smaller-scale initiatives as well as big national projects. There is no best way.
7. Cost-effectiveness is not demonstrated	Just as it has been difficult with computers in education to show cost-effectiveness evidence, we can expect it will be even more difficult with networks in education. But we do need to try. ***Lessons from the first wave?*** We need to collectively take the issue of cost-effectiveness measurement very seriously. We must move beyond theoretical predictions of great benefit to some sort of objective evidence that increased access to wide-area networks is paying off. Thus we must start now, gathering some types of useful baseful indicator data, so that perhaps in five years we can say, "Yes, but before we used the WWW extensively, students only reached the x level of some kind of attainment, but now we can demonstrate that students are reaching a better level." Will we be able to say this in five years? Perhaps we should start by asking teachers: What are your problems and what are some indicators of those problems?
8. Not to fear...	Newspapers around the world featured articles in 1995 about the dangers to children of the pornography on the Internet. Governments have even taken initiatives to "protect" children from this danger, through technologies such as "chip cards" and special agents, and through legislation. ***Lessons from the first wave?*** Given the increasing access to the "big world" and its evils that bombards children in every part of their lives, it does not seem to be a cause for concern that school use of the WWW is going to corrupt the morals of our students. Nor does it seem that we need to anticipate sociological or psychological damage from network use, any more than it occurred from personal computer use. More seriously, we do not need to fear that schools will disappear and teachers will be replaced by some virtual equivalents.
9. Not to gain...	While the Internet will open up new channels to the international dissemination of electronic learning materials, there is not likely to be a corresponding response of purchase orders via a CGI-forms from within WWW pages. Teachers and schools will want free materials or services subsidized by their local jurisdictions; a commercial market for educational network services is not likely to develop. ***Lessons from the first wave?*** It is unlikely that commercial groups will make a profit from school access to the Internet. In contrast, more use will be made of teacher-made and student-made materials, because these will be available for free. This means that decision makers cannot expect commercial interests to support schools' Internet access. Funding will have to come from educational jurisdictions, and increasingly from the individual parents and teachers in a school. Of course, this will lead to inequities in educational opportunity reflecting the inequities in society; networking will not reduce them.
10. From subsidized exploration to ... its withdrawal	Here we will suffer from being the second wave. Society, and teachers, are rather tired of computer-based innovations, and will be less tolerant of spending energy and money on them. ***Lessons from the first wave?*** Make sure the Internet-enthusiasts have good awareness of the computers-in-education history or a school or district or country. This history will flavour all new computer-related initiatives in a way that the newcomer, filled with passion for the WWW, is likely to underestimate. And also, there will be less tolerance for experimenting among teachers who already had poor experiences with computers. A justifiable skepticism about "fads" in education must be anticipated and respected.
11. The teacher in the critical variable	In the classroom, the teacher is the gatekeeper and the filter; the teacher, not the visionary, not the vendor, not the service provider, not the ministry decision maker. A good teacher may do very good things with network opportunities; a weak teacher will not no matter how we try with strategies and inservice. ***Lessons from the first wave?*** We have learned that teachers are very much influenced by and helped by each other. Stimulating and supporting teacher networking with respect to ideas about classroom applications of the Internet seems to be a good strategy decision.

CONCLUSIONS: IS THERE SOMETHING NEW?

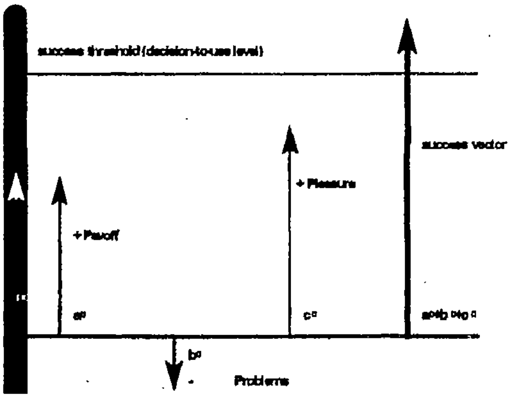
I began this reflection by asking if we could learn from our computers-in-education experience with respect to our expectations for teachers' use of networks particularly the WWW accessed via the Internet, and I have argued that there are many insights that can be applied. I do think, however, that the second wave does involve some things which will make a difference in terms of increasing the likelihood of implementation. Focusing particularly on teachers, I think that:

• The common and easy-to-use user interface of WWW browsers will be as helpful and atrractive to teachers as it is in general in society, thus lowering some of the traditional barriers to teacher use of computer software.

• The ease with which the WWW with its search engines now allows us to access ideas and examples and images and materials through a single user interface is something which has never happened before. Such single-frontend ease and international access to materials did not accompany the computers-in-education movement. We could read about an interesting software package, but had no way to see it or use it. We have finally made a breakthrough in the traditional dissemination bottleneck, and the breakthrough is at many levels. It is at a personal level: teachers can look for and decide for themselves what they find interesting, not needing to wait for the filtering process through committee and resource offices. It is at an idea and energy level: there are many, many good arid creative sets of materials being made available via the WWW by teachers and students that can now flow into the international community in a way that was never possible before. The cost of this freedom is loss of quality control, but teachers as professionals must be able themselves to judge if a resource is useful or not.

• Another thing which is interesting is that the WWW supports teachers' access to resources, to units of learning materials which can be integrated into one's own lesson and situation. We did not succeed with educational software, I think, because the teaching act is too personal to be handled by software to a teacher's satisfaction. But finding and making use of good resources and information is something different. Teachers will, I think, be much more likely to see the use of good quality images and example materials that they can embed in their own lessons than they have been likely to see the use of a software package that tries to teach.

• The WWW is a flexible and universal medium; platform independent and capable of being used in many ways and with many different media forms. The surge of creative development of WWW technology is a breakthough in society as a whole. For a while at least, ordinary people can do powerful things with the functionalities of the WWW, taking us back to the creative feeling that fueled the "computers in education" breakthrough of the late 1970s.



The "3 P" Model to predict implementation of an innovation in instructional practice

I and my colleagues have earlier argued that the likelihood that a teacher accepts a computer-related innovation into his or her practice is a function of three variables: expected payoff, level of problems that have to be overcome, and instrinsic pleasure in being involved with the innovation. We call this the "3P" Model (see, for example, Collis, 1996), and have seen it to have explanatory value in many different settings. The 3P Model says that the vector sum of Payoff, Problems, and Pleasure must be sufficiently positive in order for usage to occur. In general, "Problems" is a negatively-valued vector; pioneers and enthusiasts bring high value to the "Pleasure" vector (and also predict much higher values for the "Payoff" vector than do non-enthusiasts.). The figure below visualizes the model.

In the diagram, the innovation is likely to be used by a teacher in practice, because it is perceived having relatively low problems associated with its use compared to the perceived payoff and pleasure.

The breakthrough in network usage that is now occurring via WWW developments appears to be contributing to a reduction in the negative value of "Problems", an increase in the number of persons experiencing a "Pleasure" feeling with network use, and thus in both real and perceived ways is suggesting a positive "Payoff" vector. The personal computer breakthrough in the late 1970s changed the "3P" relationship about computer use for the teacher and stimulated much hope in Payoff. It may be that the breakthrough of WWW functionalities and the World Wide Web itself will support a positive enough "3P" vector sum so that the teacher will implement the innovation into her practice to a greater extent than has been the case with computers.

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The original is presented in English

THE DEVELOPMENT AND EXPERIMENTING IN THE FIELD OF EDUCATIONAL SERVICES USING INFRASTRUCTURES OF INFORMATION SUPERHIGHWAYS

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1. THE PROBLEM

The Society of Interactive Distance Education (Société de téléformation interactive: STEFI) is a consortium of twelve partners, working in the field of education, electronic superhighways and distribution of information. This noncommercial organization comprises educational institutions representing all educational levels (primary, secondary, higher and additional professional). The aim of the consortium is to propagade, to develop and to provide educational services by means of information superhighways.

The members of the STEFI consortium believe, that the key to the success of our UBI-Education project is almost the universal use of TV sets and what is most important, that it is the center of all sorts of common activity of the modern family. They regard the start of the UBI network in Saguenay localities as a wonderful opportunity to extend their services owing to the «omnipresence» of the network, which is being designed for the first time it will provide practically all Canadians with a broad spectrum of telematic services.

The UBI project includes several experimental subprojects, offering to the users new specific services, which will be fully appreciated in the future and will allow to realize all kinds of activities connected with education:

1. **Pedagogical support:** educational programs, self-training programs, special pedagogical programs for control and self-control of knowledge.
2. **Teleclass:** interactive distance education through multimedia means (on-line and off-line modes).
3. **Electronic library:** the access to information resources and databases.
4. **Administrative services:** submission of applications, entering on the list of students, information about students' progress, tuition charges.
5. **Information services:** information on programs and educational establishments, their location, classrooms, lecture halls and time-tables.

2. MEMBERS OF THE CONSORTIUM

Participants of the UBI project are universities, colleges, school commissions and communication enterprises, working to extend information and services, provided through electronic superhighways. The association STEFI integrates the following partner-founders;

- University of Quebec, Montreal
- University of Quebec, Chicoutimi
- Teleuniversity
- General educational and professional college, Chicoutimi
- General educational and professional college, Jonquiere
- Center of distance education of Rosemont College
- School commission, Chicoutimi
- School commission, Jonquiere
- School commission, Valin
- Radio station «Radio Quebec»
- Radio station "C.A.N.A.L".
- Consortium of the UBI project and Vidéoway Multimédia.

Another two organizations of Saguenay localities have joined Interactive Distance Education Society as associated members to promote the project at a regional level as much as possible:

- Regional office of the Ministry of Education
- Quebec Society for Labour Power Development.

3. UBI-EDUCATION PROJECT

The UBI-Education project comprises a variety of projects aiming at designing, development and introduction of new educational services through the UBI electronic superhighway and making these services available for every family. In the intermediate term perspective the STEFI consortium seeks to solve one of the problems concerning schools, colleges and universities of the future by developing projects of the informational maintenance of education whose realization would provide teachers and students with more powerful technological means thus promoting and improving education. The scheme given below shows how we look at the virtual school of the future, where all services stipulated by the UBI project are already introduced and which offer new opportunities to the three main participants of the educational process - the teacher, the student and the manager.

All members of the consortium (first of all, educational institutions on three levels of education) take interested in the realization of all the projects stipulated in our program of development. Their list is given below.

PEDAGOGICAL SUPPORT

Curricula

To make the adaptation of available curricula to the work on modern computers easier the consortium suggests that it should develop and supply the Ministry of Education and the firms producing educational software and distributing it on a commercial basis with the reference book on conditions of education, and also with the directory of curricula for their selection and adaptation.

<table>
<tr><td></td><td colspan="3">VIRTUAL SCHOOL</td></tr>
<tr><td>TEACHER</td><td>CLASS
The server of the distance education class</td><td>LABORATORY
The server of auxiliary programs</td><td>LIBRARY
The server of the access to information</td></tr>
<tr><td>STUDENT</td><td colspan="3">NETWORK</td></tr>
<tr><td>MANAGER</td><td colspan="2">CORRESPONDENCE
The server of information</td><td>SERVICES
The server of the administration</td></tr>
</table>

Software for self-training

This project aims mainly to help pupils of primary and secondary schools offering them auxiliary educational software, such as oral and written electronic homework thus ensuring self-control and making it possible to correct mistakes.

Special programs for pedagogical control and self-control of knowledges

Special programs for pedagogical control and self-control of knowledge contain the electronic directory for parents on problems of primary and secondary schools (programs, teaching materials, etc.) and software to check up children's homework, and also electronic training programs to prepare them to SEC (School Education Certificate).

TELECLASS

Distance education class

This class will help to create an original innovative educational environment. But before this class is started it should be created and tested.

The concept of the teleclass is based on the fact that the UBI platform makes direct distance learning of a large teleaudience possible. The teleclass is intended for lessons with a large number of students so that it would be possible to justify large expenses and to reach the maximum possible economy of funds. For example, in such a studio-class equipped with the server and the central control panel, it is possible to transfer several parallel images, all functions of the new information technologies and computer data exchange, as well as the dialogue between the teacher and students, not only with a small group of those present; but also with a significant number of students in their homes. In case of need the teacher can supplement his explanations with multimedia-documents.

Supplementary electronic educational tools

Supplementary electronic educational tools enable schoolchildren or students to use the potentialities of new information technologies to enhance the efficiency of learning in the teleclass doing diagnostic and training exercises with tests to prepare them for the examinations, and also using additional electronic learning modules.

ELECTRONIC LIBRARY

The access to information sources and databases

This service enables to find the necessary literature (monographs, essays) in the database or to compile a bibliography using key words. Such an additional service as the request for printed matter which can be compiled using electronic catalogues, provided with the searching system.

ADMINISTRATIVE SERVICES

Submission of applications

After the student acquainted with the information about educational programs, he may ask for additional information or documents and to start filling the application form and other papers.

Entry on educational courses list

This service enables the student to contact with an educational institution he get intrested in and enroll in the chosen course by filling an electronic application form and sending it through our network.

Information about marks and obtaining extracts

Due to this electronic service pupils (or their parents) can read their test book or their student's book which appear on the screen. They can also make a request for an extract from these documents or if it is necessary, to ask for a printed extract, which is an official document.

Payments for services

Payments for services through our network by credit cards and from the so-called "electronic purses" is mainly for students of universities and colleges.

INFORMATION SERVICES

Information about programs and educational institutions

This service can be used by students and their parents.

Information about the location of educational institutions, classrooms, lecture halls and time-tables

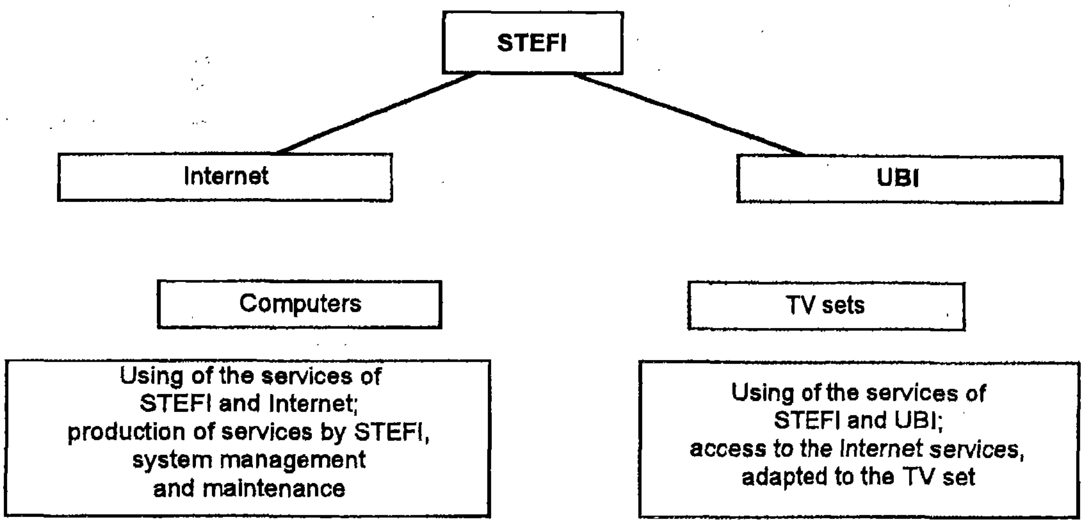
This service will enable everyone to get the necessary information, to pass it quickly and safely to those who need it, and in some cases to pass urgent information about unexpected changes.

4. STRATEGY OF INTRODUCTION

At the first stage, when the infrastructure of the UBI network will include 80 per cent of families in the Saguenay localities, the STEFI agency will take advantage of it to cover the remaining parts of the population of this region as soon as possible. To find out the forms which can meet the needs of various social groups for education and training in the best way, new pedagogical models of distance education will be tested.

The STEFI has chosen the strategy of introduction of their educational services using many ways. Taking into account the technological compatibility of the game TV set (with a game station and network interface) and personal multimedia computer, which is linked to the Internet, the STEFI will adapt their services developed for the application of one type of means, to work with other types.

The new products and services being developed by the STEFI enable to concretize the model of the virtual school - the information space, which will make it possible to connect students, teachers and the administrative staff.



The original is presented in French

Discussion

MULTIMEDIA IN EDUCATION. WHY SO SLOWLY AND HOW TO ACCELERATE PROCESS OF INPLEMENTATION

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From the experience of practical realization of computerization in education in various countries the author notified in the beginning of the process of mass installation personal computers at schools that we must not be waiting for fast revolutionary changes in the process of education. Nevertheless the break between achieved high level of information technologies and insignificant achievement in their use in education surprises. Why it is not enough successful examples? We shall try to analyze why the process of introduction new information technologies, in particular the multimedia technologies and distance education is so slow.

Basically, in this material we will speak about the problems of secondary education, but a lot of them can be distributed also to the higher school.

SOCIAL FACTOR

At first it is necessary to deliver a social factor. The process of informatization of education, together with using the multimedia technologies in education is more depending on human factor, that is on how proposed innovations will perceive by the teacher. We shall try to realize a teacher's position. Usually he has agreed and valid method of teaching, he spends not a lot of time for preparation for lessons and suddenly he must change the customary style of teaching, he should begin to work with computers, he has to use them for doing lessons and etc. Thus nobody has evidently proved him, that the using of computers helps to improve the process of education. Besides, frequently, the teacher does not know well the opportunities of the computer, could not work with it.

We shall assume, that at school there are the sufficient number of computers. Then, if the teacher will decide to use them in teaching process, he should spend considerably more time for preparation to lessons, and not at home in comfortable conditions, but in educational institution under the looking of the expert in informatics. Really, he is compelled to ask the help from colleague (because it is difficult for him to be prepared to lessons independently) and thus he becomes in a role of the schoolchild, that strongly touches vanity of the teacher. While it will be more new words and concepts (computer, expert system, base of knowledge, network, method of the projects, multimedia, Internet etc.), that there are more passive resistance of the teacher to the persistent requirement about using of the computer in educational process. But, and this is the main, an offered way of use of computers in teaching process is completely alien for him. Why is it? Before we will address to the history of a question we shall carry out some analogies.

SOME ANALOGIES

Active using of computers in education has begun more than ten years ago. Let's recall, about what we then dreamed and wrote: computers will much change the education; we shall manage to train the students on best methods, created by best methodists and programmers; in short term all system of education will change etc. Whether have we reach the delivered purposes? It is necessary to say honestly, that we have failed. Whether it means, that the computers should not be used in education? I think, that the overwhelming majority will consider blasphemous even statement of such question.

Practically the same enthusiastic words we are using now, but in combination with other new «idols», on which an information community is offering prayers: multimedia, CD-ROM, Internet, distance education, united information space etc.

At the same time the real situation with introduction of multimedia-computers in schools leaves to desire best. In Russia, for example, so far one third of schools has not computers in general. May be is it better the situation in USA? There near half of computers installed in schools have become outdated for a long ago: in the total number of computers of Apple Computer Co (this number is about 63 % of total number of computers in schools) only about 30 % are Mackintosh type, and the first models have become outdated for a long time. Is it necessary to speak about multimedia today? Without fail. It is necessary to analyze our errors and to make correct conclusions for successful progress. The computers should be used in education, but it is necessary to put more real ultimate objectives.

SOMEWHAT ON HISTORY OF APPLICATION OF INFORMATION TECHNOLOGIES

The education always carried out with the using of a certain method of teaching. A *method,* if to translate it to the technical language, is the *technology,* not the technology of the production process, but of the training process. The technological process always means that there is a definite sequence of actions for achievement of result and it even is as algorithm. Where is a place of the multimedia-computer in this technology?

Multimedia is the joining in one user product of the text, graphic arts, audio- and video-information, animation. It does not mean, that simultaneously on the screen appears some video-subjects, photographs, textual fragments. More faithfully, multimedia-technology is the opportunity with the help of the computer to proceed from illustration to videofragment, then to text, again to photographs, the opportunity to-near the sound commentary to it, thus for user is added an opportunity of a feedback, that is property of interaction. The order of using information elements is defined by the teacher or student.

Now should at least perfunctorily address to the history of appearance and use of components of modern multimedia.

Text has appeared for long ago and is familiar to all from books. The books are widely used in education, they are main educational manual.

Black-and-white graphic arts has become to be used in books in the last century, in many events has improved the understanding of the subject of study.

The colour illustrations has appeared rather recently, already at our century they have come in our life. Together with text they are broadly used in educational process.

Sound (audio) - radio, tape recorder etc. have received the mass distribution from the middle of our century, they have received distribution at school practice, may be, only when studying foreign languages.

Cinema (at first "Great dumb", and then as a sound cinema) was spread from the first third of our century. In the educational process it has not received the wide application due to the complexity of the equipment and problems, connected with flammability of film.

Video image (TV, video recorders, laser players) has come up for the second half of our century. It was expected, that the using of video in the educational process will allow sharply to raise a quality of education, since it will be possible to spread advanced teaching experience, best lectures and lessons unless on the whole world, at least, on whole country. Besides, it was expected the significant improvement in correspondence (on - modern - distance) education.

It is necessary to pay attention, that the best results in sphere of education are given by using that is invented more than century ago. The other innovations of high technologies (or components of modern multimedia) in the next once have disappointed of admirers. Radio and tele-lessons could not make a competition to usual day school and university system. The linguaphone rooms did not learn masses of people to foreign languages and etc.

GENERALIZAION

We shall try to generalize resulted sketches. Each new technical facility begins to give good results only when the new generation of the teachers will growth up and they will be ready and wanting to apply the specified technical mean with the desire, and also when teachers, who could develop a methods on using new technical facility in teaching process, will appear in sufficient quantity. They will create rather large number of examples, on the basis of which even average teacher can use this technical innovation.

Really, in each country accumulated the large methodical experience, but, alas! — with using the old facilities. To replace a strategy on the new technical facility - not each under power. Simple analogy. The development of a film-industry has made alive a new professions — of a scenario-maker and the film producer. The good photographer could not become a film producer, as he was accustomed to think in static images, its slogan is "To stop, instant!", but cinema requires as once of dynamics, movement. On the other hand the film producer can not replace scenario-maker, though he can be the co-author of the scenario, as prompts to a scenario-maker possible realization of the conceived scenario.

Today we have approached to that moment, when technical facilities much outstrip opportunities of the modern "average" teachers to perception of these facilities and more so using these means. It is necessary to ascertain,, that there is the gap between revolutionary development of information technologies, technical facilities and the evolutionary development of person. The similar fact was paid attention ten years ago, when was rather fashionable to speak about *retraining* of the teachers, *training of the teachers* of the teachers (that is those, who learns directly teachers and tutors) etc.

At the same time among teachers and methodists (which are the experts in the field of technique of teaching) a layer of people, who can write a qualitative scenario of a training product for realization on modern multimedia computer, is practically completely absent. On the expert estimation the overwhelming majority of computer teaching products is created by former programmers. In this connection the following recommendations are expedient:

- the preparation and retraining of the teachers should go by *outstripping rates in all countries. Only in this case* reduction of gap between the appearance of a new technical facility or information technology and its mass effective utilization is possible;
- in all higher educational institutions it is necessary to enter new teaching subject on using of multimedia-products in the teaching process;
- it is necessary to begin education in higher educational institutions of the students on specialty pedagogue - scenario-maker (or methodist - scenario-maker).

WAYS OF THE PROBLEMS DECISION

In the conceptual sights on informatization of education it is necessary to carry out updating of the purposes. It is necessary to select the following purposes.

The informatization of education, providing the access to .information within the framework of uniform information space. The selection of the information should be made in the view of recommendations of the teacher and according to national and religious customs. Thus in the education will be done the greater emphasis on preparation of the abstracts on problem, reports and printed work.

Mastering a computer as an information instrument *so* as contact with computer came of difficulties, not exceeding those, which we feel by using a pen.

Education at schoolchildren and students of information culture. Otherwise they can not productively use information superhighways for work, and "will be lost" under avalanche of the information, which they will request and possibly send by modern communication facilities.

As remote prospect (it is necessary not to wait miracles not having prepared ground for them) the organic computer integration in the teaching process is considered in new its quality which can ensure upheaval in education, but *not revolutionary,* as we all assumed early, but *evolutionary.*

What is it necessary to do, that the "average" teacher, at least once, did not object to use a new information technologies in its work? It is obviously possible the following.

1. *Orientation of public opinion* on the duty of using the computers (as an *element of qualitative education)* when teaching some subjects. For this purpose it is necessary widely to use means of mass-media.

2.. For lessons or lectures teacher or lecturer should be given as *much as possible «friendly» computer,* for example, computer of type Mackintosh, though for this it is necessary to pay in direct sense of this word (Mackintosh costs a little bit more, than IBM PC compatible computers of a standard configuration). Nevertheless, this is the most favorable investment of the capital, as the purpose is not simply installation of computers in educational institution or purchasing not so expensive secondhand computers, but productive using of computers with the purposes of teaching. We shall note, .that productivity of the processor, tact frequency and other technical characteristics of the computer are not so important for teacher as «friendly» of hardware-software means and integrated approach of the given decision. The teacher should not spend time for selection of the computer configuration, the most suitable for his subject.

3. It is necessary to offer to the teacher new *methodically worked models of using computer* (or computers) in teaching room. Today in Russia, for example, only one decision is recommended to the teacher - *lessons in computer class,* which is used .mainly at learning of informatics. One of the effective decisions is "the electronic board". On the computer screen (or by means of projection installation) educational material in the kind of illustrations, fragments of video films, audio spots can be submitted, it can be shown the computer model of any process. We are paying special attention, that computer used as the electronic board should be *multimedia* one, as there is no sense to reproduce on lecture screen only textual material.

The special class-room should be in educational institution; this room should be equipped by video-projector and screen for making the lecture with using the computer, or the computer should be moved from one room to another on special wheel-barrow.

The similar decision is the creation at school the electronic informational culture center (artcenter, electronic gallery) or school electronic library, that is quite possible at such quantity and already quality CD-ROM on separate themes, multimedia encyclopedia, computer albums, guidebooks etc.

4. For the teacher could something prepare something and to show on lesson, *it is necessary to have simple tool (author's) mean.* Better and easier of HyperCard for Mackintosh so far nothing is created. Just HyperCard has been able to break a barrier between the computer and teacher in USA. To HyperCard adjoins HyperStudia, SuperCard etc. In Russia there will be some problems with HyperCard, since in it language, close to natural English, is used for programming, but, alas!, to English, instead of to Russian. So the development of suitable tools for teachers is necessary, in which it will be able to use native language.

5. Basically the electronic textbooks, educational multimedia encyclopedia *should form* not in handicraft conditions by the teachers, but *qualified developers,* uniting humanitarians and representatives of natural sciences. On the basis of these materials the teacher can carry out preparation to particular lesson. In the kind of an example it is possible to show the activity of firm *КОМИНФО* (Moscow), which lets out in 1996 at once eight CD-ROM in Russian: Moscow Kremlin, St.-Petersburg, Petergof, Art encyclopedia of classical foreign art, Dictionary in pictures etc.

6. It is necessary to *explain to the teacher the advantage and lacks of using computers in the educational process.* The usual textbook was and will be necessary as the main «instrument» of the schoolchild. Any text is much more convenient for studying in usual book, instead of on screen of the computer. Electronic textbook frequently supplements usual one, and it is especially effective when:

- provides practically instant feedback,
- helps find quickly the necessary information, search of which in the usual textbook is complicated.
- much saves time at repeated references to hypertext explanations,
- alongside with brief text it shows, tells, simulates etc. (Just here the opportunities and advantages of multimedia-technologies are displayed).

Even when the electronic textbooks or educational encyclopedias are used, expediently to use a hard copy of those sections, which are chosen in these manuals for using by learners.

7. It is necessary to *guarantee each teacher an opportunity of regular increase of qualification with using of new information technologies,* for in practice shows an opportunities and lacks of electronic means. In other words, it is necessary to create for teacher «friendly environment» (computers of a type Mackintosh make a base of it); good software with clear graphic interface; simple tool means, and also to create general atmosphere, aimed at the using of computers in teaching process. It is necessary at the same time to develop of large number multimedia manuals and encyclopedias for using them in the teaching process and as auxiliary means.

PROBLEMS OF THE MULTIMEDIA PRODUCTS CREATION

As it was marked above, textbook, printed text still remain the main manual, but multimedia can essentially help in understanding of a teaching material. Really, "it is better an once to see, than hundred times to hear". It is possible to read the description of some process on tens pages, but noything realize. It is enough to see a short videoplate, and at once all it will become clear. However during preparation of the manual even more, than at work with text, careful selection and structuring of an initial material is necessary. A simple example: practically the whole population daily on some hours looks the TV set, that is audio and video materials, but results (from the point of view of education and cultures) leave to desire best.

We must say, that before the occurrence of multimedia technologies, it was not possible to create high effective'mass computer textbooks, which have much improved process of training. There is the number of good electronic manuals, which is possible and need to be used in educational process, but which have not created a base for the changing of the purposes and methods of education. In connection with the opportunity of uniting in one product textual, audio and video materials the requirements to all initial materials and author's system, chosen for the realization of a product, sharply grow.

At preparation of the electronic textbook or lecture a main figure becomes the expert in contents; he can be rather a teacher, rather a methodist, and expert in the subject area.

Writing of the script, selection and structuring the material represent a separate difficult problem requiring for the decision of a long-duration time. Such expert, connecting in self qualities of the set forth above experts, and also art designer, film producer, rather difficult to find, but just he defines success or losing of work of the whole developer's team.

It is necessary to define a platform, for which multimedia product will be developed. In Russia in sphere of education there are used many types of, computers, but as multimedia computers it is possible to use only senior models of IBM PC - compatible computers or computers of Mackintosh type - that is the best multimedia computers in the world. Unfortunately, in Russia the park of these computers (both types) does not exceed 10-15 % of general number computers used in education, nevertheless just on these computers the bodies of national education should be oriented themselves, planning re-equipment of educational institutions.

This implies that it is reasonable to develop applied products just for two platforms, especially if the developers want to offer their product to other countries (we shall remind, that in USA Mackintosh are used more than in 60 % of schools). On the other hand, it is expediently to use author's stations on base of Mackintosh, which permit to create applied products with smaller expenses of working hours for developers, and also have a wide spectrum of tool means, enabling to fulfil development at once for two platforms (a part of them will be named later).

The experts in informatics should help to choose a suitable tool means and to realize the project. Thus they do not be interested in external computer effects, as it is frequently, and strictly to follow to a general plan of the expert in contents. In turn, the choice of an author's means for realization of scenario is rather complicated. During discussion of the scenario it is necessary to reach reasonable compromise between the author of scenario and programmers.

PREPARATION OF INFORMATION BLOCKS

At the creation of an applied product it is necessary at first to prepare information blocks (text, audio and video information) with maximum quality. For education sphere this is one of most important requirements. It is possible to adduce examples as quickly multimedia encyclopedias, which are widely distributed in the world, fall behind life and sometimes contain the direct errors. Therefore the special attention should be pay to the quality and reliability of the information.

At this stage the requirements to fonts, textual formats are also defined; checking of data and editing should be carried out. Video-shootings or choosing the materials in archives of video-recordings should simultaneously be fulfiled, formats for compression of the video-information should be chosen, speeds of data transfer from multimedia-carrier, the frequency discretezation for audio-information should be determined and also sould be resolved many other technical questions, connected with realization of conceived idea.

DEVELOPMENT OF MULTIMEDIA-PRODUCTS IN CLASS OR LECTURE-ROOM

If we consider, that the skill to present results of our work in printed form is a compulsory element of information culture of the person, then skill to create electronic multimedia products will become the same compulsory element of culture in the nearest future.

The multimedia means permit considerably to enrich the educational process thanks to using of various materials. If there is the opportunity, it is necessary without fail to enter into school subjects the practical lessons on preparation of educational multimedia products. However, thus there is the danger of excessive passion for ready materials to the detriment to creative activity of the schoolchildren and students during lessons. Really, now there are many compact discs (CD-ROM) in the market, containing sound libraries, videoclips and digital illustration. Students are offered to collect the ready products from details. Thus learners as though go from "the live world", from opportunity to record the phonogramme themselves, to make a photo or video report, and then to create their "own" multimedia product or presentation.

It is reasonable to suggest the following scheme. Alongside with lessons with using of multimedia products, learning of means of navigation etc., it is necessary to carry out the practical lessons on development of ready products with using materials prepared by the schoolchildren themselves. For preparation and digitalization of such materials they sould have some addition set: a microphone, scanner, digital camera, videocamera. In class-room it is necessary to use whenever possible simple tool means, enabling to the schoolchildren under the direction of teacher on their own material to create the samples of educational products or multimedia presentations (for example, HyperCard).

Do not forget, that the schoolchildren can frequently invent the original decision (from the point of view of presence of fruitful idea), therefore it is worth while to analyze carefully the ready samples, and then the best from best can be improved by creative groups with the help of more powerful author's means, such as the *Director* or *Author - profy*. This is one of the ways of using variety of multimedia means, which is finished by creation of perfect multimedia product.

The interesting experience of similar lessons has St.-Petersburg State Electrotechnical University. Here author's system HyperMethod (Multimedia Authoring Tool) was developed; with using of this system the teaching process on development multimedia products is carried out.

DISTANCE EDUCATION

All submitted above can be referred also to the problems of development of the distance education. The modern information technologies give all opportunities for creation of this kind of education, just *creation*, instead of replacement of usual post on electronic in correspondence education, though and this step is also approved. Just as with using of multimedia technologies ought to develop new methods of distance training and to carry out intensive preparation of the teachers for the new style of work has become an integral part of teachers' qualification. Accordingly, alongside with the using of multimedia products, the opportunities for carry out the videoconferences, seminars and etc. are appeared. In distance training one of the main elements will be simultaneous work of the students at remote terminals under the direction of teacher (he is frequently named *moderator).*

THE CONCLUSION

In conclusion it is necessary to note, that just the multimedia technologies enable to carry out humanitarization of education through informatization, that on self would be major achivement. The multimedia technologies acquaint the schoolchildren with electronic reproductions of the best works of culture, permit to organize listening of musical compositions etc. Thus the works of art can be used as background in applied programs or to occur during process of decision certain historical or another problem, to become familiar for schoolchildren. Such opportunity is especially important for schools which are remote from cultural centers of country, in the view of travel expenses does not permit to organize appropriate excursions for all schoolchildren.

THE OFFERS TO THE PROJECT OF THE RECOMMENDATIONS OF THE CONGRESS

On the base of submitted material it is possible to make the following offers in project of the Recommendations.

1. To ascertain, that in postindustrial society or information society the purpose of informatization of education should be put for the first place, that is providing of access according to national and religious customs of the given community to any information in any point of the world should be delivered.
2. To recommend to introduce into curricula of pedagogical universities and colleges the preparation on new professions of the teachers: the teacher - methodist (scenaris-maker) on creation and application of teaching multimedia-products, and also to introduce a special subject of information culture, one of the elements of which should be the development of the multimedia-publications for teaching purposes, mastering of navigation rules in information world.
3. To create under UNESCO aegis the regional and national centers of system researches on informatization of secondary school, in which data on researches and applications of informatics means in teaching process should be systematized and generalized.
4. To recommend to state-members the preparation of the state programs on informatization of education. One of the elements of such program should be state support of expensive preparation of electronic multimedia- and Internet-textbooks for each country.
5. To recommend under UNESCO aegis to begin the project *"Electronic Artcentre in School"* (possible versions are *"School Electronic Library", "Electronic gallery", "Information and Cultural Center").*

The original is presented in Russian

TEACHER EMPOWERMENT AND TECHNOLOGY

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Generally it is hard to measure the importance of information technology (IT) in education as IT is only one factor amongst many that affects the learning environment and enhances the cognitive development. Parents, subject area, classmates, culture, teachers are just some of those integrated components that together create the prerequisites of education. Just to foster the ability to read and listen may sometimes be more important than the use of technology in a learning environment. Student can create personal multimedia presentations in their brains when they read or listen. Abstract, relation-free thinking is also an important goal for education.

Mankind has always tried to replace muscle power with machines. I am fascinated by the fact that the less productive work we do with our muscles the bigger they grow. Many people devote themselves to bodybuilding, jogging and physical welfare. As for brain support we did not have a real break-through until the computer arrived. Before that we have had several development steps such as the pen, the printing press, telephones, faxes etc. My ancestors the Vikings used stones to register data on and that was a long-lasting but primitive method for data handling. My hope is that today when computers support both muscle power and brain power we will start brain-building and intellectual jogging in order to enrich our lives and to unload or reduce boring, repetitive, routine tasks.

IT as a technique has developed very rapidly but it is not until the multimedia facilities arrived, that IT has got enough capacity to substantially support the teacher and students. Now we can digitize many impressions from many senses. As technique and experience of IT have succesively developed, IT nowadays supports us not only in routine work but also with simple and advanced decisions, simulations and even offer limited artificial intelligence. IT is ready for education.

IT has gradually changed our society from an industrial to an information and knowledge society. In Sweden about 60 percent of the labor force are information and knowledge workers. This change ought to affect education or should education affect the society? There are many educational theories that support both opinions so we have to consider if we want to define progressivism, essentialism, perennialism, reconstructivism or constructivism as a goal for education.

Anyhow, the changes in society have resulted in new types of jobs, new moral and ethical values, new cultures, new ways to spend our spare time, new terminology, instant access to global multimedia information, data communication, virtual organizations etc. I personally believe that education, at least to a certain extent, ought to prepare students for this partly new infrastructure and environment. Due to these continuous changes, society, the private and the public sector need a new kind of individual, a flexible, critical person with high quality thinking and familiar with the use of information technology. Industry itself has already integrated IT in their business process reengieering activities in order to reach strategic, competitive advantages and adapted its organization, administration, its material and immaterial infrastructure, partly because everyone within an organization now has access to most internal and external information concerning its business activities. Education can learn a lot from this new approach. One example is the use of Total Quality Management (TQM) thinking where everyone involved in a process contributes to make it more effective rather than to criticize the final result. The method offers an interesting new idea for how to look at grading. The process has become more important than the method for measuring the outcome and result. Other relevant methods for the creating of a new learning environment and a new approach to knowledge are the use of methods such as business reengineering processes (BRP) and organizational learning (OL).

The change in society, industry, public sector and the new demands also affect the individual. Education must contribute to offer the individual a rich life in the future, knowledge society. Students must learn to adapt themselves to the new culture, be able to evaluate and criticize information and develop morale and ethics. The school must teach them how to think rather than to reproduce data and to prepare them to be life-long learners and knowledge workers. I believe that education must reach a new ambition level to satisfy these demands. We must leave the data school, where students mainly reproduce data and teach them how to analyze data to get information, synthesize information to get knowledge or applied information and ultimately how to evaluate knowledge to get wisdom.

Teachers mainly have two roles in education. They are administrators and educators. In both activities they handle data, information and knowledge. IT ought to be a very useful support for the fulfillment of these two roles and at the same time make the teachers' life easier, more interesting and maybe even more fun. Just look at typical teachers activities. They collect, store, copy, calculate, check, register, search, rewrite, analyze, present and eliminate data. These activities are tailor-made for computers. IT can unload much "donkey-work" from education and give all parties more time for discussions, social interaction and mastery learning.

Teachers sometimes filter data and information for the students in a classroom environment. Other educational filters are old subject areas, old curricula, not updated textbooks, a restricted classroom environment and passive students. The traditional way of teaching sometimes delivers a very limited amount of information. The teacher mainly chooses the contents and collectively distributes it to the students. Reproductive learning is still favored, especially in different tests. An alternate way of teaching is Problem Based Learning (PBL) where the teacher is more of a coordinator, informator, navigator and facilitator. Students are looked upon as individuals and have direct access to most data and information in a virtual classroom in the global multimedia world. In this kind of learning environment it is essential to teach students how to navigate in the information jungle, how to search, find and analyze data and information in order to achieve quality learning or super learning.

To reach this new goal for education and to create this new learning environment we need IT. We ought not to start to buy and implement hardware and software and after that decide what to do with it. This approach often results in fragmentary solutions, efforts and ideas. Initially we must simply try to identify those new official or institutional activity goals and consider how this ambition will affect the roles for teachers and students. At the same time we must also reflect on the need for a change of the present organization and administration of the school. Changes in the physical infrastructure are also important to consider. The classroom is a very old institution and may need to be modernized. When these ambitions and goals are clarified we must ponder if or how information technology can support us to carry through these activities and reach the desired level of ambition and the new educational goals.

What I have said so far implies that IT may have an important role in the empowerment of teachers and students. For example IT can be used as a personal, administrative tool, as a personal teacher, as a drill-and-practice partner, as a partner in discussions and team-work and as a data collector, It can also assist as an intelligent blackboard and as a link to the outside world via global data-communication.

One special advantage with IT is that all kinds of educational material such as books, pictures, movies, sound, files on disks, educational software, papers and other documents now can be digitized, stored on a CD-

ROM or reached via Internet and be controlled by the computer. In a Multimedia Laboratory (MML) learning environment teachers and students can produce professional teaching material, electronic reports and many other applications for education. At this point I must stress my opinion that IT is not the only road to knowledge. It winds through a learning environment with many different pedagogical methods and various forms of teaching material. It is never a question of either or, rather both and. Information technology can and should never replace the living multimedia person, the teacher, with feelings, body language, enthusiasm and concern. This must be a key principle in education and teacher empowerment. In my country we considered this condition so important that we defined and added some general principles for IT in school:

- IT must be integrated in the curriculum, not an isolated subject area;
- IT must be a tool among other tools;
- Students must be in control of IT not vice versa;
- Education must apply an overall view - Wygotsky;
- Continuous, coordinated research and evaluation are necessary.

Even if the effects of IT in education are hard to measure I believe in what an outstanding researcher said to me "I see something positive happen to the students and that is enough for me." It is also important to understand that education is a complicated, dynamic system with many integrated subsystems. If one component changes it can and will affect many other subsystems and probably the whole system. Therefore if is important for the teacher to adapt a systems approach to IT. The use of IT in school may not only affect internal functions but also parties outside the school, parents, authorities etc.

If IT should become an efficient tool to empower teachers it is important to have this overall, systems approach and to structure, analyze and consider all components in an IT-system and how they interact. A possible start is to identify the use of IT in different educational activities for example in computer competence, vocational training, computer science and IT as a purely pedagogical support. Different activities may need different kinds of hardware, software and teaching methods. When the activities are made clear the teacher must consider and coordinate the resources necessary to perform these activities. Information needed, suitable hardware, various types of software, activity-oriented in-service-training, research and development and realistic budgeting are the most important ones. A function as computer coordinator and other "IT-pilot" functions are necessary to establish in every school.

In an efficient IT learning environment, the choice of hardware is of course essential, as well as systems software and application software. Anyhow it is important to understand that the learning environment in a school consists of many other things like the experience and knowledge built around the system. The library of teaching material, exercises, tests and the organization and administration of the IT-resource are vital components that affect the total quality and effectiveness of the educational IT-system.

I have seen many schools that think that the fragmentary change and updating of hardware will solve many problems and found that it is the contrary, simply because you must to a certain extent rebuild the IT environment. You sometimes have to start from the beginning again and in the process you lose old knowledge.

To make a summary I think that **the new goals** that need IT to be realized are:

- Partly new subject areas;
- A problem - oriented training to become information finders and knowledge workers;
- An individualized education;
- Training in critical thinking and abilities for life-long learning;
- A cross curricular and research-oriented approach with teamwork;
- More active students and new roles for teachers.

The means we need to achieve these new goals are for example:

- A new material and immaterial infrastructure for education;
- New kinds of teaching material and curricula with integrated IT;
- Adaptation of present curricula to IT;
- An activity-oriented training of the teachers in how to "informate";
- A training in data-pedagogy;
- A virtual school environment with IT-resources and distance learning facilities, available to students independent of time and place.

There is an abundance of information technology, available, for example, powerful multimedia computers, complete Multi-Media Laboratory environments, advanced peripherals, such as color scanners, color printers, CD-ROMs, portable computers, digital cameras, digital video cameras, modems for data communication, LAN, MAN and WAN, Internet, compressed video for distance learning, portable phones with datacommunication facilities via Internet, faxes, a multitude of software for most subject areas and activities etc., etc.

For me the most important resource in an educational IT system is the teacher and the in-sevice training of teachers. My experience is that a success factor is to motivate the teachers in for example a course or seminar where you "use new technique to teach about new technique." The idea is to show the teachers the power of IT and enforce them to use this new tool and virtual media in their roles as administrators and educators. Another purpose with this training is to make them aware of the new demands from society, industry and individuals, the need for an overall systems approach when they build the IT-resource and work together to consider all components and changes necessary to establish an effective IT-system for education.

It is crucial to teach teachers how to use IT in their personal administration to make them more professional, produce high-quality teaching material, material for presentation etc. It is essential to place resource computers in the teachers' room. By doing this, the teachers get acquainted with the technology and how to use IT for their own, daily administration of educational and other data. It is important that function comes first, then technology. After this introduction it is easy to teach them how to use IT and various kinds of software as a purely pedagogical tool - data-pedagogy.

One, very important point of view is that whenever a school buys software, it should be followed up by a course or a seminar where teachers from different subject areas (to stress the cross curricular teamwork) discuss how to use it effectively and how to integrate it in the curriculum.

I simply mean that in-service training of teachers must have a high pedagogical value, be motivating and activity-oriented. I saw a phrase somewhere that said. "It is hard to motivate high-tech students in a low-tech environment." For me and many others, education is the most important activity during this decade. The implementation of IT in education will no doubt expand the teachers role and responsibility and make his or her profession to a real career profession. That fact will attract still more qualified persons to work within education and that in turn may make education even more effective and interesting.

A high quality education is crucial for people to be able to live, develop and experience a rich, creative life in the future knowledge and IT society.

The original is presented in English

Commission II

ENHANCING THE TEACHER'S CREATIVITY BY EXPLORATORY COMPUTER ENVIRONMENTS

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INTRODUCTION

The fear that accompanied the first appearance of the computers in the classrooms that it could replace the teacher was closely connected with the paradigm of the educational process as one of transferring/consuming knowledge. If, on the contrary, we see this process as one of producing *knowledge by the teachers and students alike, such a fear becomes unjustified. For it is not the introduction of the computer to the classroom per se which would change the teaching process for the better but rather how computers are used. Thus if the computers provide an environment where knowledge is being produced the teaching/learning process could become more challenging, demanding, exiting. Furthermore, in an exploratory computer environment, learning can be approached as a task of discovering something rather then learning about it, the reward being the discovery itself. This determines a new paradigm of the teacher ranging from a researcher observing the cognitive development of his students to one who enriches his subject matter as a science and is ready to convey its real spirit to his students.*

On the basis of an educational experiment in Bulgarian schools various strategies for creating classroom culture, in which exploration are supported by suitable computer environments, have been tested and reported.

IT AND THE NEW ROLE OF MATHEMATICS TEACHERS

Three types of competence have been claimed as necessary for the mathematics teachers in order to adequately fulfil their new role in an IT environment - competencies related to mathematics, to informatics and to didactics. The problem is that what is hidden behind *mathematics competence* or *didactic competence* becomes dynamic in the new context. Perfection in teaching mathematics goes far beyond transmitting information of the kind *here is what is known and here is how it is used...* Our experience shows that there are teachers who are well aware of this and tune their teaching style in harmony with the nature of mathematics as a science. Instead of formulating the problems in *prove-that* style, they let their students be creative and formulate as many conjectures as they can about the relationship among elements of a given construction; or encourage them to formulate initial conditions, yielding concrete relationship. Such an attitude makes pupils accept and interpret problems as their own which is crucial from psychological point of view. What we have also observed is that some problems, once achievable only for the potential Olympic champions (in mathematics competitions), are now attacked by future champions... in light athletics. And even if the final results or proofs are not reached by all, at least students have experienced the taste of a mathematical adventure. For the mathematically motivated students, the adventure goes even further - to extend the problem, to generalise the findings, to prove the hypothesis formulated.

To help students become good experimenters and conjectures teachers have to cultivate some important skills and strategies, such as: parametrizing a construction so as to make it convenient for experiments; modifying initial conditions; generalising the problem; studying some particular cases; recognising situations leading to a *dead-end streets.*

Such strategies appear to be even more successful if the teachers themselves take the risk of performing explorations and make the students participants in their discoveries. *We cannot teach the art of the problem solving and problem formulating without engaging ourselves in inquiry* - this is the message of some Bulgarian teachers who have developed classes of interesting mathematical problems that are new to the existing curriculum. With capable and motivated teachers (even if they are few at the beginning), supported by appropriate computer environments, it is possible to help students join and share the joy of the discovery.

BINOMIAL OF CREATIVITY IN IT CONTEXT

The principle of integration was leading in the Bulgarian educational experiment of introducing IT in a radically changed curriculum. It has been achieved not only by integrating informatics with other school subjects but also through co-cperation between teachers of different subjects. An interesting partnership was established between teachers in informatics on the one hand, and primary teachers, teachers of music, natural languages and fine arts, on the other. The idea of *learning-through-exploration* dominated the way we encouraged teachers to work with their pupils. The computer was presented as an environment providing a rich collection of tools to play with ideas not only in mathematical context, e.g.:

- in physics - modelling certain phenomena and processes and playing with the parameters involved;
- in music - formulating certain rules in order to let the computer *extract the order out of chaos* and by experimenting with tempo, rhythm and tonality;
- in languages - inventing patterns in different natural languages and then generating text with specific structure;
- in fine arts - visual modelling in order to analyse and then imitate work of avant-garde artists. Working in a team with the informatics teachers enabled teachers in languages, physics and art to feel comfortable in a computer environment and to enjoy performing explorations in the spirit of their subject.

CONCLUSION

Although good examples of teachers' creativity are not found in every school our endeavour is to spread their achievements through journals and conferences for teachers, and based on them to enrich the in-service and pre-service teacher training. If we hope for a real change in teacher education, we should bring today's and tomorrow's teachers in situations in which they would stop thinking about the future in terms of exams or teaching pupils. We should rather enable them experience what they are doing as *intellectually exciting and joyful in its own right.*

The original is presented in English

INTERNET-BASED INSERVICE TEACHER TRAINING IN MONTANA

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INTRODUCTION

In a global economy, expertise, information and capital are essential to the success of any business venture. Corporations lacking the necessary expertise and information at every level of their organization cannot compete. Nations lacking competitive corporations cannot grow economically. At the same time, meaningful public debate on the environment, natural resources, community and economic development, health care, and education cannot take place in an electorate incapable of understanding the issues. More than ever, nations need mathematically and scientifically literate and technologically competent citizens.

At the Thirteenth International Conference on Technology and Education held 17-20 March 1996 in New Orleans, Sir John Daniel of the Open University stated that the demand for higher education in the third world is growing so rapidly that creating a medium sized university every week would not meet the need. The demand for universal access to higher education is a global phenomenon. As a result, governments around the world are struggling to develop effective, scaleable, affordable alternative to conventional, high-cost educational delivery systems. Governments and the private sector are investing considerable time, energy, and money in the development of computer networks and New Information Technologies (NITs) as the basis for a new educational delivery system accessible to all citizens wherever they live.

This paper reports on two projects currently providing Internet-based teacher inservice training in the State of Montana, USA.

THE NATIONAL TEACHERS ENHANCEMENT NETWORK PROJECT (NTEN)

The Burns Telecommunications Center at Montana State University (MSU) (http://www.montana.edu/wwwxs/btc.html) is a laboratory for creating a more accessible and effective university for the 21st century. It seeks solutions to several of the critical challenges facing public higher education. These challenges include:

- Increasing public access to lifelong learning, especially for isolated individuals and communities.
- Enhancing teaching and learning.
- Keeping instruction affordable.
- Expanding partnerships between universities and public/private organizations.

The National Teachers Enhancement Network Project of the Burns Telecommunications Center offers graduate-credit science and mathematics courses to teachers nationally. Teachers are able to participate in the telecomputing courses from convenient home or work locations by dial-up modem connections or Internet access. The Network provides teachers with high qualify graduate science courses taught by university scientists, engineers, and mathematicians. It also enhances professional networking nationwide between science teachers and active research scientists.

The courses are developed by teams of scientists, high-school teachers, and science educators. The teams work closely to identify appropriate content and tested classroom activities for each course. Course topics are selected based on input from science teachers, identified needs from national surveys and reports, and current events taking place in science and technology. Courses are team-taught by the university faculty and an active science teacher.

The NTEN course Visualization and Communication Tools for Mathematics and Science Teaching (http://www.montana.edu/~wwwxs/netscape/mathvis.html) was developed by the author as a means for inservicing K-12 teachers on the use of graphics-based modeling and data analysis tools. The course syllabus includes the following topics:

- Measuring Global Sea Surface Temperatures Using NIH Image
- Measuring Mars: A Visit to Olympus Mons Using NIH Image
- Exploring Phytoplankton Pigment Concentrations Using NIH Image
- Review NASA's SIR-C Educational CD-ROM
- Explore Euclidean and Non-Euclidean Geometries
- Explore Euclidean Geometry with the Geometers Sketchpad
- Explore Hyperbolic Geometry with Non-Euclid.

Texts used in the course are:

Wolf, R.S. & Yaeger, L *Visualization of Natural Phenomena*. New York: Springer-Verlag, 1993.

Thomas, D. (Ed.) *Scientific Visualization in Mathematics and Science Teaching*. Charlottesville, VA: Association for the Advancement of Computing in Education, 1995.

Participants receive a box in the mail containing the course syllabus and texts, CD-ROMs, computer disks, and other materials. Class discussions occur in an electronic conferencing tool accessed via dial-up modem or the Internet. Assignments and other communications are handled via e-mail.

Sixty-one participants enrolled in this course during the summer of 1995. To assist with the resulting avalanche of e-mail and to facilitate the use of the electronic conferencing tool, three teachers who had previously taken the course served as assistant instructors. Their participation greatly enriched the scope of the discussions and resulted in a high degree of participant satisfaction.

This approach, combining extensive mailings with low bandwidth communications, represents one solution to a problem faced by many rural teachers, limited access to high bandwidth technologies. Of course, once teachers experience the use of a fast TCP/IP connection, they are eager to acquire it on a regular basis for both professional and personal use.

THE NETWORK MONTANA PROJECT

In October of 1995, the National Infrastructure for Education (NIE) program of the National Science Foundation (NSF) funded the Network Montana Project (RED-9554251) (http://www.math.montana.edu/dave/nmp/home.html). The partners in Network Montana include teachers, administrators, and researchers from the state's educational system, leaders in state government, and individuals from a variety of community, professional, and private sector organizations. Commitments of talent and resources from all partners are focused on the development of a lasting infrastructure capable of supporting the development of a variety of educational telecommunications services. The Network Montana Project will

- Build and maintain a state-wide coalition of partners from academia, government, and the private sector responsible for directing a wide variety of K-14 educational networking activities during the period of NSF/NIE funding and in subsequent projects;
- Support and enhance a number of nationally significant systemic mathematics and science education reform projects underway in Montana;
- Develop multimedia network-based materials and delivery systems integrating mathematics, science and technology to enhance access and usability of many scientific resources;
- investigate adaptations of educational and informational telecommunications required to serve populations with special needs including those that may be visually or hearing impaired; and
- Develop a workable, rural, community networking model that promotes teleliteracy for rural citizens to enhance their involvement with lifelong learning, entrepreneurship and local/state governance.

As Co-Director of the Network Montana Project for materials development and teacher training, the author and collaborating K-12 teachers are creating on-line materials that integrate mathematics, science, and technology in the context of contemporary scientific issues and problems. These materials demonstrate the use of a variety of graphics display and analysis tools, including NIH Image. Netscape Navigator acts as the interface to the classroom activities, scientific data sets, and other resources. As these materials are developed, distance learning courses will be created to train teachers in their use. These courses will be offered through the Burns Telecommunications Center to teachers around the world.

During the 1996 -1997 school year, a set of classroom activities on the theme Earth System Science has been developed. These materials will be published on the World Wide Web (WWW) in August or September. The following excerpt from the Storm Tracker Activity illustrates Network Montana's use of powerful WWW information and computational resources to motivate and support scientific investigations.

STORM TRACKER ACTIVITY

Objective

In this activity, students continue their study of the science of meteorology and extend their use of the image processing tool NIH Image.

Focus

Hurricane Andrew - Costliest Natural Disaster in US History.

Using NIH Image to Make Measurements

Start NIH Image. When the program has stopped loading, pull down the File menu and select Open. When the dialog box appears, double-click on the image aug24. Use the hand tool from the Tools Window to slide the image up until the hurricane is visible.

1. What geographic features do you recognize?
2. What land forms are obscured by clouds?

Select the magnifying glass from the Tools Window and click repeatedly on the image. Eventually, the small squares that comprise the image will become visible. Each of these picture elements, or pixels, represents some portion of the Earth's surface. Because the surface of the Earth is curved, not all pixels represent the same area on the ground. As a result, precise measurements based on such images involve complex mathematical and scientific factors beyond the scope of this lesson. On the other hand, reasonable estimates can be made using NIH Image and a few WWW information resources.

- First, decide what is you are going to measure, in this case the diameter of the hurricane.
- Second, obtain an estimate of the average pixel size along the measuring line. Select the line segment icon in the Tools Window and draw a segment between the tip of the Yucatan Peninsula and Washington, DC on the image.

How Far Is It? computes the shortest distance between any two points on the surface of the Earth, in this case the ends of your line segment. Using the Xerox PARC Map Viewer option, zoom in on the Yucatan to obtain the longitude and latitude of the southernmost end of the line, 21.75N 87.34W.

The same procedure yields the longitude and latitude of Washington, DC, 30.44N 82.02W.

When these coordinates are entered in the How Far is it? (see "Screen").

Screen:

From: 38:53:42N 77:02:12W
to: 21.75N 8734W (optional)

[Look it up] or [clear]

– the distance is obtained.

Distance between 38.88333N 77.0333W and 21.75000N 87.34000W, as the crow files:

1329 miles (2139 km)

Initial heading from 38.8833N 77.0333W to 21.75000N 87.34000W: south-southvest (2103 degrees)

Initial heading from 21.75000N 87.34000W to 38.8833N 77.0333W: north-northeast (25.1 degrees)

Returning to NIH Image, pull down the Analyze menu and select Set Scale. Enter the Known Distance of 1329 miles after selecting Miles as your Unit of length.

- Third, measure the diameter of the hurricane by drawing a segment of the desired length and location, pulling down the Analyze menu and selecting first Measure then Show Results.
- What is the diameter of the area affected by the hurricane, not just the central part of the storm?

1. Select the freehand icon in the Tools Window and circle the strongest part of the hurricane.
2. What is the perimeter of that part of the storm? The area?
3. How does this area compare to the area of the state in which you live?

Informal field trials with these and other Network Montana Project materials among both "normal" and "special needs" student populations have shown that students respond enthusiastically to the integration of mathematics, science, and technology in meaningful contexts using highly interactive graphics interfaces. As these and similar materials developed by other educators are packaged in courses for teachers and offered to learners of all ages, governments and private sector partners may come to see the value in creating and sustaining high bandwidth educational delivery systems.

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The original is presented in English

DEVELOPMENT OF "MULTIMEDIA" TEACHING AND LEARNING ENVIRONMENTS: AN ACADEMIC ADMINISTRATOR'S VIEW

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ABSTRACT

Application of multi-media teaching and learning materials in educational and training institutions - whether addressing primary-through-tertiary or whole-of-life continuing professional education - brings two main categories of problem: technical researching and pedagogic.

Major pedagogic issues include forming a dear understanding of how to harness the strengths and minimise the weaknesses of the new technologies, and how to enable a smooth transition by teacher and learner from traditional modes of knowledge and skill acquisition to ones invoking the "open and flexible learning" paradigms. Prime amongst the technical researching issues are the development of trained staff and the acquisition and maintenance of cost-effective environments for production and dissemination of material.

Although these issues may appear multi-dimensional, rapidly-changing and daunting to those confronting them anew, they are basically old problems in a new guise. In Strategic Analysis and Planning lie the solutions.

Strategic Analysis of the pedagogic objectives of the organisation, of the results of carefully conducted and confirmed experiments and of the verified costs, benefits and capabilities of the technologies to meet clearly-defined objectives, is the essential first step. Strategic Planning to facilitate the acquisition of the resources to meet the objectives identified and to monitor and control the implementation process so as to overcome the risk situations which will inevitably emerge, must then be invoked.

The move to multi-media, like the move to effectively adopt any new teaching and learning methodology, can only be successful if it is undertaken as part of a coherent long-term plan designed to provide solutions in a system-wide manner. Any other approach is simply not viable.

INTRODUCTION: AN ACADEMIC ADMINISTRATOR'S APPROACH

An economic rationalist approach to the application of new technology in education demands demonstrable excess of benefit over cost. The paper discusses some factors relevant to analysis and planning processes which seek to ensure this outcome for students, teachers and academic administrators. The recommended process takes a long-term perspective, commencing with Strategic Analysis of objectives and key success factors and moving to Strategic Planning for implementation.

STRATEGIC ANALYSIS

Strategic Analysis is based upon the conventional S-W-O-T evaluation: Strengths, Weaknesses, Opportunities and Threats. This analysis is a useful-precursor to any proposed new individual, organisational or national endeavour, for defining long-term Vision, Mission and Objectives, as well as the Criteria for measuring achievement of the Objectives.

Details of approaches to such analyses as they relate to Informatics application may be found in Montgomery (1994) and associated references.

Strategic analysis assists in identifying key success factors to be incorporated and key issues to be resolved in the design of a solution to reach the defined objectives.

The following sections canvass some key factors and issues that are important to the effective and efficient application of Informatics in Education in Australia today.

IDENTIFICATION OF ISSUES

Over the years there have been many attempts to implement both CML and CAI in Australian Universities. (See, for example, Bruhn et al., 1988). In these endeavours - some successful, many less so - several MAJOR groups of success factor and issue have been in evidence, and may be broadly categorised into those relating to Staff and Equipment Development, those relating to Pedagogical Factors and those having overall Economic Impact. Most of the previously identified factors are equally relevant to the inclusion of Multi-Media technologies in the delivery and support of teaching and learning.

Needless to say, these factors are inextricably inter-twined. Understanding which combinations of which factors lead to success will only emerge when coherent reports of carefully conducted studies are widely available.

STAFF DEVELOPMENT

I. The Current Academic Culture

Most Australian University staff regularly use overhead projection material in their presentations and provide, in advance, copies of their notes for student use in class, and they recognise the benefits to themselves and students from doing so. However, I believe, most would prefer to attend a room with a white board or a black board and write out all material "de novo" whilst presenting their lectures, rather than have the problems with learning about, using and overcoming the acquisition and operational problems with "high-technology" teaching & learning equipment and with a shift of their Teaching and Learning roles.

The success of Australian tertiary education in the past has largely been achieved by the individual efforts of a number of talented researchers and teachers. The move to Multi-Media, just as those to CML and CAI, requires (at least the following) several cultural shifts for the academic: from presenter (powerful/leadership role) to facilitator (subservient/mentor role), from individualist (technical specialist) to team player (one of many specialists), from flexible/responsive/independent person to constrained/structured/dependent person, and from curriculum designer to curriculum follower. It is very clear that many Australian academics don't like these shifts!

In the following some of these issues are amplified.

2. Skills Inventory

Academics ask themselves "Do I have the skills necessary to construct good quality CML, CAI, Multi-Media etc. lessons myself, or is a complete team of specialists required? Do I, as the subject area expert only, want to play second fiddle to all these other contributors? And if a whole team is required, how easy is it to obtain access to that team for my subject/course?"

In many Universities, this latter step involves long delays and considerable frustration in obtaining the budgetary allocation and in securing the production team.

3. Motivation

Do I actually WANT to put my lessons "in a can" and have them delivered automatically, or is presenting to students the activity I actually enjoy most, out of all my academic roles?

In the current academic environment, how can I justify to myself investment of time in the creation of computer-based material? If I am not to be rewarded for the extra effort in learning about and using these technologies, why should I bother?

Furthermore, it is not clear which combinations of which modes are definitely effective and efficient for staff and acceptable to students. And the relevant facilities are either not available or not adequately maintained for me to use without extra effort. I do not have the time and energy to be a pioneer in this area, and therefore will not do so.

If and when all these matters are resolved so as to make them painlessly unable by me, then perhaps I will. In the mean time, I will use my traditional methods.

4. Staff Training

Can I afford the time to be trained in this new technology and to use it? In most Australian educational institutions, teaching/academic staff members view themselves as being "over-worked and under-paid". Any request for them to undertake training or activities extra to their current burden is viewed as being vexatious and stressful. Requiring staff to gain Informatics skills, even though such skills might improve their working efficiency or effectiveness, is seen by some as a great imposition.

A first step out of this impasse is to provide every staff member with the technology which is to be mastered. Next, courses have to be provided to commence skill building towards the new technology. Such courses need to be available at times and places, and under conditions which encourage all relevant staff members to attend.

No matter which method is invoked, the process of changing the culture and the skills of all staff to address the new technologies will take MUCH longer and MUCH more effort by administrators than originally envisaged!

5. Equipment Availability

Next, what arrangements exist to make the use of the equipment by staff easy and trouble free? Does the staff member have to (a) specially book the use of the venue for a particular class (b) carry the equipment to the class room and (c) set it up ready for use, returning it to some central point when use is finished?

What arrangements are made to ensure that the equipment is fully operational when the staff member arrives to develop new material and when class are convened to use such equipment?

And is that equipment adequately configured - with sufficient processor power, disk space per user, security and privacy facilities, main memory, communication bandwidth etc. - to execute the software required, with reasonable response time and without extra effort by the staff member?

If these "hygiene" matters are not addressed, for both the teacher and the student, effective and efficient use of the technology may never eventuate.

ECONOMIC IMPACT

For the academic administrator economic impact is critically important. In this matter there is a fair degree of assistance available in the literature. (See Montgomery, 1989 et. seq.). Cost/benefit can be considered in three parts:

First, what capital and recurrent expenditures need to be made to support this technology? Next, and close-coupled, what are the costs and benefits of this Informatics technology compared with that used currently? Finally, having justified the acquisition of this equipment economically, from whence are the funds to purchase and to support the recurrent expenditure which attaches to it, to be found?

6. How Much?

Careful analysis and planning needs to be invoked to identify the **whole-of-life** costs of all direct and consequential costs which attach to Informatics use for Teaching and Learning.

7. Is the Informatics Option Cost-Effective?

Evaluation of the whole-of-life costs of an initiative is difficult. The process for accurately predicting the benefits is more so.

For any given mode of teaching and learning, the assessment of the relative costs and benefits of the proposed Informatics-supported mode and the traditional style is a complex matter. See for example, Montgomery (1989), Montgomery & Beck (1995) and Marshall et al (1994). Important conclusions from such work include:

"Keep increasing investment in Technology (both capital & human time) until the incremental cost of introducing innovation is the same as the TOTAL COST OF DELIVERY TO ALL STUDENTS FOR THE PERIOD OF THE COURSE, CURRENTLY".

This conclusion gives a strong incentive for the use of technology for learning support which can be shown to improve the success rate of students. And,

"The more the price of a technology is subject to future reduction, the more urgent it may be to invest immediately" (Eden &Ronen, 1993).

Whereas technologies such as CML are categorically cost-effective for delivery of drill & practice exercises, those such as CAI have such a wide range of cost, depending upon the intended outcomes and the development tools available, that accurate cost/benefit evaluation is extremely difficult. Again the cited references give insight into - some of the major factors which affect this issue.

Clearly, the estimation of the cost of production of Multi-Media material has further dimensions of uncertainty, but cost more per hour of courseware than the foregoing technologies at this time when the tools for development of such material remain expensive and difficult to use.

The cost of professional-like M-M course materials will rival that of full Television Production and require a complete professional team with a range of technical, directing and story writing skills which are not conventionally available in most teaching and learning organisations and most certainly, if available, not readily available to teaching staff.

PEDAGOGIC ISSUES

Which modes of delivery using which type of Informatics support are effective in motivating students to learn effectively or better? We don't know. To find answers to this question we at RMIT probably are conducting experiments that have been previously performed at many other places but we are either not aware of them or are not certain that their results are relevant to our situation: so we do them again. What follow is a number of activities conducted at RMIT which have been perceived to perform well, or badly. Unfortunately, these activities also have not been carried out in a sound experimental mariner and so only add to our store of anecdotal knowledge.

What is needed is a catalogue of carefully conducted experiments which can be used as a proper starting basis for planning by academic administrators.

8. Video Delivery of Laboratory Class Instruction

We do know that some very simple applications of Informatics in the class room are extremely cost-effective and efficient and well accepted by students.

For example, at RMIT in the Department of Communications and Electronic Engineering, a video camera is used to record - for the first group of students - advice on how to make effective use of the laboratories and how to conduct certain projects/experiments. For most practical, there is only one set of equipment which has to be used by up to twenty groups. Groups after the first simply view the video before commencing their work, thus freeing staff to provide individual advice, as required.

9. Learning at a Distance

In the Department of Computer Science experiments are being conducted at this time to ascertain satisfactory mode(s) of presentation for extensive, complex, leading-edge, technical material at a distance. At this point the options being considered include:

straight lecture, video-taped and replayed remotely later, either for individual viewing or in a group, with or without a moderator; and

conventional lecture viewed simultaneously by local and remote groups with interaction and instant feedback/response from the presenter available to both groups, the lecture being recorded on video disk and available for replay in the home or work place.

It should be noted that the audio technology we have is not yet adequate for this latter mode because of the difficulty of making audio input available to all participants and then balancing the reverberation times of the auditorium and the communication loop transit times.

10. Discovery Style Learning and the World Wide Web

Can a "Discovery" style of learning assist the acquisition of a complex knowledge base such as that required for understanding introductory Artificial Intelligence concepts, and can such learning be adequately supported using the standard capabilities of the World Wide Web?

An experiment is in train to develop a course to be made available on the World Wide Web which teaches basic AI through discovery learning.

A number of complex multi-part problems is being posed which require the application of several sets of concepts for their solution. The intention is that the core material will be made available on the Web, not specifically linked to the problems set. The students will "Surf the Web" to discover what concept units are available, read sufficient of them to ascertain their relevance and if so, study in more depth so as to apply those concepts to the problem. The core material is still being stored: no results will be available from these experiments until the end of first semester (July) 1997.

11. INEFFECTUAL DELIVERY MODES

Modes of use of Informatics for Teaching and Learning support which are viewed very unfavourably by students include those where whole (10-13 lectures of 50+ minutes) lecture courses have been recorded on video-tape and are replayed, in single lecture sessions, to groups of students, with or without a local content expert/lecturer moderating the replay. Negative reactions are still evoked when the local moderator includes occasional stops in the replay to have discussion. Particularly when the video is of a distant class interacting with a lecturer, our video-viewing-students found the process almost unbearable. Subsequently, the acceptability of the courses when — re-designed and presented by local staff - not as prestigious as the original taped personalities - rose markedly.

Also of note was that, in this latter mode, even though the original video tapes, traversing the same curriculum, were made available for individual viewing in a (reasonably) convenient manner through the library audio-video service, out of several classes of 20-30 students, only one or two students borrowed the tapes and viewed them, and then for only specific ones out of the whole set.

Poor as we know the learning effectiveness of lectures is, the culture attaching to attending lectures and hearing the interplay between fellow students and the lecturer appears to be much better accepted than most applications of Informatics which simply "can" the lecture and replay it. From my experience, only nearly professional (and therefore the most expensive) teaching and learning material of a video kind appears to be accepted as an alternative to most human presenters.

In recent times, there has been a rush amongst my most technology-literate colleagues to place details of the Department's courses and subjects to make them globally accessible over the World Wide Web. Initially included in this material were complete subject guides with details such as detailed behavioural objectives, daily lesson plans, book. lists, practical assignments and the like.

The initial flush of enthusiasm has now been tempered with the realisation that material, unless controlled, can be copied freely by Web Surfers and used so as to compete with the originator. We await the time when data can be exchanged and transactions of small monetary value can be conducted across the Web cost effectively and securely.

Each of the aspects of equipment development has a profound impact upon the whole-of-life costs and benefits of the application of Informatics in supporting Teaching and Learning. Important amongst these are specification, acquisition, installation, acceptance testing, operation, maintenance and de-commissioning. In the following some brief comments are offered for some of these aspects.

12. Acquisition

Deciding which particular versions of hardware and software to purchase for the staff and students in the department should only be undertaken following a strategic analysis of the long- to medium-term directions of the teaching and learning programs of the organization. Long term needs should receive higher priority than short term wants. Uses of technology which are likely to be ephemeral should be avoided. Deciding which technologies are here to stay and which to move on can only be achieved by careful technology analysis and prediction.

13. Whole-of-Life Costs

Coupled to the strategic evaluation must be a survey of the current and emerging technology which is or will become available to address the identified long-term needs. Whole-of-life cost/benefit or cost/value analyses need to be applied to evaluate the optional solutions to the defined and prioritised objectives.

Whole-of-life costs - which include at least those components listed in the introduction above - need to be used as the basis of decision-making, assuming a life-time of 3-4 years (Rettig, 1992). Plans for high technology equipment environments should assume that either physical or technological obsolescence will render equipment not usable - for reasons of either effectiveness or efficiency - after that period.

14. Infrastructural Costs

Installation and maintenance costs can be significantly higher in some countries, cities and buildings than in others. For example, are there fully-reliable power and telephone systems, or are stand-by power generators, power system filters or Uninterruptible Power Supplies required, as well as the normal power reticulation outlets and switchboards? Is a complete halogen flooding system essential for fire control because the building is prone to fire or inadequately serviced by fully-trained fire officers, or both of these?

Is the environmental control found in normal office space adequate to sustain the correct humidity and temperature when all the required equipment is operating in the middle of summer and winter, or is a special unit required? Is sufficient space allocated to house all of the systems support, operational and maintenance staff, as well as any environmentally sensitive storage media, if all of these are required to be proximate to the computer room? Is cabling of adequate bandwidth installed or installable in the building intended to house the equipment? Can a maintenance service offering the desired response time be obtained from a third party or must that capability be developed and provided in-house? If the latter is the case, has provision been made for the acquisition of appropriate maintenance staff, for their test equipment and technical tools, and for space to house these several resources?

15. Maintenance Costs

The cost of maintenance needs to be cognisant of issues such as disaster recovery; security and privacy, back-up, on-going systems staff training and the like, as well as the formal cost of provision of on-call or on-site maintenance which typically costs around 5 % of the capital cost of the hardware per annum, or up to 10 % in the case of specialist hardware or software. And in some countries, operator and maintenance staff, as with all other support staff have to be "home grown" from raw new graduates. Has the budget been cast so as to reflect these cost realities?

These equipment development issues are not trivial matters, but they are factors very frequently overlooked in the evaluation of the costs and benefits of the proposal to invoke Informatics in the educational program and if overlooked can be major causes of unsuccessful projects.

STRATEGIC PLANS

Strategic Plans relate, primarily, to major new initiatives or changes of direction which will be implemented in the long term.

Accompanying these plans, there need to be tactical (medium term) and operational (short term) plans. These latter are useful, if for no other reason, than to assist in ensuring the planner that simple and achievable steps can be taken which will lead in the desired long-term direction. As well as assisting the planner, such plans allow others to understand more of the implications of the strategic initiative.

Furthermore, if it be accepted that success will only come by a gradual build up of knowledge and physical resources and that these will require the acquisition and disbursement of considerable funds over a long period, then a series of medium term plans is essential. Progress should be made step-by-step through a documented sequence of risk-limited and carefully evaluated implementations or pilot-projects.

Only if each such project is successful, should the next step be taken towards the defined long-term objective. Note that this mode of implementation is at variance with the approach taken in many Educational Experiments which have been driven more by polemical and unsubstantiated conviction than by logically and careful controlled experiment and evaluation.

CONFERENCE OUTCOMES

One useful outcome for this conference would be to poll delegates to contribute project details to form part of a carefully referenced list of successful and unsuccessful experiments and ongoing applications of Informatics for Teaching and Learning. Included in this list would be some of the details such as those outlined in Appendix 1 to this paper together with economic data such as those in Montgomery, 1989. Further thought would need to be given to identifying the other parameters which need to be recorded to have a useable set of data to support decision-making.

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Disclaimer

The opinions expressed in this paper are mine alone and do not represent the official view of RMIT, or of any Australian Government or UNESCO agency, nor that of any other organisation of which I am a member or to which I refer.

APPENDIX I.I:

Staff, Equipment and Pedagogic Factors Relating to Four Delivery "Technologies"

STAFF DEVELOPMENT/ MOTIVATION	Human Teacher	CML	CAI	Multi-Media Courseware
Subject Specialist REQUIRED?	10 A Subject Specialist is Mandatory	As for Human	As for Human	As for Human
New Knowledge, Skills & Attitudes beyond those of subject specialist required by Academic staff members?	0 A teaching diploma is highly desirable	3 As for Human plus formal pedagogic skills essential	7 As for CML Plus "Film Production" type skills	10++ As for CAI + additional skills relating to MM production
Current Employment & Promotion Environment Motivates Staff to apply this technology effectively?	Yes, Promotion depends upon . being a subject specialist	Some Universities give recognition to excellent teaching	Small compared with effort required	Possibly, whilst use is seen as innovative?
Assists Staff Member to Further Research?	With Teaching Finished, Research can commence	Can support research by freeing time spent in assessment & providing remedial assistance to the most needy	Investment of Time to produce high-quality CAI Reduces Research Output (unless instruction relates to Education)	Time required to produce this material in acceptable quality with existing tools greatly hampers Research
Impact Upon Ideal 1 Mentor: 1 Student Relationship	Supports, if funded appropriately	Antithetic	As for CML	As for CAI
Motivational Environment	Familiar • Individual Expert • Presenter • Power Role • Responsive/Ad-Hoc • Independent • Curriculum Designer	Uncomfortable	More Uncomfortable	Yet More Uncomfortable
		•Team Contributor •Facilitator •Subservient Role •Planning/ Measured •Dependent • Curriculum Follower or Collaborator		
			As for CML ++	As for CAI ++

APPENDIX I.2:

Staff, Equipment and Pedagogic Factors Relating to Four Delivery "Technologies"

CURRICULUM DEVELOPMENT/ PEDAGOGIC STYLE	Human Teacher	CML	CAI	Multi-Media
Responsive to Interactive Ad-hoc questions from Students?	10	0	1?	2?
Patient in Explaining?	2-6	6+ Graded levels of detail, finally providing the correct responses if incorrectly answered	3+	4 +?with "Intelligent Tutor" – type technology
Can Flexibly Adopt Pedagogic Style to suit subject material and students?	10 Top-Down, Bottom-Up, Middle Out, Discovery etc. Depending Upon Material & Learning Style of Student	0 Mostly Bottom-Up/"Drill & Practice"	1 Top-Down & Bottom-Up are Common Modes. Simulation is available & and useful for dangerous etc. environments	Potentially 6-8 All foregoing modes available PLUS MIDDLE OUT Plus Discovery mode is more feasible than for CML or CAL

Provide rapid feedback to small but detailed questions for large numbers of student?	4	10	Not major objective of CAI.	Potentially high, if a CML-style component exists
Effective for Large Number of Students?	10, for small class size 0, class size large	6-10 depending upon acceptance by student	6-10 depending upon acceptance	8-10, if material is of high standard
Efficient for Large Number of Students?	0	10	6-10 if the equipment environment supports large numbers	6-10, as for CAI
Providing the benefit of Group Interaction and Problem-Solving	10 Can facilitate such activities	0	I?	5?? Future ?? Potential for Group-Ware & Group Interaction
Providing one-on-one tutorial support?	1 for large classes 10 for small	5 Having discovered struggling students, can target them for support	As for CML, if the material has an assessment component	As for CML, if the material has an assessment component
Access to Globally-Soured, Well-Structured and Up-to-Date Data, Information and Knowledge, at both broad and deep levels?	4-10	2 Not dynamic	4 Not dynamic	Potential is great. However, the current chaotic lack of structure is debilitating
Assessment criteria ensure that use of system is essential for student success?	Yes Essential	Yes Definitely	Yes As for CML	As for CML/ CAI

APPENDIX 1.3:

Staff, Equipment and Pedagogic Factors Relating to Four Delivery "Technologies"

EQUIPMENT DEVELOPMENT	Human Teacher	CML	CAI	Multi-Media
Equipment Required	Standards Black/White Boards + Overhead Projector	Standard + Monochrome Hardware + Software. Around $2000 per station extra	As for CML with more expensive Software and Colour Display Around $2500 per station extra	As for CML + cost of CD ROM or Video Disk Player + Internet Connect + Larger Processor Around $3500 per station extra
Infrastructure Required?	Standard	Standard + Reliable (or conditioned) Electrical Supply + Purpose-Built (Security/ Heating/ Lighting/ Ergonomics) Space	As for CML	As for CML + Reliable & High Bandwidth Connection to Internet + Dial-Up Facilities for Students & Staff at Home/Factory
Maintenance Expediture and Maintenance Staff Required	Standard	Standard + Reliable (or conditioned) Electrical Supply + Electronic Equipment & Software Maintenance + Housing for all relevant staff and equipment	AsforCML	As for CML but allowing for more complex Hardware & Software Environments
Skills in Obtaining Funds,	Standard	Significant New	Significant New	Significant New

Specifying, Acquirinq, Installinq, Operating and Maintaining Equipment, and Training Staff for Effective Use		Skills for Teachers or Additional Staff	Skills for Teachers or Additional Staff	Skills for Teachers or Additional Staff
Technology Stable & Capable of Long-Term Extension	Yes Subject experts will be required, if only to codify, categorise and catalogue knowledge, but also as curriculum definers, motivators & discussion leaders	Yes Applicability of this technology appears to be relevant in the very long term	Dynamic BUT definitely becoming more accessible	Very Dynamic, BUT the bandwidth bottleneck will DOMINATE for foreseeable future
Subject to Resource Bottlenecks when used intensively	Yes!	No Extremely Efficient if Operational Mode is Correctly Chosen	Yes Each person requires lengthy periods of use	As for CAI + network BOTTLENECKS are frequent AND INCREASING

APPENDIX 2:

Estimating Whole-of-Life Costs and Benefits

FACTOR	WHOLE-OF-LIFE COSTS	WHOLE-OF-LIFE BENEFITS
OVERALL COST-BENEFIT	See detailed cost models for each technology which generally give excellent guidance for the development and delivery cost components but all other cost factors MUST be identified and included	Details of Cost Reduction and Learning Improvement for Learners with differing preferred Learning Styles for each Teaching/ Learning Mode and for each Technology are not yet well evaluated, documented and verified
STAFF DEVELOPMENT	Staff Development is considerable for New Technologies. Such Development incudes, at least: •Technology Familiarisation •New Pedagogic Skills •Major Motivational Challenges, including those arising from role changes: Independent – Dependent Presenter - Facilitator; Flexible: Planned Unquestioned - Subject Expert - Team Collaborator Personal; Power Role: Subservient / Mentor Role; Curriculum Designer: Curriculum Follower	
CURRICULUM DEVELOPMENT	Still require Subject Expert but: •The Required Shift from Ad-Hoc/ Flexible definition to Planned/ Pre-Determined Curriculum is found very difficult by most tertiary academics •The best Teaching / Leaning style and Pedagogic design for different subject areas and student types are not well understood	
EQUIPMENT DEVELOPMENT	Employment of High Technology Equipment brings major additional costs and skills relating to: specification, acquisition, installation, acceptance test, operation, maintenance, housing, environmental control and de-commissioning •Failure to recognise problems in any one of these can be detrimental •Successfully Managing issues of equipment availability, performance, realistic levels of utilisation, restart & recovery, disaster recovery and the like, are ESSENTIAL to trouble-free application of the technology	
COURSEWARE DEVELOPMENT AND DELIVERY	Requires significant additional skills and capital (human and financial) to develop and deliver knowledgware	

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BUILDING A COMMUNITY OF LEARNERS: NEW TOOLS FOR COLLABORATIVE LEARNING

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INTRODUCTION

This presentation describes the results of a long term study on the experiences of teachers using a prototype network-based computer-supported collaborative learning (CSCL) environment as a tool to help create collaborative knowledge-building communities. The research, beginning in the Spring of 1993, focused on the exploration of the use of this new tool for collaborative learning in both middle school and higher education settings. The Knowledge-Building Communities project was a semester-long project, funded by the Texas Center for Educational Technology (TCET) and supported by Apple Computer, the project combined the exploratory use of classroom-based networked computers and telecommunications and a beta-test version of an educational groupware program called MacCSILE.

Intensive professional development and support was provided to both the participating teachers and college faculty during the Spring 1993 project utilizing a social constructivist approach to learning, teacher-to-teacher mentorship, technology support, and collegial collaboration on-line and in monthly meetings. Computer support was provided by Apple Computer for the development of the Collaborative Learning Laboratory in the College of Education and computer placements in some of the participating middle schools. The project team, directed by Dr. Paul Resta, included Mark Christal, Adrienne Kennedy Puthoff and Karen Ferneding Lenert.

The middle school component of the Spring 1993 field-based project brought five teachers with prior experience in CSCL — specifically the classroom use of MacCSILE (a beta-test version of an open-ended networked software package for collaborative work) — into a mentorship/peer-support relationship with four teachers from another district. The project goal was to explore the nature and impact of this collaborative collegial relationship, in the presence of new technology and the challenge of designing new opportunities for their students (both in curriculum design and instructional strategies) which incorporated the new technology and the social-constructivist view of the learning process which the software specifically engenders.

The results of this initial research and development effort were promising but the question of the longer term effects of the application of this new toot on teacher practice remained unanswered. A follow up study was designed to better understand the long term impact of the Knowledge-Building Communities project and the technology itself, on the participating teachers, their thinking about curriculum and instruction, and their report and reflections about their emerging classroom practices a full year after their participation in the pilot project. The study was specifically designed to capture the teachers' voices, to hear their stories, to identify the main themes among their reflections and understandings, and to surface the implications of this pilot model for the advancement of teacher change and technology-supported innovations into today's classroom practices.

One year after completion of the initial project, a follow-up study was conducted using in-depth interviews of the original nine teacher participants. Each teacher was interviewed by two members of the research team and a third member assisted in the coding and analysis of the interview data, and in cross-

checking their codes discussing the implications and emerging themes, developing the research findings.
The analysis of the interview transcripts revealed five major themes that emerged from the teacher experiences in the use of technology-based environment to support collaborative learning and also the social cultural contexts of schools, and school change. The following sections describe the CSCL tool used in the study, the results of the study and their implications and recommendations for policy and practice.

DESCRIPTION OF COLLABORATIVE LEARNING SOFTWARE

MacCSILE, a beta version of the CSILE software program was used as the primary collaborative learning tool in the study. Conceived in the mid-1980's, the original CSILE software was the work of cognitive scientists Scardamalia and Bereiter (1992,1993, 1994) at the Centre for Applied Cognitive Science, Ontario Institute for Studies in Education (OISE), Toronto. Canada. The heart of the system is a student-generated database that begins empty, but grows as students enter their text or graphical notes Students are encouraged to address all aspects of their learning process in these notes-their wonderments their questions, their theories, their knowledge goals, the knowledge gaps, their plans for pursuing their knowledge goals, their new learning-by having the choice of stamping each entry with a "thinking type" that describes the nature of a given entry. The MacCSILE 1.0 implementation employs the thinking types "Problem," "My Theory," "I Need to Know," "Plan," and "New Learning." Theoretically the use of the thinking types helps students make their covert knowledge construction activities more overt, as well as encouraging specific cognitive learning strategies such as questioning, identifying knowledge lacks and making plans for pursuing specific knowledge goals.

In the expanding CSILE/student-constructed database, students share with others both process (reporting questions, plans, and progress) and content of their work. (Scardamalia, 1992).

The version of CSILE software used in the TCET project:

1. Provides for the presentation of topics, questions, or themes by the teacher.
2. Opens the database to any participant logged into lhe system.
3. Safeguards each entry by author-password, to insure editing of any note, comment, or link solely by author.
4. Configures the database around "thinking types" (entry indexing, generated by the author, tags each entry as problem, i.e. the focus of the student's inquiry, theory or tentative hypothesis, information needs research plan, or acquired information/insight); and
5. Promotes collaboration among learners through access to the database for:

a. reading notes retrievable by author, topic or "thinking type", and

b. interaction using "between-entnes" features of commenting on an existing note or linking between any two existing notes.

By default, all notes in the MacCSILE knowledge base are public. Each note is stamped with the authors name and the class topic it addresses, Students "own" their notes and have the choice of editing them but they may not change others' notes. The system specifically provides for student collaboration by allowing students to compose notes that are comments to other notes or link two existing notes MacCSILE facilitates collaborative communication by notifyinq a student of all of the comments made to her notes when she logs onto the system or requests the "Comments to My Notes" list.

MacCSILE also provides search functions that help make the growing knowledge base a useful resource for learning. Students may search by author, topic, or thinking type. Some versions of the software permit keyword searches as well. Since, ideally, a single CSILE knowledge base will serve multiple grades and multiple subjects in a given school, using the search functions for topic or keyword has the potential of facilitating the transfer of knowledge across subject domains, another important cognitive learning skill.

Finally, MacCSILE employs hypermedia functions for two different knowledge building purposes. As notes become linked or commented upon, the system automatically attaches navigation buttons to the notes so that students may move between comments and the target notes of comments by clicking on the buttons. making it easy to follow sequences of collaborative communications. Students may also attach text labels to text or graphics notes which are hypermedia buttons that pop up other notes, permitting students to create elaborate hierarchical representations of their learning For example, clicking a "leaf label on the drawing of a tree may allow a user to "zoom" in to a detailed drawing of a leaf in another note that may have active labels of its own.

The recommended configuration for a CSILE classroom includes 8 computers networkecd to a file server that may support several classrooms with a communal database. In the schools involved in the TCET 1993 pilot study, the recommended ideal was only approximated, with 4 to 6 computers per classroom.

In addition to the classroom sets of networked computers and the CSILE software, the TCET project technology also included use of a university-based bulletin board using SoftArc FirstClass software This College of Education/Learning Technology Center technology contribution to project activities allowed participants to be electronically linked between campuses, to engage in spirited conversations on-line to swap stories, questions, concerns and schedules through e-mail and chat functions, and to develop an electronic arena of e-mail conferences designed specifically for the project. All participants were given both the client software and cursory training in the BBS uses.

In practice, however, for nearly half the teacher participants, teacher use of She BBS was frustrated by having no computers with phone lines readily available Nonetheless, once the technology became available. the bulletin board service to teachers and to then classes became a highly active arena for teacher-to-teacher as well as student-to student exchange

TEACHER INTERVIEWS

One full school year after the completion of the Spring 1993 TCET project, researchers returned to the participating teachers to interview them regarding ther experiences, perceptions and reflections on the project and the impact which their project involvement had on them as teachers, their conceptualization of their teaching role and their on-going teaching practices. After hundreds of hours of interviews, data analysis deliberations, literature searches and interpretations, a wealth of story and teacher voice has emerged from this project.

RESEARCH FINDINGS

This research yielded a core of five themes which emerged from the teachers reflections and responses. The themes included:

Theme 1.

The knowledge-building community changes teacher practice;

Theme 2.

Support acts as the framework of a diffusion process;

Theme 3.

Adoption of CSCL transforms social interaction;

Theme 4.

Understanding "resistance" and structural factors as barriers;

Theme 5.

Teachers' visions and the new professionalism.

The themes provide the touchstones by which we can unpack and deliberate the many complex and confounding aspects of technology and the human story of teachers, students and schools in the context of a collaborative knowledge-building learning community. What has evolved are understandings and recommendations regarding technology and schools, teacher development, curriculum and instruction, administration and policy issues.

THEME 1: THE KNOWLEDGE-BUILDING COMMUNITY CHANGES TEACHER PRACTICE

The teachers in the study articulated the ways that the provision of the new collaborative learning tools and support significantly changed their practices. The study indicated that in the presence of permission, encouragement and support, technology implementation can offer a novel arena for experimentation and learning exploration opportunities for teachers. In the otherwise highly conservative, low-risk mentality of most school settings, the unknowns and the pioneering spirit of such novel work as open-ended technology applications in classrooms, afford teachers a rare and invigorating risk-taking forum. This risk-taking forum, coupled with the current cultural status of technology, further legitimates the explorations and experimentations.

Specifically, in the CSCL project and its particularly open design for high teacher involvement, the mood of teachers' openness, inquiry and self-reflection embraced many levels of questioning and reflective practice — from the perfunctory placement, management, and other basic questions (schedules, topics, specific uses, and the like) to the deep structure questions at the very heart of education and schooling (individual and community values, utility, equity, learning goals, productivity, performance, mastery, student engagement, accountability, and the like).

Both in the general and in the specific case of the CSCL project, these aspects of exploration, risk-taking and reflection undergird the development of a true knowledge-building community in which the stultified or rigid, defensive or authoritarian posture of the institution of schooling gives way to honest inquiry, purposeful exploration, introspection, formative evaluation and on-going adjustments. Grappling with substantive questions and deliberating purposively within the frame of knowledge-building learning community, teachers themselves become candid, reflective teacher-researchers.

In contemporary discourse on public education and schools, such shifts are often central themes in the literature of school restructuring or professional development. Yet these are recognized as being changes which are hard-wrought within a typical top-down institutional model. Embedded in the reflections of the teachers in this technology project is the phenomenon that these markers of restructuring or professional development actually arose — "bottom up" in an institutional sense — from the teachers themselves in the course of their project involvement.

Emerging from the teachers articulated experience is a congruent and compelling picture that technology linked to pedagogy, broad-base support, open-ended explorations, and teacher reflection represents a powerful means of facilitating changes in instructional practice.

Table 1 provides a summary of the changes related to curricular and instructional practices cited by the teachers.

Table 1

The Knowledge-Building Community and Changes in Instruction, Curriculum, and the Role of the Teacher

Changes in Instruction	
Change From	**Change Toward**
Teacher-directed practices	Student-directed learning
Independent student work	Collaborative learning
One learning activity at a time	Many learning activities simultaneously
Changes in Curriculum	
Change From	**Change Toward**
Curriculum as plan for achieving predetermined learning outcomes	Curriculum as an environment designed to enable knowledge creation in a specified arena of discourse
Curriculum is subject or content based	Curriculum environment designed around themes, projects, or problem-solving
Curriculum designed by outside specialists	Curriculum designed through collaborative brainstorming between members of learning community (teachers and students)
Tendency for curriculum to remain fixed	Curriculum under constant revision, based on past experience
Changes in Teachers' Roles	
Change From	**Change Toward**
Teacher as subject-matter expert	Teacher as learning guide or coach
Teacher as curriculum consumer	Teacher as curriculum designer
Teacher as follower of curriculum	Teacher as director of curriculum

Although each informant expressed specific-experiences unique to the alteration of their individual instructional practices as they worked to transform their classrooms into knowledge-building communities, there were some common threads woven through each of the individual teacher's stories. In fact, the majority of the project teachers shared the following changes in their instructional practices: (1) student-directed learning, (2) collaborative learning, and (3) multiple, simultaneous learning activities. Each of these elements are examined in more detail in the following sections.

Student Directed Learning

Perhaps the most obvious change noted by our informants is the change from teacher-directed classroom practices to student-directed learning. The change has been expressed as one of degree rather than an absolute change. In fact, several teachers noted that there will always be a place for direct-teach methods such as lecture, recitation, and independent seatwork, because these are such efficient methods of exposing students to basic information. Some of the teachers reported having made dramatic changes in their teacher-directed/student-directed ratio. While other teachers did not speak of perceived changes in their instructional practice specifically in terms of the degree to which it was or was not "student-directed," they were clearly making some kind of a transition towards adopting increasingly student-centered approaches based on their statements about class organization, curriculum development and instructional procedures.

A Shift in Curriculum: From a Plan to a Learning Environment

A traditional view of curriculum depicts it as a plan for achieving predetermined learning outcomes. In a given course, students participate in learning activities which are guided by learning goals mandated for that course, usually in a specific sequence. By accomplishing the learning tasks for a few learning objectives every day, they build up sufficient knowledge and skills to satisfy the learning goals set by the curriculum. In contrast, within a knowledge-building community, the notion of curriculum shifts from a *plan* for achieving predetermined learning outcomes to that of a learning *environment* designed to enable knowledge-creation in a general area of interest.

Curriculum Designed Through Collaboration Between Members of the Learning Community

Traditionally, the source of curriculum is from outside specialists who attempt to design a curriculum that will fit educational requirements enunciated by authorities at state and federal levels. Such efforts are quite capable of addressing the top-level concerns for education, but are not likely to address the local conditions of a given knowledge-building community. The approach to curriculum we witnessed and teachers reported in the Knowledge-Building Communities project is one which embraces the notion of collaboration between all members of the community in the creation of curriculum. Not only are teachers interacting closely with colleagues in brainstorming effective curriculum ideas that will work well for their local community, but students are given as much responsibility as possible in designing and elaborating significant aspects their own curriculum. "Student choice" is a phrase that several teachers use to describe the curriculum they aspire towards.

Curriculum Under Constant Revision

Once developed, curriculum which derives from such traditional sources as textbooks and state curriculum guidelines tends to stay fixed. In stark contrast, we have seen how the curriculum of knowledge-building communities remains under constant revision, based on the ongoing experience unfolding in the classroom. The ongoing goals, of course, are constant improvement and relevance to students. Several of the teachers indicated how they felt it was necessary to constantly revise the curriculum as they saw the needs of students become more apparent. Teachers indicated that, typically, the curriculum needed to be altered in order to: (1) encourage more student collaboration and reflection, and (2) have it be more appropriate to *all* levels of student ability.

Fundamental Changes in Teachers' Roles

When teachers change their instructional practice and their relationship to the curriculum, they tend to also change their role in the classroom. The traditional role of the teacher may be characterized as that of a subject-matter expert whose responsibility it is to transfer a specific body of knowledge (the curriculum, usually defined as the material in a textbook) to the minds of students primarily through the method of lecture, demonstration, and drill; evaluate the success of the transfer of knowledge through questioning and tests; and provide remediation as needed. We have seen teachers in the Knowledge-Building Communities project depart from the traditional role in three ways. First, we have seen teachers depart from a direct teach approach, so that they use less lecture and demonstration and act more as a learning guide or coach for students who pursue their own knowledge goals. Second, we have seen teachers become less consumers of curriculum and become more involved designing curriculum that is more sensitive to student interest. Third, we have seen teachers becoming less followers of curriculum as they take on the role of directors of curriculum.

The Teacher as a Learning Guide or Coach

Given that becoming a self-directed learner is something that must be learned as well, being less "teacher-directed" generally means that the teacher changes to a facilitating role for the student, leading the student toward more competency in self-directed learning. Many students will initially lack the skill and motivation to pursue their own learning goals. For these students the teacher provides a scaffolding of support that is gradually withdrawn as students become more capable of pursuing their own learning goals. Students with better learning skills will require less teacher direction, but will still need guidance and coaching as the teacher attempts to guide them toward appropriate learning goals.

Several teachers noted that the CSILE networking software helped create a classroom environment that permitted both more student-directed learning and an opportunity for teachers to take facilitating roles. For example, one teacher explains, "We saw that if we had the curriculum designed properly and the kids had multiple jobs to do that would free us up to facilitate."

The Teacher as Curriculum Designer

The conception of the teacher which emerged out of the history of education in 20th century America diminished the role of designing curriculum. Teachers are generally expected to deliver the curriculum to the best of their abilities through instruction, and typically 75 % to 90 % of instructional time is structured around the textbook (Woodward, Elliott, & Nagel, 1988). To take creative liberty with the curriculum usually entails special dispensation from the school administration. Substantial revamping or creation of curricula often requires special permission from higher administrative authorities at the district or state level. For most of the teachers in the Knowledge-Building Communities project, explicit permission for creative curriculum control came from the district or school administrative level, or both. Given that the CSILE program comes without any content and no explicif curriculum design, teachers would need to grapple with important curriculum decisions in any case. To their credit, the teachers in the project responded to this new duty in a positive way as a new professional challenge.

For the teachers in the project, curriculum design, as it is particularly required by CSILE, was a new experience, but one they undertook with interest and enthusiasm. Two curriculum elements emerged as important challenges for several of the project teachers. First of all, despite the fact that the teachers were given permission to depart from the official curriculum, many of them felt if important to include as much of it as possible in their CSILE curriculum designs. Secondly, the teachers realized the importance of making their curriculum as engaging for their students as possible.

Teachers noted the changes in their roles and views of the curriculum as a result of the project experience. For example, one teacher characterized his curriculum concerns prior to CSILE as one of "just trying to follow the district and the state essential elements." Another teacher indicated that prior to the project she "followed the State of Texas TEA Essential Elements*, the guidelines that were printed by the state...". She related that without the CSILE experience, she would not have spent very much time rewriting the curriculum. However, both of these teachers talk at length about how they spent a great deal of time designing curriculum for CSILE that would be true to the student-directed, collaborative pedagogy of the software, yet also would satisfy most of the same curriculum as outlined by the state and district mandates.

The Teacher as Curriculum Director

Traditionally, the curriculum has functioned much like a script to be followed by the teacher. State adopted textbooks supplement their content with teacher guidelines that give detailed recommendations on precisely how to teach the course content. If the traditional teacher role is one of a "sage on the stage," then the curriculum is the "behind-the-scenes" director. This arrangement tends to relegate students to the all-too-passive role of audience.

In a knowledge-building community, the roles of curriculum, teacher, and student all shift. As we have seen, teachers become the designers of the curriculum. In the implementation of that curriculum, they perform more the role of a director than simply a follower of the curriculum. They set the stage for learning, assure that the appropriate elements and materials are present, and direct their students in their active role as learners.

The teacher's position as director of the curriculum is also true in the sense expressed by one teacher's remark about being like a "traffic cop at Picadilly Circus." The knowledge-building community curriculum is much less like a script to be followed and more like an environment to be navigated. This is highly related to the change in instructional practice that the teachers described as they began taking on more the role of a learning guide or coach.

Implications of Theme 1

The teacher experiences related to Theme 1 indicate the ways the knowledge-building community requires changes in teachers instructional practice, their relationship to the curriculum, and the roles teachers play in the classroom. In order to support intentional learning, departure from what is commonly understood to be classroom practice is substantial. No longer are students strictly focused on the teacher who has the responsibility of delivering a curriculum handed down from above. The whole learning community has considerable latitude in defining the curriculum and appropriate instructional activities which further the community's pursuit of knowledge. The profound changes in instruction and curriculum also transform the social interactions among the members of the learning community. In particular, teachers, who, in the past, had isolated themselves within their classrooms and explored only their assigned subject areas, learned to interact more with their colleagues in the knowledge-building communities and expand their curriculum content. Students also experienced their relationships with learning and fellow students as being transformed in substantial ways. For instance, students gain much more of their learning through peer interactions, while they become more aware of their own processes in the construction of knowledge.

THEME 2: SUPPORT ACTS AS THE FRAMEWORK OF A DIFFUSION PROCESS

The teachers interview data provide insights into their perceptions of how introducing technology alters social interactions among colleagues involved in a specific project; how such an innovation effects the overall school culture; and how the use of CSILE (and social-constructivist instructional practices) alters the social interaction among students within the classroom. The alteration of social interaction among the teachers generally illustrated what may be called "power shifts," resulting in interactions reported to be characterized by a "why them and not me" attitude. Yet, the reported changes in social interaction were complex. For example, in one school the introduction of technology fostered a "why them not me" perspective among certain teachers as well as providing a forum through which teachers could share technical expertise and instructional uses of technology. Changes within the classroom reported by informants indicated a broad range of positive and negative social interactions. Some children who were not active participants in traditional classroom settings became enlivened with the introduction of CSILE. Others seemed to exhibit some form of "resistance" or rejection of the technology and/or a collaborative approach to learning.

According to informants, CSILE acted as a motivating force, and in combination with self-directed learning, seemed to engage students to the extent that discipline problems were greatly reduced. Yet it is interesting how some informants perceived technology, including CSILE, simply as "bells and whistles," while others focused on CSILE's power to facilitate student collaboration and social interaction as the cause of increased motivation. This mix of specific perceptions about CSILE illustrates how teachers hold various perceptions and assumptions about the importance of instructional technology in general. The mixed attitudes of how technology (and CSILE) acts as a motivating factor, and the particular changes CSILE engendered in social interaction among colleagues, indicate that teachers construct particular attitudes and social discourses about technology and education. As expressed by some of the informants, these attitudes and discourses often feature specific allusions to descriptors such as "fear" or "resistance."

THEME 3: ADOPTION OF CSCD TRANSFORMS SOCIAL INTERACTION

The interview protocols provide useful insights into the informants' perceptions about certain barriers to the realization of a knowledge-building learning community. Analysis of these perceptions revealed how the notion of support covered a broad area of needs arising from the process of change. The special nature and circumstances of the diffusion of CSILE into these schools circumstances - specifically as a collaborative research project with many levels of support – offered teachers the unusual

* *Texas has a set of learning outcomes required for the core curriculum in all public schools, called the Essential Elements. Many school districts require that teachers document their coverage of those state requirements. Mastery of the Essential Elements is assessed with a statewide achievement test, TAAS or the Texas Assessment of Academic Skills, which students must pass in order to receive their high school diploma. The Essential Elements is currently being rewritten for all subjects, and will be called TEKS, Texas Essential Knowledge and Skills.*

experience to reflect upon actual and potential barriers arising from political, economic and social spheres. Their responses indicated the complexity of the diffusion and adoption processes, and that the diffusion process is largely framed by policy. For example, a thread that weaves throughout the interview data pertains to the differences in needs and perceptions between the two districts in the study, indicating that social-economic and cultural factors permeate and strongly influence the diffusion process.

The informants' responses clearly indicate that diffusion of innovation in an educational setting must address the context, the social/cultural environment in which a knowledge-building learning community evolves. In terms of the ecology framework of diffusion, the social aspects of change (diffusion) on a macro level is engendered through policy. Whereas the social aspect of change on a micro level is realized though collegiality (adoption). Yet the adoption process itself is made even more complex by another variable related to the social context — "resistance."

To contemplate the notion of adoption is to conjure the opposite process — "resistance." The three interrelated elements — adoption, "resistance" and collegiality —function under the umbrella of the diffusion framework and together create the contextual and social dynamic of change. Given this, a bottom-up model of diffusion, as featured in this project, requires us to revisit typical assumptions about "resistance" and how it configures the adoption process.

THEME 4: UNDERSTANDING "RESISTANCE" AND STRUCTURAL FACTORS AS BARRIERS

The data analysis indicated that the adoption of CSILE is both enriched and made complicated by the purposeful design of the technology itself. Because CSILE acts to shape or scaffold changes in teachers' attitudes and behaviors, it was evident that CSILE exits not only as a tool, but as a social process, since both pedagogically and procedurally CSILE engenders changes in social interaction. This is evidenced by changes cited by the informants in several realms such as their teaching practices, beliefs in learning theory, and alteration of social interaction amongst colleagues as well as within their classroom settings.

Analysis of the informants' experiences also showed how perceptions about the construct of "resistance" can affect teachers' adoption behaviors, as can their perceptions about the traditional uses of technology in education. The typical understanding of "resistance" as a private, individual experience characterized as fear or phobia of technology may add to or in fact act to rationalize the divisiveness between those teachers who are "pro-technology" and those who seem to be "resisters." Some teachers are in fact "resisting" the use of computers in education because they fear or feel mistrust towards computer technology in general. The issue we must consider is that their concerns may be justified on some level given the problematic history of technology diffusion in education. In addition, when an innovation is introduced, due to existing structural forces, teachers are positioned to make "situationally constrained choices" (Cuban, 1993) — a factor which directly affects the adoption process. Other important issues raised by informants were related to the possible danger of using technology as an end in itself and the influence of equitable distribution of hardware within a school, in terms of how this affects collegiality.

Despite the fact that most informants experienced some "resistance" from their colleagues to the diffusion of CSILE and other computer-based technologies, the informants' collective vision clearly indicates the perception that the diffusion of electronic technology into education is "inevitable." This perspective was strongly expressed by informants from one of the two participating districts which, at the time of this study, was formulating plans to install a district-wide telecommunications infrastructure.

THEME 5: TEACHERS' VISION AND THE NEW PROFESSIONALISM

The Knowledge-Building Community model of instruction is so well supported by technologies such as CSILE that some of the informants could not envision such a learning environment without the use of CSILE. In addition, many of the teachers expressed how CSILE, because it embodies a social-constructivist theory of learning, also has the capacity to change the teaching practices and learning experiences of those who are exposed to it.

In fact, for many of the informants CSILE offered support whereby their teaching practices moved towards the direction of collaborative, intentional learning.

At the school level, learning technologies such as CSILE can make social-constructivist based instructional practices more feasible to implement into practice by the nature of their design. For example, by using learning technologies that support intentional learning, teachers find that their teaching practice changes to accommodate such learning. In effect, a technology such as CSILE is purposefully designed to embody social-constructivist learning theory. When used in a classroom setting it can act as the scaffolding whereby teachers move from a traditional teacher-directed instructional style to one which embraces collaboration, generative, intentional learning and an interdisciplinary curriculum.

Even if teachers do not use CSILE, as the informants suggest, exposure to it can invite reflective thinking on common sense assumptions about teaching and learning. However, we are not advocating that the mere presence of technology in the schools, guarantees adoption of social constructivist-based instructional practices. If schools adopt learning technologies whose design is based on the instructional theories which emerged out of the industrial age (i.e. behaviorist inspired), then information age instructional practices based on collaboration and communication are not likely to come about. In effect, schools need to consider the relationship between the qualifies of a technological innovation and the desired changes in instructional practice.

Many of the teachers' understandings about what type of learning technology was suitable for supporting their CSILE-inspired vision of instruction not only included CSILE. In fact CSILE was but one component of a mix of technologies that expressed their emergingvisions and concepts about instruction. Three specific technological components in particular were offered by some of the teachers, in terms of the requirements for technology-supported classrooms: a networked configuration of computers, telecommunications, and expanded access to various sources of information. These three components are so highly interconnected, that it is often difficult to speak of them separately, so we have grouped them all under the general term, "connectivity."

Networked classroom computers running CSILE provide a public space for knowledge-building within and between classes at a given school. The knowledge-building community, however, becomes widened when other schools and outside experts interact via telecommunications. Telecommunications, especially Internet resources, also bring into the classroom a vast repository of information that students may use in their knowledge-building research along with non-networked information resources such as CD-ROMs and traditional information resources. The connectivity with teachers both within and between schools enhanced their own sense of professionalism and greatly reduced the sense of professional isolation typically encountered by teachers who spend the greatest portion of the day in their classrooms isolated from their professional colleagues.

Connectivity is a powerful means through which the barriers of space and time collapse. It enables students to engage in knowledge-building activities, and allows teachers to enhance collegial interaction through collaboration with each other, outside experts, school administrators, parents, and support personnel in their role as professional educators. Connectivity offers not only the possibility for new methods of instruction, but it offers a new level of professionalism for educators as well. Previous learning technologies, such as Computer Aided Instruction and Integrated Learning Systems, are based on older models of instruction, and, according to some researchers (Apple, 1993), had the effect of deskilling the teacher. These technologies, some of which were described as "teacher proof," acted to undermine the need for teachers to make essential curriculum decisions. Learning technologies based on information age connectivity, when associated with social constructivist theory of instruction, however, place the teacher at the center of educational decision making, requiring her to work closely with colleagues in the design and implementation of curriculum and assessment.

Connectivity also has the potential to facilitate collegial interaction by providing forums for the collaboration process. Teachers between schools can augment their face-to-face planning with telecommunications, as well as utilize educational resources available on the Internet. However, connectivity also brings with it a new set of teacher and administrative concerns, as it demands changes in more than just classroom instructional practice — it most likely will require changes in the very structure and culture of education itself.

Making the kinds of changes in the structure and culture of education that will allow knowledge-building communities to become commonplace is an immense challenge which we have only begun to address in our study. If we decouple the notion of connectivity from the technological hardware, then what is left are social technologies (conventions and practices) that bring people together in effective ways to address educational aims. At the classroom level, collaborative learning, with or without computer support, brings students together with other students, guest experts, teachers, and information in the service of knowledge building. In the sphere of collegiality, collaborative curriculum development brings teachers together with teachers and educational consultants to devise a curriculum suitable for a knowledge-building community. At the level of policy, there are approaches to institutional decision making that embrace the input from all the members of the school community in collaborative deliberation.

OVERVIEW OF CONCERNS AND ISSUES EMERGING FROM THE RESEARCH

In a computer-supported knowledge building community framework, new "collaboration-friendly" technologies (groupware, networked databases with collaborative writing and commenting functions, e-mail, etc.) provide a robust social-cultural forum for teachers, students, and other partners in a learning community. Based on what the teachers shared in their interviews, technology diffusion activities work synergistically and effectively in two important dimensions: 1) in introducing teachers to technology and 2) in engaging their interest and commitment to change.

To be successful in fostering a sustainable technology-rich school culture and learning environment, technology diffusion must include the following key components:

- networked (preferably classroom-based) computers, telecommunications, and configurable open-ended software including such features as an empty database with structural or organizing options, procedural prompts, and multiple search options;
- a generative pedagogy based on sound learning theory and the cognitive sciences, which is open to individual teacher interpretation and experience levels;
- open-ended exploratory curriculum applications designed by the classroom teachers themselves;
- active teacher development, including reflective teacher practice, collegial exchange and interaction;
- administrative support and policy which allows inquiry, risk-taking, collaboration and shared decision-making;
- project design and seamless research activities based on advocacy and action research which likewise promote authentic engagement and ownership of teachers and students.

The Human Dimension

Teachers in supportive settings explore and appropriate open-ended technologies as an extension of their understanding of themselves as educators; their understanding of curriculum design and their sense of personal, direct design involvement; and their understanding of instructional practices, both traditional and familiar, as well as those new to them.

In supportive settings, experienced teachers come to open-ended technology opportunities in much the same manner that they might examine a new textbook series, compile ideas from an instructional workshop, or conceive of designing modifications to existing assessment practices. One teacher may work initially out of his/her sense of teacher as an content guru or as a process innovator. Another may work from the posture of an adventurer or risk-taker. Still another may come to the experience as a meticulous planner monitoring or imposing high structure on each fragile detail of a careful beginning.

From an overarching bird's eye view of a teacher's initial or primary relationship with technology, we have observed that, while some teachers aggressively embrace technology from an innovative sense of design and implementation and as a direct part of a larger teaching mandate, others approach technology with a staid or minimalist sense of using technology as a subtle substitution of some learning activity already" existing in his/her traditional teaching practice.

Indeed what we witnessed repeatedly — with the open-ended and supportive/exploratory nature of this project — was a remarkable continuity between the technology approach of each teacher in the study and who they were and/or how they understood and conducted their teaching roles prior to the technology. In each case, the initial uses as well as the subsequent assessment issues which emerged over time had the unmistakable fingerprints of the individual participating teacher. Each appropriation of the computers by either the more technology-experienced or the more technology-novice teachers was clearly reflective of the particular teaching style; each application was stylistically each teacher's own.

The important distinction here is that the applications which teachers made of the technology were related more strongly to who they were, how they saw themselves as teachers, how they understood their teaching roles, and how their existing practices could be incrementally stretched, guided or expanded by the technology than to their technological sophistication, practice or familiarity or their technology interest or advocacy. The significance of this finding to the design and implementation of the collaborative learning tools is evident in the teachers' own stories.

As was documented in the original TCET project and confirmed in the follow-up interview study, project openness and the openness or malleability of the technologies can provide participants a window to view the nature of adoption from a wide range of teacher backgrounds and teaching styles. In studying these phenomena, the authenticity of the teacher responses — both to the appropriation of the technology itself and to the interview questions — confirmed the openness of the project, as well as the openness and malleability of the technology.

In the study we additionally confirmed that teachers develop new practices, usually linked to successful past practices, as they incrementally come to understand and integrate a new pedagogy and the innovative aspects of technology. While this may seem obvious and commonsense, the nuances of this position have significant implications for the technologies we choose in technology diffusion plans or the manner in which pedagogical shifts, or changes in curriculum and instruction, are brought to teachers. This too will be further discussed below.

In meeting the technology challenges and in implementing their own classroom explorations, teachers are validated and strengthened in two important, mutually supportive dynamics:

1) their sense of ownership of the technology and

2) their direct action in shaping their curriculum and instruction to optimize the available technology.

This validation of the person of the teacher is the pivotal point in developing and supporting teachers in an arena of professionalism and personal efficacy. When each teacher personally works to interpret and filter a technology for his/her own classroom practices, the technology itself becomes *not* an externally-grafted requirement or expectation, but an individual professional decision and a design question integral to curriculum and instruction issues. In our study we repeatedly found teachers who — with the added challenge of technology integration — were actively asserting themselves and engaged in curriculum and instruction in wholly new or rekindled ways that they had rarely experienced or that earlier might have been unimaginable.

Notwithstanding the added job complexities and time-consuming adjustments to technology implementations, many teachers in the project displayed high involvement, enthusiasm and increased interaction with colleagues and other project participants as a direct result of needing to work through the unknowns and the challenges. Under an open-ended exploratory model of technology diffusion and the built-in interest and capabilities for collaboration, the technology itself becomes a powerful social, intellectual and pedagogical artifact in scaffolding teachers' own learning and in sparking necessary changes for teachers, as well as students. When the threat is low (an encouraging learning-community environment) and the potential reward high (seeking to fulfill a professional goal or create an innovative curriculum milestone), teachers engage in reflective practice and seek out collegial connections and collaboration as part of pursuing and incrementally working out their own on-going professional development in technology applications to their classroom practices.

SUMMARY

This study has shown that the introduction of CSCL environments like CSILE has the potential to alter both the structure of classroom discourse and the school community. Yet the opportunity to capitalize on the benefits of connectivity may not be fully realized if their adoption only serves to support elements of the existing system and the traditional organization of schools. Therefore, the process of adoption itself needs to be seriously addressed, especially in terms of the role of teachers and the underlying pedagogical assumptions of the technology.

We have discovered that teachers' resistance to technological innovations may be discounted and/or misunderstood. Historically, teachers have been excluded from the decision-making processes within schools, especially in the case of top-down reform campaigns based on technology infusion. Also, the current structure of schools creates for teachers a "culture of individualism." However a formal approach to school decision-making based on teacher collaboration would challenge and potentially reverse the tradition of teacher isolation.

Although there are several models which guide the organizational changes of schools, many have been adopted from the field of business administration and therefore do not address the importance of building community specifically within school settings. However, the approach to curriculum adoption developed by Schwab (1993) is unique in that it addresses the decision-making process itself. Schwab's approach characterizes the adoption process as collaborative decision making and emphasizes the central role of the teacher. His approach is examined more closely in the following section. Schwab's deliberative approach to decision-making outlined in his four papers on "the practical," offers a community effort of deliberation shared by students, parents, the school principal, community members, social scientists and professional academics and especially teachers. In fact, the role of the teacher is central to the decision making process. Noting that "teachers practice an art," Schwab (1993), believes that the process of active involvement in deliberative decision-making "constitutes the only language in which knowledge adequate to an art can arise" (pg. 245).

Unlike typical models of diffusion and adoption created from business and industry's guiding principles and goals, Schwab's model pertains to the specific needs and goals of educators and schools. His framework encompasses all of the "commonplaces" of education: students, teachers, subject matter and social-cultural milieu. His approach would therefore address the contextuality of technology adoption, including the influence of political concerns: The framework, however, is designed so that each of these commonplaces bears equal weight. Each commonplace is examined in its full range of complexity, as the framework utilizes an "eclectic" approach to deliberation of concerns and issues, inviting a variety of contending perspectives, viewpoints and theories. Thus, the concerns of those who question or resist the infusion of electronic technologies into schools would be given a safe forum for discussion.

Schwab's framework applied to technology adoption would characterize it as an ongoing process. Technology adoption and its integration into curriculum would be seen as a trial and error process of discovery characterized by flexibility and open-endedness (versus blame and "failure"). In effect, Schwab's approach could act to "scaffold" a "convivial" (Illich, 1973) approach to the realization of CSCL environments. A "convivial" approach fully recognizes both the benefits and limitations of a technological application/innovation. This balanced (and less naive) understanding about a particular technology becomes anchored through the process of deliberation and discussion. The resultant guidelines and stated values become integrated into adopted policies which guide the instructional aims and applications for an educational technology. In effect, the outcome is a reflective model of technology adoption and diffusion. This reflective aspect is imperative as our technologies become more powerful and complex.

RECOMMENDATIONS

The five themes which emerged from the data analysis indicate how a CSILE based CSCL environment can scaffold the transformation of teachers' instructional practices and ultimately change the structure of classroom discourse. If was also discovered that the introduction of CSILE caused "power shifts" and transformed social interaction within the school community as well as in the classroom. These shifts in social interactions are dependent upon support from the realm of policy (fiscal, leadership and teacher development) as well as the school community. We also found that the technology of CSILE as a "philosophical framework" not only aided teachers in transforming their instructional practice but also influenced a re-envisioning of their professional roles; especially when they considered the general "inevitability" of the diffusion of networked telecommunications systems into education. This is very powerful.

The interaction of the three major components (school community, the technology, and the realm of policy) underscore the breadth of contextuality and complexity which characterize the conceptualization and realization of a CSCL knowledge-building community. The networked systems scenarios outlined by Morrison and Goldberg (1996) indicate that *our values and normative understandings about schools* tacitly, if not overtly, guide the application of a technology. Thus support, in its may forms, acts as a framework for adoption. *This factor becomes especially important if the technological innovation, as with networked systems technologies, possesses the power to alter our relationship to time and space and ultimately change social interactions (i.e. discourse structure and "power shifts").* It may be that the traditional models of diffusion, and the assumptions which guide them, need to be abandoned or augmented by an approach which questions a dominate cultural bias, which is to approach technology as a solution to social problems uncritically (Segal, 1996) and apolitically (Winner, 1980).

Based on the findings presented in the data analysis and the summary sections of this paper, we make the following recommendations:

- Technology "adoption aimed at creating a CSCL environment guided by social constructivist pedagogy needs a structure which *invites* the concerns of those typically excluded from participation in traditional, top-down models of infusion. We strongly recommend that educators review the work of educational researchers who have developed models of *community-based approaches to reform* which support collaborative decision making. No matter what approach to decision making a school employs, a *deliberative approach is central* to the success of collaborative efforts, as it gives equal weight to the commonplaces of schools and invites a wide range of perspectives, including those which counter the status quo. Although Schwab's approach, for example, focuses specifically on curriculum development it could also be applied as a framework to the practice of technology adoption on the level of school communities, as well as diffusion, which includes the realm of policy (building level and state administration, and to some extent, federal influences).
- Commitments from the micro (School Community) and macro (Policy) levels are required to support the necessary changes to make CSCL knowledge-building communities a sustainable reality. Such changes may include alterations in school culture by means of shifts in power structures including the discourse structure of the classroom, the professional responsibilities of teachers, and the general hierarchical power structure of schools.
- Changes in the discourse structure of the classroom requires teachers to become actively engaged in students' lives. In order to support teachers' efforts to become effective and compassionate advocates of students from diverse populations, the training of teachers in methods germane to CSCL knowledge-building communities also needs to address multiculturalism.
- Teachers must have time for reflective practices, especially as they adopt roles as curriculum developers and engage in an iterative process of curriculum and instructional development. Teacher collegiality and collaboration amongst teachers must be encouraged and supported in a climate of professional status and respect.
- Educators involved in the adoption of educational computing technologies need to be more mindful of the underlying assumptions which relegate certain student populations to only a few specific instructional technologies (i.e., low SES or "at risk" students' needs best served by drill and practice instructional software). These underlying assumptions may in effect serve to create inequities regarding student access to more empowering tools of educational computing (i.e. CSCL, telecommunications, multimedia).
- CSCL approaches to education implies new skills for practicing teachers and administrators that in the past have not been a part of the typical training programs. Colleges of education and teacher education programs should reexamine their programs in light of these new skills. For example, experience in team building and negotiation become necessary and fundamental skills to engage successfully in CSCL knowledge-building communities.
- Given that innovations such as CSCL face significant challenges in overcoming the common sense notions of schooling, a key element in effective support is the need to educate not just the immediate school community (administrators, teachers, parents, and students), but the community-at-large, about the pedagogy, educational philosophy, and educational research behind the knowledge-building community approach and the technology that supports it. The public already expects to see computers in the schools, but this expectation must be cultivated toward greater understanding and awareness of the collaborative and knowledge-building applications of not only computers, but network system technologies.

The original is presented in English

REPORT

Yves Brunsvick

HONORARY PRESIDENT OF INTERNATIONAL BUREAU OF EDUCATION
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Quick development of technologies has brought about such upheaval in conditions and practices of education, which was difficult foresee and which has brought about deep changes to the educational system.

The cybernetic space constitutes a parallel and constantly expanding world, which resembles a sensor world and will be occupied in the nearest future by millions of operators and will present to youths, students, men and women wide volumes of numerical information. What is more this infinity of virtual worlds must be accessible, unless for everyone, but, at least, for majority of people.

«Mathematization» of reality, being manifested itself with speeding up of its development, poses a lot of problems confront of our society, weather concerned about the inevitable confusion between reality and «virtuality», about manipulations and deviations, caused by it, or about probabilities of inequality of possibilities, which it will intensify.

Can this be imagined that corps of teachers would ignore a shock being triggered by promoting of digital technique and discovering of virtual spaces mastered by man?

The digital technique promotion and availability of data compression are the general phenomena at the end of century. This is the basis of «globalization» of intellectual, industrial and trade exchanges.

The consequences of this process are out of norms and measures of control, intended to TV and telecommunication; they create a whole scale of interactive programs, integrating a word, an image and a sound together, in one unit.

What influence on educational systems can be and would be from the side of the consequences of so-called cultural shock in cognitive process, in management of school programs, in estimation of their efficiency?

What would be the educational potentials of Internet type networks?

Trying to ignore the new information technologies would mean to remove a part of young people from the formalized training and to enable the degradation of secondary education.

Unless the purpose of each training stage is the effectuating of cognitive methods through better strategy of training? First of all, the case in point is assisting the teachers to absorb the new knowledge along with their professional career, to teach better and in different way. From this point of view they should, most likely, to learn, first of all, to convert the information into knowledge, making this in the world, in which people shall be separated only by cultural frontiers. To a greater extent than earlier, they should elaborate pupils' analytical properties, critical approach; they should be care of pupils' development of taste, of their due quality estimation, that means criteria, which are hard to survive in mathematized, non-sensored world.

In new pedagogy some principles of programmed training will take up their place: information is divided into elementary blocks, each person is educated in its own rate; intentions of developer must be clear and comprehensible, distinguished from the commentary and recommendations.

In appearing new process of getting the knowledges must find a place active methods, in particular, access to databases for getting the bibliographic references or necessary information; such access will soon become part of the normal mechanism of getting the knowledges in school and university training.

Teachers' corps ought to become implicated into emanating shock, to be the participants and (why not) the actors of changes, which are to be controlled.

Exactly on the share of teachers – and in the first place – will fall out responsibility for the conservation by the school of its place in the society; exactly they will come to keep a check on that information society become a society of knowledge for everyone, where teachers and instructors will find their worthy position.

It is in school the initial contacts of person with the others take place. Nobody denies that it is the best factor of social unity. Unless in school teaching time the necessary realizing of common values set, being of our cultural property, the erosion of which will promote a world without frontiers, surrounding us?

Unless a school should be remained as a place, in which all children of school age teach on equal, using educating facility, provided by new information technologies; a place, where the teachers and instructors can develop and create their own CD-ROM?

The similar pedagogic approach can ensure a motivation and prestigious value of work, show new behavior modes, which assume the new role of instructors and, undoubtedly, its willingness to work, in frequent occasions, in one team, in a framework of renewed profession.

Away from this, it is a cause for a content of users' background of multimedia products of unequal quality and, in frequent occasions, of controversial.

One can envision that the lack of interest and learning motivation, which distresses the teachers and instructors nowadays, will be lowered noticeably.

The teachers are in a center of problems which are the result of changes in our society: they can be confined by following to those changes, can slow down them, can control over them.

At the European countries meeting, organized at the end of April 1996 in Warsaw on the initiative of the International Bureau of Education for preparing the International conference on educational problems, the topic of which should be role of teachers in changing world, there were accepted the following recommendations relating to new technologies:

- it is imperative that the educational system would master these technologies for to avoid any technological, cultural and economic dependency, as well as any marginal transformation of school with respect to the external world;

- the positive influence of NTIC on organization of teachers' and pupils' work, the access to information, the satisfaction of individual demands, the development of cooperation, the opening of the world through the creation of networks;
- the condition of their successful using is not only technical approach, but increasing of pedagogical potential by cooperation between organizations for software development, granting an access to ICT over timetables, ensuring accessibility and integrating in network;
- intercomplementability with respect to other approaches, as at a rate of class and pedagogical activity, in the field of unceasing preparing the teachers (way of remote formation);
- the unique function of teacher, implying that the information is to be converted in knowledge, that the mastering of choice and critical estimation is to be brought up and, on the other hand, that the cultural traditions are to be transmitted as «a way of existence of human being», to install personal and social relations, promote a development of personal and social contacts, living in the community and realizing of common values;
- the necessity to develop researches and mutual use of information on influence, role and limits of using ICT in education;
- the necessity to stimulate the cooperation between institutions at the national and international level, to encourage the comparative studies;
- the necessity to take care of recent investigations for strategies of ICT application in education (European Union) and results of 2-nd UNESCO Congress «Education and Informatics» (Moscow, July 1996).

To master to learn, to master the new technologies of work, to master being oriented in hypertext, to reveal for oneself the unlimited possibilities of cybernetic space, to discover for oneself the resplendence of data bases, learn to apply them, and all this in order to convert school radically and provide a road - according to remark of Pierre-Jilles de Gennes - to «such education, which opens for youth not previously created world, but that, which would be created».

If a man do not want to be a toy of future, may he constitute it by himself?

The original is presented in French

Part IV

Theme 3

TECHNOLOGIES

Plenary

WHAT TECHNOLOGIES ARE USED IN EDUCATION? NEW EDUCATIONAL TECHNOLOGIES IN THE DEVELOPMENT PERIOD

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1. IRRETRIEVABLE CHANGES

Many of us can appreciate the technological progress in the field of education comparing former pedagogical methods with the methods, which are now widely used in the countries having appropriate industrial structures. The following funny stories can serve as a good illustration of the situation.

French schoolchildren of the 'baby boom' period while at school get to know much better the 'music' of the multiplication table than the music of the national hymn. Music helps to recall the words which are forgotten, but not many people could claim without any doubt, that the multiplication table by 12 may be a useful knowledge which must be stored (1 multiply by 12, 12 multiply by 12: how many adults could easily give the answer and at what age?). The use of calculators in everyday life and in examinations has freed us from mental gymnastics, doubtless partly useless, and the simple way in which we can get the answer within ten decimal points only corresponds to the difficulty with which pupils can evaluate the answer and check up its plausibility. At the first congress of UNESCO on informatics and education J. Weizembaum spoke about the following experiment. The schoolchildren were offered a simple problem: how many buses are needed to carry 256 passengers provided that each bus has 50 seats. The pupils were quick to give the 'correct' answer (5.12 buses). Needless to say that the correct answer is 6. All teachers doing research work know how helpful were the means of machine schedules when teaching mathematical functions. Many teachers are also aware of the difficulties with which more advanced students evaluate the order of the value of mathematical or physical result; the initial figures are set precisely, it is enough to make an input mistake (to leave out naught for example) to get the answer by 10 times less or greater, but the evaluation of the answer in the physical sense is not made. Can we contemplate the progress if the rules of calculation are passed to calculating devices and computers, if the progress in the exactitude of the answers is paid off by the regress in the evaluation of the calculated phenomenon?

In Jule Ferri's school it was considered good form to learn by heart the list of the prefectures and superprefectures of the ninety three French departments. Who would encourage such «mental gymnastics» these days, if it is enough to use the terminal of the Internet to get the list of these departments, the complete data about economy and geography of the departments, especially as all the information will be supplemented with photographs which could not be found in any historic data of any file of any scholar, *and not a single professor would be able to restore them from memory?*

But who can be sure nowadays, that our students know how to get access to the information they need through the Internet in a shorter period of time than the teacher who knows nothing about the methods used in XIX century to find in his personal library the book which contains the synthesis of data on the search; this is not a favorable comparison for our Internet users. Can we be sure that within the World Wide Web local geographical data may be easily found using thousands of references, which are caused by a simple demand in the process of search. These two examples, and any teacher can add his/her own examples generate a few questions which will be in the form of the theme under discussion.

The question can be set: what is the use of the in-depth knowledge of information and computers? If one takes into account that at the present moment informatics is the pivot of economic activities, then it is necessary for every student, for every pupil at secondary school should get basic knowledge on the subject. But would if not be a mistake to believe, that the knowledge «about something» (what is the computer, what is its architecture, what are its functions) can give knowledge of information and its use? The person working with gas-mines has to learn about gas-mines, the mechanic has to learn about gas-mines, the mechanic has to learn mechanisms, the physicist has to learn physical laws; but the electrician does not have to master Maxwell's equations, and gas-main worker does not have to learn hydrodynamics. At the first stages of the introduction of computers into education the computer was regarded as the object for learning. No doubt, it is important for the professional in the field of informatics, but is it necessary for the user to learn the computer's architecture to solve his problems?

The Industry of information, its transformation and transfer leads to the increase in the number of new professions. Such increase is accompanied by the change of the paradigm of informatics as a discipline: the problem is not to connect the terminal to the computer to ensure processing, the problem is set to establish connections between people and institutes to divide the information. Consequently, businesses pass from the information processing to the communication informatics: this will be the main purpose of the theme "information superchannels" for our system and our education methods.

Parallel to this technical changes the unprecedented social and economic changes are taking place The distance in space between places of work, people's homes and educational institutions results in the fact that the borders between them are not so clearly defined: people get education at their place of work or at home, the working time is increasingly devoted for the search for information, which is one of the main components of education and the means of acquiring knowledge. Do the information and communication systems which are used at educational institutions meet the demands caused by the above changes? Can education remain concern of only one country or nation when global computer networks come into being?

Doubtless, the issue is in the focus of our debates. Nowadays the acquisition of knowledge is not necessarily limited by the period beginning when people are young and finishing when they become young adults: school and the first years at university provide people with education, but this period of education does not come to a close when one begins an active life. Everyone has to renew, to enlarge and to change several times in a lifetime his/her knowledge and skills because of the developing technologies and constant changes in social and economic fields. It should be mentioned that the mastering of new information technologies would be faster if the process of education was conducted in accordance with the requirements stipulated by the sector headed by J. P. Arnaud, an economist. The application of informatics in education was realized faster in the sector of continuous education, especially in the field of informatics, than in the sector of primary and university education.

Actually, the use of new technologies in education can be described using three characteristic features of education if we understands it as we are used to understand. These characteristics are really the rules of the classic French theater:

- The unity of place: both teachers and students come to the educational center (school, university, center of continuous education, enterprise);
- The unity of time: at the appointed time (very seldom it is everybody's choice) students assemble in the classroom;
- The unity of action: they do it to listen to the teacher or to do excersises or to take part in a test.

New technologies make it unnecessary to meet this main set of requirements, comprising the three ones mentioned above. That is why this technologies make the education more open in the sense of receiving information for professional needs. But in this case the same number of problems, as compared with those already solved, arise:

- Is it possible to get such education as easily that is to obtain information for individual learning?
- What is the role of the teacher in such a situation when his presence seems to be unnecessary, even more so, because the student does not know how to get in touch with him in terms of time and space; who will define the contents of learning: the student or teacher?
- How does the student becomes part of the system, can he be sure that he will get an adequate education? Is it better to teach the student to use the technologies before he masters them? Sometimes discussions of the professionals in the field of education seem only to be part of similar discussions which have been held on these problems for some time in industry.

In both cases what is necessary is to find the way which will enable users to master engineering technologies. Thus, within the framework of the subject under discussion it would be interesting to consider the progress which has been made in the application of informatics to economics, which as it is believed, the most advanced students of our educational institutions study at present. This issue will be considered in the next paragraph.

2. FROM THE INFORMATICS OF DESIGNERS TO THE INFORMATICS OF USERS

2.1. Technological changes

Recently we have witnessed rapid technological changes; however, the fact that informatics was remarkably stable during the first 20-year period of its history, escapes one's memory. At that time the aim was to provide professionals in informatics with the means for data processing, supplying them with terminals which ensured access to processing devices (computers). Equipment was being improved in various ways (the increase of computers' efficiency), the application of equipment using monitors and keyboards instead of peripheral equipment using punched cards, the development of devices with operative memory, etc.). These changes allowed not only to make progress in technology, but to meet the most urgent demands in terms of memory and processing.

By the late 80s the tendency became obvious which was entirely different from that mentioned above: the installation and application of large networks, the development of communication architectures provide users with new models to organize information system, that is the first time when the paradigm is changed, that is not data, but the information is placed at the center of the information system. In this case the role of informatics changes: it becomes not only the means of 'information work, but means of acquiring management skills. Nevertheless, it is not the user's working tool. Taking this into account, at the first congress «Informatics and education» several speakers (see, for instance, the speech of P. Douge the clearly defined the borders between the «limited» and the «total" (sweeping) approach. To put it in a simplifying language and with reserves one can say that the main problem at the moment is the following: mus» everybody - students and teachers - learn programming and computer architecture irresponsible of the subject studied? This way of formulating the question which is well justified when it is in line with debates in industry and economics, has resulted in the increase in the number of all kinds of institutes. These institutes aimed at dissemination of information science («science informatique»), the mastering of which was regarded as a necessary condition to maintain full employment In this connection France can present a significant example: The World Informatics Center was set up; lycées and colleges were equipped with computers not taking into account the fact whether they are in keeping with the production used in industry; it was not taken into consideration because the purpose was not to teach how to use the means of information processing, which graduated students will then use in businesses and industries - their future places of work. The aim was to provide education in informatics, which itself was regarded as science and technology.

The 90s came to destroy this scheme. Two events caused an enormous impact in the world of information: the wide use of microcomputers as a means of access to information, and the mass use of networks with various architecture.

In the early 80s, when there appeared the first models of microcomputers, professionals in informatics were skeptical. From the user's point of view the computer was (now) the means of learning and the means to avoid influence of information management. Microinformatics technologies are the simplified technologies of traditional informatics; in fact, the personal computer has a limited power, a limited operative memory and peripheral memory devices. But by the late 80s this scheme undergoes changes, especially when the conception of the interface «man-machine» came into existence as well as new graphic devices as a result of research work, particularly, that carried out by the firm Xerox. Since then the trend in innovations has sharply changed in direction and microinformatics has become a separate independent area. As the new industry (the companies Apple, Intel, Microsoft) was growing more powerful, the existing poles of industrial development were shifted in the direction of the unprecedental growth, of the computer park at the users' disposal.

The computer which was first used as a personal means, was then increasingly used as the most preferable means of access to information.

This change was accompanied by profound changes in the technological area. When the personal computer was first introduced it was supposed that it would be absolutely the best as compared with other means of data processing: complexes of calculating devices, text-processors, archive devices, printing devices, which were designed as peripheral devices. The computer used as a mean of access to the information system is connected with the network and enables to gain access to any source of information and processing device irrespective to their location: with the user or at a distance. We have passed from the age of microinformatics to the age of networks.

In the time when the increase in the park of computer means actually becomes exponential, the introduction of local networks drastically changes the manner in which they are used The client\server architecture is being developed, and at the present the microcomputer enables to separate processing and data and to ensure the access to complicated peripheral devices in addition to personal peripheral devices (printing devices, memory).

Realized in such a way technological changes lead to the conception of the architecture of the groups of organizations which are geographically remote and functional organizations, businesses and institutes as a diagram, mostly a three-level one, which includes working stations, local servers and central servers. Such reorganization led at the turn of the 90s to considerable changes in the conception of information systems. This can serve as an example counterbalance the advance in the application of technologies in the educational system.

2.2. The reorganization of educational technologies

Quite early professional working in the field of education turned their attention to the possibilities which the technological changes listed above, give for the professional activities. Therefore, first of all the use of informatics in the field of information technologies has two different trends:

1. Education in the field of information technologies is regarded as a technological store of knowledge mainly for engineers but also as a mark of general education. The project «Informatics for everyone» («Informatique pour Tous») proclaimed in France in 1986, is significant in the view of the ambitions which a typical of some government in this age. Doubtless, the advantage of this approach is the wide-scale acquaintance of students and all educational community with microinformatics. It goes without saying, that providing education with this purpose in mind it was expected, that the software students were supplied with, should be nearly the same as that used at places of work. Great success was achieved in this field. Nevertheless, it should be mentioned that a recent examination, carried out in approximately a hundred computer classes 10 years later showed that the number of classes connected with the network is insufficient. The situation can partly be explained by the problems which emerged, according to the maintenance stuff, they can be divided in the following way: the management of hard disks, software support, virus problems; hardware maintenance, general support. It is no surprise that under the circumstances the mounting local networks in computer classes was given problems,

2. Informatics as a teaching tool; in the case informatics is regarded as a pedagogical tool in the same way as microinformatics was defined first and foremost as a personal means, and the use of technologies in teaching was mainly focused on individual training; the purpose of such tutoring was to provide information means to get access to information. Numerous programs were introduced for the purpose which helped to realize this conception also in developing software for education or improvement from school to university levels. This software has the names «Computer Education» («Enseignement Assisstée par Ordinateur» - EAO), «Courseware». This software is much more economical as compared with traditional methods of education and it enables to realize new applications while carrying out experiments (for instance, using modeling), and also to solve particular pedagogical problems without difficulties (these programs are more neutral than the teacher, the computer never gets tired and nervous and gives answers to questions, which are mostly asked repeatedly, in a calm manner, it ensures objective self-evaluation, etc.). However, the situation was the same as while teaching informatics (as well mentioned in 1): the means which were developed in the second half of 80s highlighted real technical difficulties connected with the introduction of informatics into education: the problems concerning the support of EAO software and its improvement; the compatibility of software and hardware; technical equipment for students, etc. The analysis of a set of

these problems helps one to arrive at the conclusion that the following approach is vital to integrate educational stations into the networks and to load educational materials into computers which makes it possible to change programs more easily and to better manage computer used by students. Parallel to the technological changes which take place when the client/server approach is used and the integration of networks into information systems, the questions arise connected with the organization of which in educational institutions. When discussing this problems one should take into account organizational and sociological changes which influence knowledge is passed to the general public which increasingly becomes the «client» of the educational system. In fact, if institutions providing general education, particularly primary and secondary, can ensure the variety in teaching and learning within one day, the educational centre seems to «disintegrate» more and more because of number of reasons:

- the transmission time to large industrial enterprises is becoming longer, thus increasing the time for institution, so some students refuse to continue learning;
- as there is the growing specialization in their departments universities make borders between them less rigid and increasingly call upon the teaching stuff and the centres where professionals work to cooperate;
- the period of learning is not limited by a short period, it lasts as long as one's career; it is more and more difficult to get education; the borders between the time for education and the time for work are becoming less clear;
- the economic situation makes businesses to increasingly participate in education; it is all the more necessary because the business itself take part in solving the education problems and in research, especially in technological areas;
- finally, education process is increasingly taking place in businesses or at one's place of work. In this conception the following survey presents interest, which was carried out by Ashridge Strategie Management Centre in 1993. It showed that the authorities at enterprises are involved in the education problems in 52 % of examined enterprises, the proportion being changed from 67% to 87% at multinational or private businesses. As the borders of educational institutions become less clear marked it is necessary that information and communication technologies should be coordinated in the form they are used in pedagogics, on the one hand, with new organizational and geographical structures of the education system and, on the other hand, with new users consisting of students and a new contingent.
- students who get education at home;
- students who get education at their places of work.

In conclusion, it is worth knowing that learning informatics and new communication technologies can be very useful for students if the technologies they are provided with are nearly the same as those they use in their jobs. In other words, new education technologies should be guided by technologies used by professionals and, consequently, to use communication networks and the client/server architecture to a greater extent. The experience gained by The National School of Arts and Crafts (le Conservatior National des Arts et Métiers - CNAM) can illustrate the afore said.

2.3. The example: The National School of Arts and Crafts

A special institute in the system of education in France, The National School of Arts and Crafts. Suggested that the students who had professional skills and often both worked in their particular area and studied, should do a course of studies to get a degree in engineering or economics or a degree of one of CNAM's institutes. By the decree worked out by Abbe Gregoir in 1794 under the name of the National School of Arts and Crafts there was founded the «park of machines, models, instruments, descriptions and books in all fields of arts and crafts», besides the institute was set up for people who had a teachers; the motto of the institute «Docet omnes» (it teachers all) symbolizes inspiration. 200 years later the CNAM found it necessary to set up a network of 53 joint centres which encompasses the whole country and provides learning through pedagogical management by qualified instructors; the process of teaching staff of each educational centre.

The growing audience which was the result of the increasing number of hearers, resulted in more clearly defined boundaries of the regions in which the territory was divided, the branch centres were founded for teleeducation; they made it possible to become closer to students' homes or their places of work. If in the middle of the diagram one placed educational centres and a detailed description of the courses thus the three-level structure could be created which could not but resemble the structure of the information system, considered above. This structure resembles the structures adopted by other similar institutions, such as the Open University or by some American educational institutions. What else should be done to transform the abstract technical structure into the real one? Two points should be emphasized:

- The distribution of pedagogical resources between the joint centres: the Internet is well adaptable to extension. In our opinion the extension of the network gives new opportunities to reduce the number of communication failures between the objects connected with the network.
- The choice should be made of the right industrial type to avoid making the same mistakes, receiving technical and educational reclamations as a result of such mistakes and to ensure long-term operation.

Finally, the pedagogics which uses new trends cannot disregard new opportunities offered by multimedia and networks, these approaches form industrial policy under the name «Information Highways».

3. NEW TECHNOLOGIES AND MODERN EDUCATION

3.1. The Internet phenomenon

Nowadays informatics can be separated neither from communication networks which ensure its effective support nor from multimedia which play an ever increasing role in devices providing the dialogue with the user (man-machine interface mode). The educational institution is not a business: students are not on the staff, they cannot be offered their own network; as a rule software and hardware available are different types.

The timely generalization of network technologies and their introduction which is more widely known as the Internet, is the source of a considerably advance in the introduction of new communication technologies in education. People in charge for new educational technologies notice, in particular, the following aspects:

• Superuniversal technologies which ensure great independence from suppliers and the opportunity to contact the systems in other offices, as well as the systems of various partners (administrations, businesses, etc.).

• Low costs of software for clients; it is important if one takes into account the number of working stations that should be provided with it and that the growing number of students will have access to the network from their homes.

• The system is open for functional expansion. The Internet, and especially WWW, are now being expanded by the software developers as user's basic variant, which can have supplements (devices of serial reading for video and audio devices, joint processing, animation, audioconferences, etc.) it will enable to make the standard interface regardless of the choice of suppliers.

• Should one believe that the Internet ought to replace something in any other network when choosing the communication structure for learning?

Far from that, especially if one realizes that networks, which ensure access for villages worldwide, are expensive and the quality of service they provide is variable; it depends on the country and even on the region where these networks are distributed. Approximately 34 % of American centres have at their disposal home computers; 70 % have access to the Internet or are serviced through telephone lines, but in France there is only 1 % of such users; it shows how different are the situation which are compared. Therefore, the preliminary analysis is necessary that aims to define what is available (technical means, network, people) depending on the type of the institution under consideration, its place in the system of education, its real pedagogic orientation. Looking at the example concerning the CNAM project mentioned earlier, we should single out the educational institutions and centres in Paris, which were connected through the Antenne to educational television. The data in the chart are the result of the brief examination. The chart shows the type of the network which is available for the user and the type of the user depending on the purpose.

Name of network	Teacher	Student	Engineer	Researcher	Service staff	Network type
Paris	Yes	Yes	Yes	Yes	Yes	Local network, Internet
CRA	Yes	Yes	Sometimes	Sometimes	Sometimes	Local network, Internet, RNIS, RTC
Antenne	Sometimes	Yes	No	No	No	Local network, RTC

The analysis will help to specify the technical means needed by each side and the type of communication with future partners. One should not neglect the cost of conjunctions and hesitate when choosing simple technologies because of an imperative need: telephone networks with the switchboard is an interesting choice if the objects which are to be connected cannot use expensive conjunctions and have no stuff for technical maintenance (it refers to the network Antenne in particular). The work done cannot be regarded complete without making the industrial choice which will enable to, fix standards and so to make it possible to pass from the conception stage to putting the model into practice. Such normative definition is necessary because of the following reasons:

• *Training provided for teachers.*

There is one key point. If not-a single teacher sought to get advice before he/she starts work, then the situation would be far from satisfactory in the transition period to the conception of education through electronic means: "computer literacy" still remains a privilege of some section of the teaching staff, and teachers of informatics are not always in the vanguard. The lack of any normative definition of the nature of support ensured makes any efficient training for teachers impossible. It results in the lack of experience, it makes impossible to see how efficient new methods of learning are and, what is doubtless more important, the teacher comes to depend on new technologies.

The main and invariable purpose of the technical support in this direction should be to ensure the teacher's independence - he should be free as much as possible from such concerns and realize what he can expect of technical means and in what way he can rely on professional assistance.

• *Training provided for students.*

The introduction of technical means should not entail extremely hard and special efforts on the part of learners. In a greater degree than the Internet itself the introduction of software for clients, which is widely used for the WWW users, is the source of hope: it is continuously and widely used in learning devices both in the Internet and in the Intranet; it enables to normalize the man-machine interface and to bring down the prices charged for training in particular technologies.

• *Succession in operation and maintenance of the systems.*

The industrial approach enables to economize and to ensure the application of specialized complexes of certain technologies in educational institutions. We can examine for instance one of the chosen variants, which was realized in practice when the whole territory was divided into regions using the CNAM project, and the centres chosen according to this project. One should notice the fact that the multimedia server is available in this case, its use presupposes in its turn the industrial choice of the means to develop and to receive image and sound as well as the normative choice of the means to put data in memory devices.

3.2. Advanced technological multimedia or the tool to develop pedagogical production

According to Gartner's group (le Gartner Group) studies in 1995 from the view point of multimedia developers, education is not the best field for the application of multimedia

- However, the question what is the multimedia remains the most difficult for professionals. Let us remind in short that the problem is how to use digital technologies to store and to transfer images, sounds and data. In what way can it influence learning and teaching? It is clear that the ability to store the set of videodata is the main advantage of multimedia because teaching can be conducted using gestures (middle-course technical training), there are teaching situations in which the manner of behavior is important (learning languages) or imparting knowledge based to a great extent on one's experience (study of commercial situations).
- When trying to define the configuration of multimedia working stations for education one faces the same difficulties as with information working stations mentioned earlier. Thus, since the late 80s it has become possible to develop independent working stations supplied with peripheral devices to read videoclips; they enable to read videosequences synchronized with the information of the given type, which makes it possible to transfer information on the subject taught and to test students' knowledge.
- The experiment carried out by the National Federation of Educational Equipment (la Federation Nationale de l'Equipement Electrique) in France gave a chance to see how good this approach was for training technical staff to mount control systems for ships. The experiences gained in such a way using the Dornomedia system shows that the pedagogical approach using multimedia should also involve the solution of organizational problems, including:
- rules of using software and hardware for the given pedagogical approach;
- the way to distribute devices for videodisks, the rules to get the license and the author's rights;
- to get an agreement of professionals to ensure training on the use of hardware and software;
- to make the park of information support uniform and to evaluate how suitable the local devices in use and their information infrastructure are;
- to provide tutors and to analyze the results of the students' progress.

It would be a mistake to believe that the replacement of videodisks by CD-ROM, and in the future by DVD, will change anything as regards the given problems. The types of information carriers can affect the cost of the information support but they will not help to solve the problems which must be solved, and the total cost depends largely on the adopted organization than on the types of information carriers.

The transformation of animation into digital form should lead, if for instance, one believes what G. Thery writes, to the reduction in. the production costs of animation; this reduction may amount to 200,000 - 1 min. Francs at present to 5,000 - 10,000 Francs in the near future. Nevertheless, even this cost remains exorbitant for education. Besides, it is not taken into account that the most essential problem is to develop a conception; it ensues that the total cost of production using CD-ROM, in which animation is only a small part, is between 500,000 and several million francs. At the present moment not a single educational institution can pay such a money and ensure the introduction of quality digital devices for the whole set of software. But after all these discourse the question can be asked whether they are really indispensible. Before one pursues the policy of costly education programs, one might consider another approach, which views the prospect of using multimedia in education in the future at another angle; this view takes into account the contribution of the teacher into the teaching process, the fact that most peripheral devices operating independently become soon antique is realized more clearly; this results in the need to coordinate the courses of study with the advanced in technical devices and economic situation. If one looks at the situation in which CD-ROM is a means of the information system, one can see that this approach should not influence the quality of material, which is a pedagogical support, in any way. The technical maintenance will develop without obstacles which arise when videodisks are used if the following points are taken into account:

- Additional memory devices operating independently should be used to store invariable data and on-line memory devices to store variable data and pedagogical data (evaluation of knowledge, conducting lessons, etc.)
- The role of the teacher as a mediator should be preserved not to break the connection of the student's working station and the teacher. This can be realized directly without mediators (see the example above, training technical staff - electricians) or by using networks serving as mediators, which provide simultaneous communication with servers containing variable data and establish communication with teachers.

Taking this into account, the experience that has been gained enables us to use the material which is now highly valued and which was established through TV education and when the multimedia were first used. Thus, the material gained when the electricians were taught can be used, provided it is corrected accordingly, and supplemented with new data. For instance, according to G. Théry the information stored about images which is at the disposal of the Institute of Sciences of Paris (Cité des Sciences de Paris) is estimated at 2,000 hours. Bearing this in mind it should be mentioned that the main obstacle in the development of multimedia educational material is not the lack of 'exhaustive' material, which is the common complaint, but the need to resent this material in pedagogical context on the one hand, and, especially, the need to edit this material by professionals in a better way than it is usually used to be done in educational courses using ordinary means to transfer information or when doing so through TV courses. One can only express regret that the games industry or informatics have the standard which is far from the standard to which our students have got accustomed; our Anglo-Saxon friends who coined the world «edutainment» (education and entertainment) had marked the hindrance, which we confronted, very clearly, it is not by chance that Microsoft with its product Encarta become the first seller in the world of encyclopedias. The requirement to take into account the cost of production, that is estimated in such approach, undoubtedly reflects the global vision of the problem. The need to meet the demand concerning quality leads to the problem of high qualification of the teaching staff who should master technologies, and thus in the substantiation of technical normative choices.

4. WHAT ARE THE RECOMMENDATIONS FOR THE PARTICULAR ACTIVITY?

The attempts to outline the range of tasks for informatics and new communication technologies in education were made based on the above mentioned. It is obvious that the garage owner should be a good driver, in the same way it is not obvious that the student who is well acquainted with information technologies and computer architecture should be a skillful user in the field of new technologies as well. Information technologies make a considerable part of the store of technological knowledge of the «real man/woman» of the 20th century, they share this privilege with the store of technological knowledge which form the present. Nevertheless, training to master these technologies should be conducted not creating illusions about its contribution to the better use of the technologies under consideration. First of all, as large part of the population as possible should master in a cultured manner the methods to search for information: we know many specialists in the theory of informatics who are unable to share their knowledge or to their knowledge into practice to search for information; on the contrary, it is not seldom that considerable contributions in the field of information technologies are made by the people who are not professionals in these areas (mathematicians, ergonomists, economists, etc.). Further we consider technology as the tool of renewed pedagogics, and also as a means which makes it possible to train our students better in using modern technologies.

The first obvious point, perhaps banal, should not be forgotten: it is necessary to define technological • situation on the basis of pedagogical situation but not vice versa. There is no one answer to the question about which technology should be used in education. Thus, one can choose among the following technologies.

• *Distance educational courses;* the means of group communication (audio- and video conferences) being widely used nowadays; when using technologies of this kind people mostly forget that initially these technologies were not developed especially for pedagogical purposes: videoretranslation of transparencies projected on the screen is much worse than in the case of a means of common use (the division of information supplement, information panel ...) in addition to a videoprogramme. Besides, the question can be asked whether the video program itself is less important than the separate use of the supplement, but it can affect teachers' habits and the marketing of designers.

• *Courses on request* when the students use teaching materials without the manager and for which World Wide Web technologies grant great opportunities.

• *Providing management and conducting lessons,* where managerial functions are realized; in case such technology is used it presupposes that there is a teacher for one group of students who are distributed at random over numerous geographic regions. There should be a complete store of various means (formulars, exchange of messages, common use of supplements, access to information servers...).

These are but a few examples by which we mean to illustrate the variety of situations which consequently need a variety of technologies, that have to be supplemented with numerous supporting communication networks; restrictions imposed by economic reasons should also be taken into account.

It is obvious that primary and secondary schools cannot compare with universities or engineering schools in this respect. Education authorities have not learnt to analyze and evaluate the policy pursued in education in technical and economic terms, the policy that the institute should choose and realize. They do not use the rich past experience which is available. In case of need high engineering bodies should be prepared to render help in conducting lessons by granting allowances. International researches can presumably be focused on repeated experiments carried out by institutions which have been offered to participate in the project to integrate their students into the network. First of all the results of these studies can be used to evaluate the policy which is to be realized. Besides, the joint data of these studies are necessary to take into consideration various social and economic conditions prevailing in the region for which the choice is made, the differences in the means available concerning the infrastructure of networks, microinformatics depending on the equipment available, the differences in the distribution of students ... The evaluation of the chosen projects from the pedagogical point of view is one of the most urgent tasks to avoid uneconomical use of investments in the period when they considerably increase. In fact, mutual exchange is becoming the international reality, there is no going against it. Besides, economical restrictions should also be taken into account. The cost of electronic equipment in education is sure to remain high, and it is increasingly true for a separate institution. Therefore, national and international cooperations choosing the direction of work should concentrate their efforts to determine the full content of the courses; however the cultural differences of such approach ought not to be underestimated the most difficult thing is to adapt multimedia products for international use (the translation of messages, transferred by voice, the peculiarities typical of the producer-country, historical and geographical variety of the material used, etc.). Research should be carried out to study these peculiarities, and it can be part of the work conducted by your institution.

Therefore, technical means should be introduced in accordance with economic and cultural features of each member of the project. Cultural peculiarities should be taken into consideration in the same way, as language peculiarities. In this case I speak about a very difficult problem, its research has not been supported with reliable means: computer translators, diacritic marks, alphabets of some countries, etc. At present the technological language is always English, the indication of which is the nature of some acronyms that I had to use earlier: CD-ROM for Compact Disk Read Only Memory (compact disks only for reading), DNS for Domain Name Server, SMTP for Simple Mail Transfer Protocol and others. The need to create the uniform technical vocabulary should not tempt us to simplify the cultural exchange: on the contrary, the dominating technologies ought to ensure the cultural variety at its highest. Under the circumstances, the variety of languages used by your organization should enable it to be the organizer to begin the research, and the promotion of the exchange of messages should help to enlarge your competence in these issues. In the near future the only means which remains is common languages used by people of different countries and the information means which present information not in the code, such as telecopies and, in the future, any multimedia. It is necessary that the regional centers should be set up, which would combine knowledge and experience so that in the future the means of communication could be used according to one's inherited linguistic requirements: it should be as convenient to use the Internet in French or Russian as it is in English. The use of the simplest ways of communications ought not to be overestimated: a lot of research is needed to solve pedagogical and organizational problems in tuition by correspondence and by television. Linguistic research should become part of the adopted policy, and the use of national and regional networks should be backed.

It is essential to take into account cultural differences if one seeks consent and active participation of those who are the main motive power of these activities - the teachers. The use of new technical devices inevitably change working habits, this situation and the added change in teachers' traditional approaches can doom this operation to failure. To avoid this conflict one should try to make the teachers want to master electronic means and means creating support materials; it means that at present a comprehensive program of teachers' training is needed almost in all institutions that bear a relation to it, even if the purposes set in the programs differ on a regional or national scales.

At present the program of teachers' and students' training is one of the main factors when introducing informatics in education. This training should be viewed in two aspects:

• training of general public to use technical means to get access to information, which will determine their whole active life;

• passing specific knowledge to students and teaching staff on those technical devices, which are to be used in the process of training.

To minimize the economical and organizational difficulties of the second aspect it should be brought as close to the first aspect - which has no bounds - as possible. It should be reiterated, that the choice made on the second aspect should be as much «industrial» as possible and reflect the situation with technological maintenance, one ought not to pay too much attention to innovations, except the pedagogical ones; the standards accepted by the executives should be general and in line with approximate standards set at the project's design stage. Doubtless the implementation of the set of chosen projects would lead to the economy of funds; but such set can hardly be coordinated on the international level: regional and national economic policy is sure to provide the decisive influence on this approach. Nevertheless, it is advisable that the international coordination should be carried out, which aims at the transfer of pedagogical support to various technological platforms in the case, when the differences are undesirable, which result in a set of pedagogical approaches of those countries that are poorly equipped in industrial terms as compared with the countries that are technologically developed in the areas of informatics and teleprocessing. Obviously, the diversity of the problems exceeds the potentialities of people who are responsible for the introduction of new technologies in educational institutions. Those at the head of the projects do not have the results of research and cannot rely on those who carry out research but have been giving wrong answers up to now and who are poorly organized. Obviously, the help should be given to set up centers, which are to be competent in the area of educational technologies (consultation societies, inside administrative support services, etc.). The international exchange of information between those centers will enable to pass on technologies from the countries having greater experience to the countries having less experience. This efforts cannot be only reduced to the introduction of the systems: the introduction of local networks in the institutes, their connection to the Internet, the possibility of connection of educational network to the network of enterprises guarantees a better service for the users, simplifies the maintenance of communications and ensures better service. The joint networks of students' working stations is also desirable from two points of view, which are important for our practical workers:

- joining up into the network (Network Computer) if it is realized will enable to ensure the better management of the configuration and the technical support of users at lower costs;
- if the question is settled about the joining of establishments (particularly enterprises) to the education system it will enable to learn more about students' life and, especially, the need of continuous training during the whole career: training is known to be more efficient if it is part of the process, which aims at the acquisition of knowledge at the time when its need is conditioned by an activity. Education can be provided «just in time» only through the educational communication network open for professionals in the field of economics.

Therefore, meeting these two objectives confirms the benefits of joining up into a network of set of technological means of education using both local networks (LAN) and distributed networks (WAN). The policy of extension of the Internet and information highways gives, in this case, a good chance to attract experts in the field of education: one has to make sure that the educational section is systematically included in the projects, and this section is available for all experts in pedagogics, engineers and economists. Finally, one can mention a low quality of methodotogical research on the application of new technical means as compared with the teaching objectives according to the information from the experts in different countries who were commissioned to work in the field of new educational technologies there is a tendency which indicates that these technologies do not result in a considerable difference in the efficiency of traditional courses and those which use new technologies. These results should be specified, and their methodological framework should be set in such a way as to give the opportunity to compare at the international level using general methodology. In conclusion, I believe that the head of administration should be in the center of the information system in all our activities, and the commercial manager at the head of managing of automatization technologies in trading businesses. This approach is similar to that which was suggested in the introduction dealing with another area and in which the patient was in the center of the hospital information system. The education system ought to begin to listen to its «patients». The research carried out by SORRES in France in 1991 among educated adults showed that the expected advantages in home education through multimedia are mainly centered around the factor of time: the opportunity to set one's own pace of work, to schedule one's time ... In its turn, the study of lessons using Teleservices in France carried out by Centre Eutelis found out the factor of pace: when asked about preferences concerning the place of learning students gave answers shown below:

Location of place giving access to teleinformation	Choice
At home	27%
Local collective stations	27%
Educational centers	24%
Establishments	21%
No answer	1%

New technologies, which combine mass technologies and professional technologies, help tyo divide our environment: interactive television will be available in every home in the form of a box containing both the memory and the processing device, satellite networks will ensure the worldwide access to information even on a larger scale. Our duty is to define the place of these technologies and to make sure that those in charge of the electronic programs of interactive television will allow to transmit the contents of the pedagogical support which we are going to suggest.

In the situation when the unity of time and action is broken the role of the teacher as the distributor of knowledge will be transformed into the role of. «engineer» of knowledge, who organizes the access to electronic means of information for students. It is necessary to prepare the teacher to play this new role. The definition of the teacher's role is the main subject of our discussion. This role ought to be recognized not only when he/she gives lessons, but when a time consuming job of creating pedagogical computer support is carried out, which results in the reduction of time of the teacher's presence at the lessons. The institute of education should be provided with funds and be competent, this will enable it to realize its pedagogical and technical project at a high level. But it should be empherized that even in the light of the afore said, it is the student who should be the focus of technical education. We must concentrate our efforts to meet his requirements.

The original is presented in French

Commission I

INTERFACE TO INTERACTIVITY: TECHNOLOGIES AND TECHNIQUES

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ABSTRACT

What makes a technology interactive? Is radio interactive? Television? What about books, lectures, conference sessions? Is interactive multimedia really interactive? A TECHNOLOGY is not in itself interactive - it is the INTERFACE we design for it that is interactive. What makes an interface interactive?

1. INTERACTIVITY

Each new advance in educational technologies heralds new possibilities, often before fully realising the potential of the previous technology. Interactive multimedia promises interactivity. But have we never had interactivity before? Is a book not an interactive experience? Does a lecture have to be only a passive experience?

As Kristina Hooper Woolsey (1988) states:

"Anyone who has looked at run-of-the-mill computer software or branching videodiscs that continually interrupt the viewer with multitudes of unappealing choices understands that interactivity is not a sufficient condition for a good experience. Similarly, those of us who have sat on the edge of our seats in lecture halls and theaters, enjoying a nonpassive experience even though we have no control over outcomes or opportunity for any

interaction, must acknowledge that there is really something to the crafts of rhetoric and storytelling" (p.320).

Very often it is the skill of the designer that guarantees its interactivity, whether that technology be a book, a lecture, a video, or a CD-ROM. Interactivity is not necessarily inherent in the technology itself.

Multimedia marketers would have us believe that the ability to point and click is a far more interactive experience than the ability to turn pages in a book. Books do not have to be, and in fact often never have been, only used for linear presentation. They, like multimedia, can provide information in chunks and provide the reader with the ability to navigate in any direction - via the contents page and an index. If the book as a format was not such a wondrous thing, then why do so many interactive multimedia developers imitate the book as an interface metaphor?

This is not to say that the older technologies are perfect. Design of hypermedia systems can lead to improvements in the design of older technologies. Ted Nelson's *Xanadu* system was an early hypertext system, pre-dating HyperCard by over ten years. His book, *Computer Lib: Dream Machine*, challenged the format of the traditional print medium twenty years ago.

Another example is Apple's book *Demystifying Multimedia* (1993). This book uses **bold** to imply links as does any hypermedia document, but instead of being able to click the bold to go to that link, the page numbers of the link are in brackets after the bold. The book is also organised so that each page is a chunk in its own right, and can be read in whichever order takes the reader's fancy, or in which order the reader has need, more like a magazine than a textbook.

We need to be clear as to what we mean by the word 'interactive'. It is being promulgated as a necessary condition of an effective learning environment. However, interactivity goes beyond mere point and click. An analysis of the different types of interactive experience is provided in a previous paper "Beyond Browsing: Making Interactive Multimedia Interactive", Wills (1994). It may variously mean: simple electronic page turning, hierarchical menu choices, point and click browsing systems, or testing and tutoring on black and white facts. However it could more aptly describe active environments that engage the learner in a challenge or mission based on manipulating the information contained in the system. Interaction may be better defined as *engagement.*

2. INTERFACES

2.1. Guides

One of the best ways of engaging students in a task is through the personality and enthusiasm of the teacher. Designers of educational interactive multimedia can engage users by personalising their interfaces. Some use guides, wizards, and agents as techniques for "characterising the interface" (Oren et al, 1992).

Two products I've designed, utilise guides as a technique:

- Interactive Handbook and
- Interactive Proceedings.

The *Interactive Proceedings* was developed for an IFIP Working Conference on Interactive Multimedia In University Education: Designing for. Change in Teaching and Learning, at The University of Melbourne in 1994 (Beattie, McNaught & Wills).

Prior to that, in 1993, we set out to design an interactive version of The University of Melbourne's Undergraduate Handbook Volume 1. The 60 page colour handbook is distributed to prospective students and contains information about the university and its courses. The design team treated the task as building a graphical user interface on top of the 30,000 words of descriptive prose in the handbook.

One solution to the problem of providing interesting navigation through 30,000 words of prose was to humanise the handbook by providing eight university students from a range of courses and backgrounds to act as young guides to the university. Audio grabs from the guides give insight to university life from their personal perspective and add humour to what was probably a dry publication. The guides offer pathways into areas that the interactor might not otherwise have explored.

Oren et al (1992) used guides for a similar purpose with an American history database prototyped at Apple in 1989:

«It has been widely noted that hypertext systems are characterised by user disorientation, or "getting lost" while attempting to find a way among the myriad connected documents and links... The hypertext author's purpose may be to provide an educational experience, but the cognitive load posed by navigating among the various items may be so great that the user has little energy left for absorbing the content... We began looking at the use of characters and the human figure to suggest a storylike structure and get the user involved in a search for relationships among the various pieces of information... Guides first appeared in the form of travel agents... [Then] we decided to change the interface so that it... all looked like part of the historical period. We wanted to add visual richness, provide a context, and seduce users into the mood of the database from the start" (pp.367 - 371).

They then researched how best to represent the guides: as icons, as cartoon figures, or as photographs/video using actors. They observed interesting differences in users' reactions, noting that even with iconic guides, users assumed characterisation although the designers had not explicitly set out to develop them as characters.

"We have found value in the deliberate personification of the interface, in introducing the conventions of storytelling, point of view, and character into the computing milieu. This seems to result in engagement, projection, and suspension of disbelief on the part of the users. Children often assume educational material is objective and comprehensive, but in fact any encyclopedia has a particular perspective... Guides suggest a natural way to present multiple voices and points of view" (p.376 - 7).

In creating guides for the Interactive Handbook, we chose an alternative not available to the historical database designers - we used real people. The Schools Liaison Officers often remark that students are the university's best sales vehicle. The implications that follow from the design choice of real students versus invented graphical characters include the need to:

- update as the students grow older/change interests/change hairstyles;
- write scripts in keeping with the real students character;
- train the students how to perform enthusiastic or humorous 30 second grabs!

A number of other universities have now prepared CD-ROMs for prospective students: ELVIS from WA, Studylink from Wollongong. SYDNEY-ROM from University of Sydney, and the University of Waikato Student Recruitment Kiosk. However, to my knowledge, none have used guides as an interface.

The University of Wollongong Education Faculty's

Exploring River Nardoo, a soon-to-be-released ecological simulation, following the success of *Investigating Lake Illuka,* makes excellent use of guides. The guides are an interesting hybrid of video actors and hand-drawn graphics.

Guides as a technique in the *Interactive Handbook* was well received and achieved the goal of taking the interactors into parts of university life that they might not have otherwise seen. However one of the evaluating students said in their thinking aloud video: "It is an unfulfilled promise - it raises our expectations and fails to deliver". They wanted a conversation with the guides! The design team felt that the CD-ROM needed additional features to enhance its interactivity, for example, an adventure game or puzzle to solve; interviews with graduates; and video clips of the university experience such as lectures, tutorials, field trips, laboratories, and the social scene.

The capability to personalise information and humanise the interface with guides is something well handled by interactive multimedia and not as well handled by books. However, this doesn't mean that books cannot do it. The printed handbook went part way towards reflecting our human interface - it provided a snapshot and thumbnail interview with each of the same students.

2.2. Text

Another reason why the *Interactive Handbook* prototype is an "unfulfilled promise" is the disparity between the professionalism of the graphical user interface and the amateurism of the textual information. The design team came to understand that text does not translate directly from book form to multimedia form. The large amounts of descriptive text in the handbook needed re-purposing for the screen. Text in multimedia publications needs to be treated in ways more akin to text in television and video productions, that is, use of bold concise headlines and bullet points. [See previous paper, The Book is Dead - Long Live the Book, (Wills and Swart, 1994)].

Our multimedia publication hadn't replaced the *existing* print-based handbook. Text is very well served by print technology. In hindsight, the multimedia publication has to serve a different purpose from the print-based handbook.

Menu choices in the *Interactive Handbook* structure reflected the print-based handbook structure therefore the publication did not address aspects of university life that multimedia capacities could have dealt with if we had designed the content from scratch rather than rooting it in the existing delivery format.

The process of designing, evaluating and reflecting on the nature of the *Interactive Handbook* has forced a re-think of the function and format of the traditional handbook, and other University promotional products such as videos, in recognition that each medium has unique characteristics that could be better harnessed to complement each other rather than compete.

Oren et al noted similar concerns with their historical database:

"... *in designing an interface to a textual database, we have found that the writing style adapted to the print medium is not optimal for the computing medium. This is a warning that there may be sharp limits to the notion of "repurposing", that is moving existing content to a new medium by simple format conversion... Because the text base was fixed, expanding the guide's role in the video version required adding content in the video sequences. The result is that the richness of the video image currently dominates the user's experience. The text appears flat and boring in comparison" (p. 378).*

3. INTERACTIVE INTERFACES FOR CONFERENCES

Participation in a conference is an interactive experience not matched by the traditional print-based proceedings the rest of the world gets to see. The print-based proceedings produced as an outcome of a conference is a non-interactive experience. In fact the book we see published is not a "proceedings". It does not show the totality of the conference process.

An aim in deciding to design an interactive proceedings for the IFIP conference was to bring closer together the conference process and the conference outcome. The team set out to produce an experience for the interactor that reflects the interactive nature of such conferences; to capture the atmosphere and the progressive development of the debate and discussion; to enable the interactor to see and hear the personality of the authors via video and audio.

Editors of conference proceedings in general take one of two routes for organising the print-based proceedings: alphabetical order of authors or an order that reflects the conference timetable. An interactive proceedings allows the interactor to approach the papers from multiple angles not just those structured by the editors. In this *Interactive Proceedings,* multiple perspectives are provided via the Theme Roundabout, the Guided Tours, the Expo Hall, the Souvenir Stand and the Library. Hypermedia links provide alternative perspectives not usually possible in a print-based proceedings other than via a comprehensive index.

The Theme Roundabout is a means for authors to position their papers against each of the three conference themes (Design, Implementation, Evaluation) whereas the conference timetable allows positioning only under one theme dictated by the programme chair.

The Expo Hall was designed to contain most multimedia demonstrations used at the conference. This feature is a quantum leap on print-based proceedings, which merely talk about multimedia instead of doing multimedia. The Expo Hall allows review and reflection on demonstrations that went all-too-fast in the confines of a conference timetable. Print might be a good medium for *discussing* multimedia but it is a poor medium for *demonstrating* multimedia.

The Library houses the traditional papers in alphabetical order of author (as does the print-based proceedings) and provides fast scrolling, hypermedia links, and audio comment from each author.

The Souvenir Stand supplies major elements of conferencing that are missing from print-based proceedings:

- networking and
- touristing.

It contains formal and informal snapshots of the conference including social events; business cards; home video of Melbourne sights; and postcards.

The officially designated conference Reflectors, and selected conference participants recorded Guided Tours while at the conference to reflect and link aspects of the papers that were important from their personal or institutional perspective. For the interactor, these Guided Tours provide comments from discussion sessions and links to papers via audio and video clips recorded live at the conference.

There is also a facility ("U-Drive") for the interactor to record their own tour using the presentation-maker which bookmarks their selection of screens and attaches their voice comments. Like marginal scribbles in a print-based proceedings, this "U-Drive" facility enables the interactor to tailor a multimedia report of the proceedings. Tools such as these, which allow the interactor to construct, manipulate and add value to pre-prepared published content, provide higher levels of interactivity than a print-based proceedings.

Another aspect of the product design is the flavour and style of the graphics and interface. Part of attending any conference is the humour, repartee and social events. It is not just the academic content that one remembers but the interaction with people. Traditional print-based proceedings are stuck in a formula that do not reflect that atmosphere of friendliness. It was our aim to produce an interface with humour - it should make you smile.

Did we succeed with our interface techniques for interactive multimedia? Not entirely. As Brian Harvey says in his guided tour in the *Interactive Proceedings:*

"So-called interactive multimedia makes a promise it cannot keep. The interaction is very far from being a conversation. We experts get to do the talking while you users get to choose which expert to listen to."

4. CONCLUSION

Some of the features described could in fact be utilised in the design of print-based proceedings which are, unfortunately, usually based on tried and true, but boring, formulas. There is a danger that the design of an interactive publication can be tied too closely to the print-based medium with which it is associated. The interactive publication should challenge the design of the traditional academic proceedings. Once a paradigm shift has been achieved, the design of an interactive publication can inform on the design of its associated print publication, as occurred with the *Interactive Handbook* described earlier.

Conference proceedings are now being published on the network, in fact many assume that the web is all we need now. *AUSWEB95* is an excellent example of a multiplatform proceedings - it's on the web, in print, and on CD-ROM. So is *OZCHI195. Teleteaching 96, a* virtual conference later this year, will only publish on the web and CD-ROM, bypassing print altogether.

However we still have much thinking to do about the value of each platform, about reassessing the role and best features of each technology, and using them appropriately. Currently they are too closely tied, copying each other in form and content. The learning need, or information need, is not likely to be best addressed by a sole technology, nor is it cost effective to publish on all platforms. A combination of appropriate technologies seems more sensible - "multimedia" in the original use of the word, meaning multiple forms of media.

As the bandwidth of networks increases, the capacity to publish multimedia conference proceedings, and university handbooks, will become the norm. The powerful combination of multimedia publishing and network publishing will be a paradigm shift in conferencing and publishing. The technologies are there, but do we yet understand the techniques for guaranteeing the interactor a truly interactive experience?

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Much of Section 3 and parts of other sections are from my 1994 paper which was co-authored with Ricci Swart.

The original is presented in English

IS TECHNOLOGY THE ANSWER FOR OUR CHANGING EDUCATIONAL NEEDS? YES, BUT ONLY IF...

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LEARNING TECHNOLOGY AT A CROSS-ROADS

The "yes" in the title of my talk suggests a generally positive and optimistic outlook, which is tinged, however, with a good dose of scepticism. In the course of my talk I will fill in the dots and elaborate on this scepticism.

The argument which lies behind the thesis implied by the title is that Learning Technology or, more elaborately, Informatics for Education and Training is at a critical juncture from where one road can easily lead to decline and disrepute of the field if we do not actively set the direction of development. To be sure, learning technology is here to stay. The necessities that will force us to use some form, or forms, of learning technology are driven by global development trends that nobody can reverse.

However, we might easily see a severe setback of the field by a decade or more as funds could dry up if viability is not convincingly demonstrated. We might also see the field go off in directions we won't like. We might be confronted with the development of serious negative side effects as in the case of public television, a technology with a still unexploded potential for mankind.

EDUCATION AND TRAINING TODAY

What are the trends that have created an urgent need for the employment of learning technology? These trends have been described at length at countless occasions for a number of years. I will only briefly touch upon them to create a frame of reference.

In the course of this century we have seen a breathtaking branching out and subdivision of disciplines into a bewildering panoply of fields and specialities. The scientific approach to interpreting and coping with the world around us, pioneered during the renaissance, set off a development that brought us an avalanche of knowledge that needed to be managed. However, science and technology are not the only culprits. The forces of the free market system worked toward an increasing flood of new products and enormously enhanced productivity requiring new skills and new areas of knowledge.

With the proliferation of products and the differentiation of production methods, the structures for keeping the whole system running became ever more complex and interdependence among people increased. This in turn required new skills for managing an emerging web of new interdependencies. Non-professional skills from filing complicated tax returns to navigating in a maze of contracts, laws and regulations, to handling intricate machinery of transportation and telecommunication needed to be mastered by everyone.

When high-performance transportation and telecommunication systems created the opportunity to expand a persons net of interrelations over great distances, interdependence received another boost requiring additional skills to cope.

CONSEQUENCES FOR OUR EDUCATIONAL SYSTEMS

The consequences for our educational systems can be summed up as follows:

- Accelerating change in nearly every aspect of human life and the need to cope in an increasingly complex society necessitate the acquisition of skills the teaching of which overtaxes the traditional educational institutions. Methods with improved didactic efficiency are required.
- The distinction between pure training phases and life-long training paralleling one's work life becomes fluid. As opposed to a one-time formal training period concluded with a degree, there will be repeated training phases. Between these training phases, there will have to be training accompanying a person's daily work. When training has to be integrated into a work schedule, systems for Open and Flexible Learning are needed which are based on computer, television and telecommunication technology.
- Traditional demarcation lines between individual disciplines dissolve as disciplines penetrate each other creating new subdivision. Coping with the ensuing checkerboard of specialities requires new delivery systems for education and training.
- The dividing line between higher education and vocational training is becoming fuzzy and will continue to become more permeable. While American universities have always had an eye on the immediate usefulness of the skills they teach, universities in other parts of the world, certainly in Europe, need to strike a new balance between equipping their students with a solid theoretical base and teaching them skills that are immediately applicable.
- The differences between formal university enrolment and learning opportunities offered to the public at large are becoming less pronounced as universities need to be more practice-oriented and the quality of training through commercial course providers increases.
- As technology advances and new products enter the market while others become obsolete, economic dislocations will continue to cause unemployment of major proportions unless they can be countermanded by making the adjustment process quicker and more efficient. The unemployed quickly need to be made employable again by new industries through a responsive, flexible and differentiated restoring system. Such a system can only be built with learning technology. The reduction of structural unemployment requires learning that is more market-oriented,
- With the internationalization of markets,

companies, to stay competitive, need to follow the principles of Lean Management and outsource services such as training. Training services are increasingly supplied by course providers and training brokers who act as wholesalers of education and training. For this market to function smoothly, learning technology is indispensable.

- Overcoming cultural barriers on the road to international cooperation is facilitated by cross-border learning opportunities. Through technology-supported distance learning, immediate access to sources of learning which originate in other countries becomes possible.
- In this new situation our traditional institutions of education and training, especially the universities, need to set up structures through which they can respond faster in an environment in which the training needs change at an ever increasing pace. Coping with these challenges requires the development of a diversified and effective learning technology and the adaptation of content to the new media. The universities need to cover new ground if they want to avoid being relegated to a diminished role.

OPEN AND FLEXIBLE DISTANCE LEARNING

All these phenomena and trends create an urgent need for the development of Open and Flexible Learning Systems which will be largely, but not exclusively, systems for Distance Learning. The major qualities of Openness and Flexibility will be independence of location and time. Learning presupposes interaction of some sort. Where the learner interacts with a medium rather than a person, e.g. with a multi-media learning program on a CD-ROM, the technology allows him to be truly independent of time and location. With the appropriate technology the learner can then learn where and when he or she chooses. When the learner interacts with a person, even if this interaction is delivered by means of telecommunication, the learner will be subject to certain time constraints as he needs to be co-ordinated with the distant instructor.

The learner still enjoys the more important benefit of flexibility, namely the independence of location. If education and training is relieved of geographical constraints, this will also at least loosen time constraints since overall co-ordination of instructors and learners becomes more flexible.

In any case, technology is needed to bring the opportunity for learning to the learner's home and workplace. Technology is also needed to give the learner access to rare experts and specialists at distant places. Another expectation from technology is a substantial improvement in didactic efficiency through multi-media tools such as video sequences, animation's, pictures, graphs, simulations, audio clips etc. With the possibility of wider distribution through technology, a much more careful preparation of content becomes affordable.

EXPECTATIONS FROM INFORMATICS

The needs are straightforward and the means by which to meet these needs seem, at first glance, straightforward, too. However, throughout the history of the digital computer, informatics applications with a socio-psychological component have been accompanied by the persistent temptation to expect technical solutions to non-technical problems that are not amenable to the algorithmic approaches of the computer world.

A fascinated public has repeatedly placed great faith in computer technology to solve societal problems, only to be disappointed when the hoped-for benefits fell far short of expectations.

Over the decades a certain pattern has evolved. First, deficiencies are seen in some area of human activity. Computer technology seems to have the tools to remedy these deficiencies. Straightforward solutions are attempted. These solutions either fall short of expectations or fail totally. The situation forces a deeper analysis of the activity to be improved. The analysis then reveals that the activity depends on a host of non-obvious factors that were not, or not sufficiently, taken into account when the activity was changed, seemingly improved, through the introduction of technology.

AN EARLY WARNING

An early sobering experience and instructive example was the development of computer-based information systems. Their development was the first endeavour in which the complexity and interdisciplinary nature of a field and the meshing of the formal-algorithmic and the socio-psychological spheres were underestimated challenges.

The field of information systems was also opened up with high expectations and enthusiasm for the quick establishment of distinct theories and methodologies and for the rapid alleviation of a serious societal predicament.

After a period of optimism and intriguing visions of the future, the field of information systems went into a severe slump in the early seventies when funds dried up after disappointing performance in terms of user acceptance of elegantly designed and prima facie attractive systems. Only after a long hiatus, the field recovered slowly with initially quite unspectacular applications based on practical experience and scaled-down expectations.

When information-seeking behaviour was analyzed, it became apparent that far too much had been expected from the algorithmic penetration of this complex activity. It was realized that the way information is sought determines the information found and thus is an inseparable part of an intellectual accomplishment that cannot be expected to be automated. Criteria by which information could be judged relevant, namely a relevance measure, could not be satisfactorily defined and statistically stabilized. The unsatisfactory performance of information system spawned quite a bit of research into information flow in science and technology. It turned out that the essential information flow that determines the course of science was much more determined by personal contacts and exchanges, many of them adhoc, spontaneous and seemingly unplanned, than by the formal mechanisms of congresses, publishing and archiving.

When the original ambitions for remedying a general societal problem were given up, the field of computer-based information systems recovered slowly and in time prospered more healthily. Awareness had grown that the patterns of a human activity that has evolved over many years, if not centuries, creates an extremely complicated web the performance of which diminishes if it is perturbed by too radical change.

A LESSON LEARNT

The lesson learnt from the information system debacle was the stipulation that an activity should only be "computerized" if the structures in which the activity is conducted are well understood and have reached a certain degree of formalization before computers are employed. These structures should then be precisely mapped onto computer algorithms before they are honed for higher performance exploiting the specific capabilities of the computer. The field of information systems got a new start from very practical applications like the airline reservation systems. These systems had matured with paper, pencil and file cards, and all structures of information flow and processing were in place before computers were used. From such pragmatic and comparatively unambiguous application, the field evolved in small steps to more sophisticated functions.

We must ask ourselves if such lessons do not apply to the field of informatics for education and training as well.

HOW MUCH IS TELE-PRESENCE REAL?

Before we will take a look at specific learning technologies, let's consider how the learning process will be altered by learning technology. Generally speaking, there is less interaction with people if we employ technology. Either the interaction with the instructor/teacher is reduced if his or her presence is only a tele-presence, or there is no interaction with a person at alt as in the case of Computer-Based Instruction. In tele-presence we convey, by technical means, only certain aspects of the instructor/teacher, the ones we think are important.

When we reduce, in some way, the presence of an instructor, we reduce the bandwidth of his or her personality, figuratively speaking. One reason, of course, is the limited technical bandwidth that is available to us. The question arises: Would we know what to convey had we unlimited bandwidth at our disposal. I think we must say that we don't know precisely how much we are losing through telepresence.

Even if we transform the teacher from an instructor to a guide, facilitator, or collaborator, we don't know how much a teacher's presence is essential in a specific setting. This will depend, of course, on the student group, the subject, the cultural environment and other factors. However, learning is intricately interwoven with identifying with a model and being motivated and encouraged by the example of a person representing or living the subject to be conveyed.

HOW IMPORTANT IS A ROLE MODEL IN LEARNING?

It is hard to find words to convey the full breadth of the phenomenon I want to describe. Not only in learning, but in other fields as well, we have a tendency to underestimate the extent to which the essence of an interaction between people is mediated by deeper personality traits which the offering person has and emanates. These deeper personality traits have to do with very general qualities that are hard to capture with language. You could say it is cognitive style, i.e. the way the person sees and interprets the world, but more than that, it is the way the person is in the world and his basic attitudes toward it. To describe what I mean, let me digress for a moment to other fields. Take psychotherapy. There are many schools of thought about how therapy works and what it is that causes a person to heal, in fact what healing in the therapeutic sense actually is. Based on these different schools of thought or theories, there are innumerable psychotherapies competing with one another for being the right method based on the right theory.

Comparative studies show, though, that the success of therapy is much more determined by the qualities of the therapist than by the therapeutic method. Such qualities are hard to define. It is something like the credible example of another connection to the world, to people, to mankind. And it is the capability to "infect" the other person with such a different basic attitude.

These attitudes are so basic that they also are hard to describe with words. How can one describe what in religion is meant by the term "Trust in God"? You don't even need to be a religious person to experience that kind of stance in life. Many people have this basic attitude without identifying with this phrase. Such a basic disposition toward life is not conveyed by ever so many text readings. The way people get it is by being "infected" by another person at some point in their lives, the fortunate ones in their childhood by their parents.

TELE-PRESENCE IN LEARNING

My claim is that such mechanisms play a stronger role in learning than is generally accepted. As these mechanisms are not easily amenable to scientific study, our pedagogical research and body of knowledge is dominated by other phenomena, those which are scientifically and statistically manageable.

I am not saying that we need as much physical presence in the learning process as we generally have today. There are many autodidacts who are capable of going through extended courses of study without interaction with an instructor, teacher, or professor. There are many subjects that can be taught partially or in to without human interaction. Other parameters are age and cultural context, or plainly the availability of instructors.

However, if we do not take the importance of role models into account, we are in danger of losing an important element of teaching and learning. I have not even mentioned the more general problem of the deterioration and depletion of social interaction that modern society is plagued by. Computer technology, Computer-Supported Co-operative Work (CSCW), and telepresence certainly intensify this trend.

Students in traditional distance learning have complained about social isolation for a long time. In this case, tele-presence will actually relieve social isolation to some extent. The important part is that planners of learning technology be sensitive to social needs and provide for a mix of learning modes and facilities to satisfy these social needs in a reasonable way.

COLLABORATIVE LEARNING

So far I have talked about interaction between teacher and student or students. Similar considerations apply for interaction between and among students in a classroom setting when the classroom is geographically distributed with the help of information and telecommunication tools.

Learning and motivation for learning in a collaborative setting is just as much influenced by a multitude of factors and parameters, some obvious and easily accessible to analysis and emulation, others subtle and hidden in a web of semiconscious or subconscious dynamics. What prompts interactions in a classroom setting and how these interactions exert an influence on motivation, attention, intellectual engagement, and retention seems relatively accessible to analysis at first sight, but is actually determined to a considerable degree by complex group dynamics and by complicated signal exchanges between participants.

To have these interactions pass through computers and telecommunication equipment will change the character and the effects of the interactions. A considerable amount of filtering will take place. Simultaneous and quazisimultaneous events will have to be sequenced. Some stimuli will be cut off. New phenomena will crop up.

At this point, it is unknown whether the character of the interactions will be sufficiently retained to induce participants to look for the same benefits that they are used to from traditional settings, or whether the character of the interactions will change into something new that might be less or, possibly, more helpful in the learning process. A novel character of educational interaction might call for new avenues of optimization that might lead into other directions than those suggested by the traditional type of interactions.

My thesis is that we don't know beforehand how much human interaction we need in a particular instance. This is as much an unpalatable factor in developing learning technology as the peculiarities of human information seeking behaviour were in building computer-based information systems. For every educational setting we have to develop a balanced mix between computer-supported self-learning (e.g. by learning programs), synchronous and asynchronous collaborative learning (e.g. through computer-video connections to tutors and email-type exchanges), and phases of physical presence.

What we need, therefore, are modular, scaleable systems of learning technology which can be tailored to a specific scenario.

THE TOOLS OF TELE-LEARNING

What kind of information and telecommunication tools are available to us for education and training?

We can, of course, use telecommunication and technology in many simple and straightforward ways for learning, be it by receiving instructions over the phone, getting learning material by fax, or viewing a television program or video tape. When we speak of learning technology, though, the following tools and technologies come to mind:

• *Without inter-personal interaction* (network-based or as stand-alone applications):

— CBT (Computer-Based Training), i.e. learning programs from simple page-turning text-based courseware to sophisticated interactive multi-media applications on CD-ROMs.

— Instructional video tapes or TV broadcasts Interactive video disks.

— Access to educational data bases.

— With asynchronous inter-personal interaction (deferred-time communication):

— E-mail.

— Computer conferencing.

• With synchronous inter-personal interaction:

— Relay Chat (*real-time textual exchanges*).

— Computer video via small-band ISDN Interactive television, one-way television - two-way audio.

— Interactive television, two-way video - two-way audio, both over multiple ISDN channels.

— Interactive television, one-way television.

— ISDN video back channels.

To satisfy the needs of a particular situation, these tools and technologies can be combined in a wide variety of ways. Thus a learning technology can be tailored to meet the requirements of a specific learner environment.

Such specific requirements can be:

- The availability of transmission media or, possibly, one specific transmission medium (e.g. telephone, ISDN, TV).
- The familiarity and experience of the learner community with a particular technology.
- The kind of equipment that is already in place.
- The funding situation.
- The form in which high-quality content is available.

AN EXAMPLE: THE ECOLE SYSTEM

In the DELTA and TELEMATICS Programmes of the European Union several systems combining various tools were developed. I'll use the ECOLE system as an example. ECOLE was developed under the assumption that one specific transmission medium would be available to build a transmission network for a learner community, namely ISDN. So the question became: What kind of tools can you combine to make full use of ISDN as a transmission medium. The result was what I call an "ISDN-based Comprehensive Learner Environment".

ECOLE would typically serve a distributed home learner community where each learner has a PC with video capability and an ISDN connection. All he or she had to do in addition was to load the ECOLE software. The goal was to give each learner a comprehensive set of tools that would allow him to participate, at a distance, in a course of study pretty much as though he would be enrolled in a university or other educational institution and be physically present. The video capability with the support of an appropriate user interface was to set up distributed classrooms in which collaborative learning could take place at a distance. One feature of this special user interface was to be a Group Situation Schematic through which the essential signals that characterized the group dynamic could be exchanged.

The facilities that had been integrated into the ECOLE system were:

- Audio conferencing (limited video conferencing)
- Joint screen
- Advanced e-mail
- Electronic conferencing
- Data base search
- File transfer
- Scheduler
- Course guide
- Educational data base
  - Course catalogue
  - Schedules
  - Tutor / student listings
  - Administrative data.
- Curriculum Planning
- Questionnaire handler
- Questions & Answers
- Authoring system.

Let's put ourselves into the position of a student who enrolls in the ECOLE Campus. He might use some of the ECOLE facilities in the following order to get answers to his questions and participate in a course. The tutor might utilize the Authoring System to jointly edit, with a collegue or expert, his course CBT material based upon the feedback he or she received in the class.

Course Catalog: answers: Which course is of interest?

Course Guide: answers: What's in the course? Prerequisites?

Curriculum Planning: answers: How do the courses fit together?

Educational Data Base and **File Transer:** allows to download multimedia CBT materials.

Schedules: answers: When is the course?

Address Book: lists "office" hours & contact information on tutors.

E-mail: can be used to sign up with tutor.

Joint screen/audio-conferencing used for general co-operation and distributed classes.

Questionnaire Handler: allows the administration of tests.

Authoring System: enables the tutor to co-edit multimedia CBT materials together with an expert.

How does the ECOLE system look in the light of what we have said before? It is one of those prima fade elegant and attractive systems which generate immediate enthusiasm. However, it also one of those systems where a preconceived total educational concept was realized. The concept is a new form of learning environment which differs in too many aspects from what we are used to, i.e. from the traditional systems of learning that have evolved and stabilized over centuries. Even though we all agree, that our educational systems need overhaul, we also tend to underestimate how much optimization goes on in a long development process.

As much innovation as was attempted in one swoop in the ECOLE system is not playable with a chance of realization and survival. The major principle of socio-psychological application of informatics has been violated: Building on existing proven structures and developing new structures in short implementation - evaluation - redesign cycles.

VOICES FROM COMPUTER-SUPPORTED COOPERATIVE WORK

Part of learning technology can be seen as a branch of Computer-Supported Co-operative Work, a field which deals with computer-based tools for tele-working and other co-operative activities. These tools range from schedulers to joint editing software for distributed groups.

The CSCW community realized years ago that systems, even when they were conscientiously and capably planned to relieve acute needs, even when they were appealing and seemed helpful at first glance, in the majority of cases did not perform well in an actual user environment. The reaction at the time had been to intensify pre-design studies of the prospective user groups and to analyze their history, cultural environment, cognitive style, and group dynamics in depth.

This approach was successful to a certain degree. Especially helpful analyses resulted when ethnographers were employed to conduct such studies. After failures with straightforward approaches, awareness had grown that CSCW was dealing with a complex world of hidden phenomena, a situation ethnography has been in all along and has crafted a methodology for. Part of the ethnographical perspective is avoidance of preconceived notions and careful observation of the subjects. Such a perspective exerted a beneficial influence on CSCW where careful user observation before the design phase and user participation during the design phase were henceforth considered indispensable for the success of a project.

The approach gives an indication, though, of what kind of caution is in place if information applications are used to deal with human interaction.

Human interaction covers a broad spectrum. CSCW has been very successful in areas where the social interaction between participants is non-critical and incidental to a specific focus. An example is distributed collaborative designing and manufacturing which has revolutionized a number of industries. Today's aircraft industry, for instance, develops and manufactures components for its products world-wide. Engineering design and manufacturing are highly goal-oriented activities conducted by engineers. In this context the subtleties of interaction are less important.

In other types of human interaction where the social and *psychological aspects of interaction are critical*, it is the incidental, accidental, seemingly coincidental, certainly unpalatable, contacts that determine creativity and the richness of the outcome. This is especially true for collaborative learning such as it takes place in seminars, classrooms, or any kind of instructional sessions. Accordingly, success in this area has been elusive.

There is not sufficient knowledge on the complex group dynamics and complicated signal exchanges between participants of an educational event. Little is known as to which elements of these group dynamics are so essential that they need to be taken into account in distributed systems to make an educational event successful. There are no substantiated guidelines by which essential elements can be distinguished from nonessential ones. Such a differentiation is indispensable, though, since the real-life signal exchanges will have to be pared down to limit equipment costs and transmission bandwidth. Not everything that goes on in a classroom can be transmitted. What makes the situation even more complicated is the high degree of "situatedness" of educational settings, i.e. every setting is different.

ADVICE FROM CSCW

Over the years, the CSCW community has developed a catalogue of guidelines:

- *Study user environments carefully.*
- Investigate the social, political, and motivational factors active in the target group.

- *Be sensitive to changing needs from user group to user group.*
- Insure high context-sensitivity in the design process.

- *Involve social scientists such as anthropologists and ethnographers in the group analysis.*
- Use video-based interaction analysis as an effective research tools.

- *Support informal communication.*
- Support informal mechanisms of social control.
- Design for group control of the group's space and resources.
- Find a group-specific compromise between system passivity and intrusiveness.
- Structure group processes and provide facilitation. Assign responsibility for the facilitation function.

- *Avoid small communication barriers.*

- *Make the user interface tailorabte.*
- Keep the system flexible by building in many switches that allow a broad range of configurations.

- Plan for exception handling and low-frequency events.
- Design for open protocols allowing group ware implementers and administrators to create a wide range of interface and interaction policies accommodating group differences.
- Provide a variety of floor control policies.
- Devise a group-specific plan for managing acceptance of a system.

- *Prepare users for change.*
- Insure early and continual focus on users.
- Involve users in the design process.

- *Insure early and continual user testing.*
- Use mock-up simulations during the design process.
- Support mutual education of designers and users.

- *Mediate between the users' and the technicians view of the system, and guard against the dominance of the technicians' view.*
- Seize the "window of opportunity" for system introduction.
- Exceed the critical mass of system utilization fast.

- *Lay out an iterative design process.*

Would this set of guidelines lead to a practical procedure of designing and implementing a system? I think not. There is too much to think about, and in the end there is no guarantee that we did everything right. What this set of guidelines really indicates is the unpalatable nature of information system design for applications in the socio-psychological sphere.

We are dealing with phenomena that are so multivariate in nature that there is no hope of developing a procedure based on a set of rules for developing a system from beginning to end, i.e. realizing an innovative, pre-conceived educational concept through learning technology.

LOOKING FOR BASIC PRINCIPLES TO GUIDE US

What are we to do then? After half a century of informatics it has become clear that there is a basic principle for applying computer technology to the socio-psychological sphere if success is to be ensured:

When introducing technology, build upon existing structures, however deficient they might be, and advance in small steps to new patterns and practices.

This way, user environment studies and interaction analyses automatically merge with the development process. They are then no longer expensive separate projects. Artificial phenomena are avoided. Conjecture is reduced to a minimum.

The catalogue of guidelines from CSCW can then be used as a set of reminders and consciousness raisers while the user needs of the particular setting determine the progress of system development. It is good to keep in mind that high priority must be given to satisfying the often neglected social needs of the learner. There is a tendency to assume that the learner just wants to learn about a subject when in reality he will be comfortable with learning only if his social needs are met at the same time. It is also important to realize that social needs cover an extremely broad range. Engineers will usually put up with most anything including dismal didactics and low technical quality. They are highly trained in making sense out of seeming chaos. Children tend to be the most sensitive to social dynamics.

GUIDELINES FOR LEARNING TECHNOLOGY

Social needs can be met in two ways:

Create a careful mix of traditional learning, based on physical presence, and technology-based tools in which social interaction will be reduced;

or include in the technology, as much as possible, the opportunity for signal exchange geared to social interaction.

The latter possibility is a precarious one and is fraught with pitfalls. Here again the situation varies widely from learner environment to learner environment. Valuable contributions have come from the developments of tools for Tele-Presence. Telepresence aims at mapping our everyday signals with which we regulate our social relations onto technical metaphors which are realistic enough, so that technology recedes in the users awareness. Telepresence is the frontier of the field and must be considered experimental at this point. Here again, my advice is to start from traditional methods and advance by adding on technology.

A very important factor to consider is the phenomenon that we might call the **malleability of human behaviour.** Individuals adapt their behaviour to achieve their goals despite obstacles in a technological environment. If an unfamiliar technology promises to meet unsatisfied needs, people will make astonishing efforts to adapt. If needs are not strong or are expected to be satisfied more easily in other ways, the readiness to adapt is surprisingly low.

This means, however, that **content is of exceeding importance.** If the content is interesting to the learners in a particular environment or is acutely needed, learner acceptance of technology is surprisingly high. If the content is boring or of marginal interest, the best technology will be viewed critically or even rejected.

If starting from established structures and advancing in small steps when introducing technology is the first law of informatics for education and training, then the second law is: **Introduce learning technology only if the content to be delivered is determined, is genuinely needed by the target group, and provisions are made to ensure high quality in structure and presentation of the content.**

High quality presentation is another frontier. There is still a dearth of presentations in which the power of visual communication is fully exploited. Our sense of quality is actually distorted by the mediocrity of the visual part of most video tapes and television programs. The majority of them have moved away from the preponderance of the written or spoken word only minimally. Most visual signals are mere aesthetic embellishments of the spoken or written word. The visual part still is almost exclusively the packaging of the word using up most of the bandwidth, i.e. most of the money. In developing a visual culture in which the viewer demands that the power of visual information be used to inform and teach him or her rather than please him with aesthetic, but meaningless, embellishments, we are at the very beginning.

The kinds of obstacles people will readily overcome if the content is needed and/or interesting is not totally arbitrary. Experience has shown that **picture quality, for example, is not highly critical.** Since the transfer of visual information devours most of the bandwidth and therefore money, here is an opportunity to economize.

More critical are interruptions or waiting periods. Generally speaking, any technical performance aspect, even if flawed, that still allows the learner to be drawn into the content and/or the interaction with instructor or co-learners and allows him or her to forget the technology, is acceptable; on the other hand, **any interruption of the signal flow or a period during which the learner has to wait for some technical feature to function will break the learners attention and focuses it back on the technology, and should be avoided as much as possible.**

CONSEQUENCES FOR SYSTEM PLANNING

There are many situations in which the two laws I have presented, namely advance from existing structure in small increments and begin system development with the focus on content, are hard to comply with. Sometimes a decision on the introduction of a learning technology on a larger scale is unavoidable if, for example, a system is to be planned for a population that otherwise is not reachable at all because it might be widely dispersed or if the number of instructors is too small for a given population. Sometimes funds need to be allocated if their loss is be avoided. The allocation of funds, of course, presupposes specific and detailed plans. Funding agencies will rarely content themselves with plans for extended experimentation.

In such a case the only solution is to rely on systems that have already been successful. What would be a measure of success? Systems should be considered successful if

(1) they have been used in actual user environments and have taken over the function of traditional structures and patterns of learning and teaching to the extend that they have proven their viability in preparing learners for professions and taking learners to certification and degrees, and if

(2) they meet a high degree of acceptance in the user community.

The only learning technology that meets this criterion and can look back on decades of experience is Interactive Television for Education and Training. I am using the long name because the term Interactive Television alone, in some parts of the word, e.g. Europe, is often associated with entertainment and tele-shopping. In Europe the term Tele-Teaching is more and more used for ITV for Education.

EXPERIENCES IN ACTUAL LEARNER ENVIRONMENTS: *INTERACTIVE TELEVISION*

Interactive Television has been used extensively in many US-American universities. A wealth of experience with this technology is already available. Equipment, classroom design, didactic parameters, conduct of lessons, and administrative structures have already been considerably refined and well integrated. The performance of this technology can be gauged by the strong demand for it, the increasing number of diplomas earned through it, and its economic success.

Most of the experience with Interactive Television has been gained from settings in which a video signal is broadcast or directly transmitted to receiving sites that are in two-way audio contact with the originating site (one-way video / two-way audio). This is a very effective and surprisingly low-cost form of Interactive Television. For some purposes Interactive Television should be expanded to two-way video / two-way audio. Good results have also been achieved with learners viewing taped instruction under the guidance of a tutor (as in Stanford University's Tutored Videotape Instruction).

Building on extended experience with these basic forms of Interactive Television, US universities are now moving to combine them with other technologies (e.g. computer video). Integrating various forms of telematic tools (e.g. email, computer conferencing) will give Interactive Television added effectiveness.

In the United States, to a limited degree in Europe, educational institutions can look back on many years of methodological, economic, and pedagogical experience of actual ITV course delivery for credit. Consequently, in ITV we **have a technology in which cost-benefit ratios and pedagogical efficiency have already been optimized to an appreciable degree and which can serve as a reliable platform for further development of telematics for education and training.**

While a multitude of PC-based learning environments has been developed, none has been employed in actual user environments to a remotely comparable degree. However, we can see television and computer technology growing together and institutions employing ITV moving toward computer-enhanced systems that can bring instruction to individual learners at affordable cost without the necessity to use expensive learner sites.

An argument that is often advanced against Interactive Television concerns high production costs. Production costs will be high if developers let themselves be lured into satisfying the viewing habits that have been trained by commercial television. **Costs can be dramatically low if ITV operators stay away from the style and practices of commercial television by deciding not to compete with any aspect of commercial** TV. American universities have shown that users can be led to develop different viewing tastes and habits that are more related to content than the over-stimulating, content-void flicker of commercial TV.

INTERACTIVE TELEVISION: A SUCCESS STORY

Interactive Television has gone through the type of development which I advocate for all learning technology. Initially, some lectures or classroom instruction periods in the traditional format were broadcast to distant locations or were taped for later viewing. Once this was accepted as a welcomed increase of flexibility, the desire for interaction arose. Interaction could be added easily by using the telephone as an affordable feedback channel. The waiting periods caused by dialling the number and waiting for the connection to be made was a considerable obstacle in the light of what I said before. Ways were sought by which an audio connection could be made instantly. This could be done in a variety of ways: the line could be kept open, which increased costs; a line could be leased where traffic warranted it: ISDN's fast switching capability could be used where available.

Over time, a variety of modifications evolved. Where the nature of the educational event was basically asymmetrical, even with intensive interaction, one-way TV / two-way audio proved to be sufficient. Many US educators even argue that they prefer one-way TV for instructional purposes because it provides for better focus than two-way TV. Where educational events are symmetrical as in the case of two groups collaborating at a distance in a seminar-type setting, two-way TV is, of course, to be preferred. However, two-way television is very expensive because of two-way point-to-point or point-to-multi-point transmission. This is the area where the growing together of computer and TV technology with the help of bandwidth-scaleable switching technology, e.g. ISDN (to a very limited degree) and ATM, will be pushed by demand.

US universities are now at the point where they are ready to introduce computer networks and computer-based tools on a broad scale to enhance ITV learning technology on the basis of their solid experience with this medium.

WHAT'S REQUIRED FROM A SYSTEM FOR OPEN AND FLEXIBLE LEARNING

In the light of our discussion, let us ask how a learning technology for Open and Flexible Learning would have to look that satisfies the following conditions:

The Learning technology

- can be built upon existing structures and patterns of learning,
- makes use of technology that has been proven in actual learner environments,
- permits incremental development while allowing planning into the future for funding reasons,
- provides for the opportunity of a good mix of modes and media for learning in response to the needs of the particular situation,
- is built using existing equipment reducing development and equipment costs,
- has a good chance for international standardization of components alleviating compatibility problems in cross-border learning,
- holds out the prospect of international cooperation of equipment and service providers,
- is modular to allow further development through the exchange of modules, and
- has the potential of growing into an international Education Highway.

Such a system is already in the making and a description of it will not seem spectacular or even innovative. However, it is important that we reinforce evolution and avoid revolution in learning technology for the reasons we have discussed. If we exert an influence on the evolution that is already under way, we have the best chance of succeeding in meeting the goats we have in providing good learning opportunities world-wide.

CONTOURS OF AN EMERGING EDUCATION HIGHWAY

I think the above-listed stipulations are best met by a system which is based on interactive television and is made up of components that can exist independently, but fit together as modules in different configurations. Tools based on computer and network technology will fare best if they are used as components in such a system.

The components of this system are:

Broadcast Television (terrestrial, cable or satellite).

- Television as an educational tool can be used either stand-alone or as the video part of interactive television.
- Television has spread around the globe and is available in the most remote regions.
- Through mass production and television's ubiquitous presence costs are low.
- There is already a culture of offering and taking instruction by television in many countries.
- In the wake of television, video recorders have almost equally proliferated around the world. Therefore, instruction by television and by videotape are compatible technologies which can be used in a number of different configurations: Videotapes can be sent to learners; learners can tape lessons from television broadcasts; in Tutored Videotape Instruction scarce high-quality material can be combined with the advantage of interaction.
- Education channels already exist in many places. Patterns of supporting educational television are established political structures in a great number of countries.
- More and more instruction is offered on video tape.
- A task that lies ahead is setting up alliances between television channel operators, content providers and operators of feedback channels (telecoms) to use broadcast television as interactive television where needed.

Classroom Television

- With broadcast television normally too expensive for delivering education to small groups, there have to be facilities that allow television transmission of educational events at minimal costs.
- Over many years of delivering university education by interactive television, US universities have reduced costs dramatically through equipment selection, classroom design and production practices. **Production costs for an educational event are in the range of 100 to 200 US dollars per hour.** That is a totally different dimension when compared with normal television production costs.
- Every opportunity to cut costs has been taken advantage of in these classroom productions. To quote just one cost factor, classrooms appear to be no different from ordinary classrooms and seat the normal amount of students. The technology is unobtrusive, and the instructor or professor holds a lesson in his or her accustomed way making use of the props he or she is used to (blackboard, overhead projector, video demonstrations, computer read-outs etc.). This arrangement means that the instructor needs no television training, and no rehearsal is necessary. In these settings, at the most one operator is necessary who is present only during transmission time and replaces a whole television production crew.
- Classroom television can be transmitted via local links or fed into broadcast networks. It can use feedback channels from the telecoms.

Feedback channel network

- All prerequisites for a differentiated network for feedback channels for interactive television are in place. The still missing link in many places is cooperation between the telecoms and television operators in tailoring feedback services to different types of ITV events and having them available when ordered.
- The service will depend on the nature of the educational event, cost considerations and the availability of technology in a specific area.

- POT, Plain Old Telephone, is available in most places. In the case of older switching technology, either the disadvantage of waiting times for establishing connections would have to be tolerated or lines would have to be kept open for the duration of the event. If institutional support is available the cost for the individual learner or learner group could be reduced by establishing a network of local telephone numbers for the specific purpose of a long-distance feedback network.
- An attractive spectrum of services can be offered where ISDN is available. Connecting times are minimal. A person can be acoustically connected to the instructor practically without delay by pushing his microphone button.
- ISDN, though, offers a lot more. Feedback channels can transmit video without prohibitive costs. This way, two-way video is realized at very reasonable expense. For many applications a transmission rate of 128 Kb/s is quite sufficient the cost of which corresponds roughly to two simultaneous telephone calls.
- A transmission rate of 386 Kb/s will tie up 6 ISDN channels and produces a picture that for most educational applications can be termed high-quality. The transmission cost is still reasonable for many situations where groups of learners are served at the receiving end.
- Depending on the nature of the educational event, an ISDN feedback channel network can be used as a stand-alone facility for seminar-type events. For those applications the telecoms must have the required bridge technology available, so that ISDN conferences can be set up.

Computer network support

- In the environment I am describing here, the various facilities of the "comprehensive learner environments", such as email, file transfer, computer conferencing, data bank and Internet access have the best chance for successful development into viable services. In this environment they can be gradually added on and tested for efficiency and user acceptance.
- These kinds of services can, of course, also be added on to traditional educational structures and practices and provide great benefit. My argument had been that it is risky to introduce an educational system based exclusively on such facilities in one step replacing previous and proven structures. By expanding a platform the success of which can be ensured with greater certainty, the facilities of the "comprehensive learner environments" are placed in an environment in which they have a realistic chance for successful development.

On purpose I am suggesting a system, or better environment, that is based on existing technology. My focus has been on patterns, structures, and practices of learning, as well as political and private sector cooperation, rather than specific technology.

The most important question is: How can we influence patterns and structures, so that technology will be benefit the learning process and is accepted. In the educational environment that we are creating that way, it is relatively easy to exchange technical components.

In today's fast paced technological development we cannot afford to wait for the next generation of technology to arrive. By that time a new development will be on the horizon. Also, it always is hard to predict when a technology that might already exist is ready to be introduced on a large scale.

The technological changes that are probably not too far off in the future are the growing together of television and computer technology and extension of the switched networks to scaleable high-bandwidth transmissions If the basic patterns of technology-supported open and flexible distance learning are laid out as described, it will not be too difficult, in any case manageable, to exchange technical components.

The original is presented in English

Discussion

THE IMPORTANCE OF MULTIMEDIA FOR VOCATIONAL TRAINING

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1. VOCATIONAL TRAINING AND CONTINUOUS EDUCATION SHOULD DEVELOP INDEPENDENCE AND INITIATIVE

Let me tell you about an interesting episode. Two years ago a Russian of the German descent came to Germany and settled in Bonn. His ancestors came to the Lower Volga on the invitation of Catherine the Great 230 years ago. She offered them very good conditions for settlement so the chap found a job as a metal worker and he is still working there.

Once the machine tool stopped: something went wrong with a bolt. There was not a spare bolt in the workshop and there was nobody to ask for it (the master was away) so he sat down in the corner, opened a box with his food, picked up a newspaper and waited. In three hours' time the master and a foreman came and wondered why he was not working though the work had to be done in the morning. The young man explained that he could not work on the machine tool because it broke down. Then the foreman asked him why he did not go to the hardware store to buy the bolt to be able to go on with his work. The chap answered that it had never occurred to him. Why had it never occurred to him? Because in Russia where he came from the state took care of everything, it was not his job to solve such problems.

Gorbachev writes the following in his memoirs, «Under Stalin's system the initiative was forbidden»! This is a very good illustration of the main difference between economic and educational systems in Western and socialist countries.

Our economic system which to be more advantageous can only operate if people can work independently, are full of initiative and if they are cooperative. To behave like that they should learn it while in the kindergarten, in general school, in vocational school, then to learn such things at university and after that the whole life in the system of continuous education. The state and society should grant them sufficient freedom, so that they could act independently and take part in decision making.

A week ago the chief of a kindergarten and a school director came from Moscow to Bonn to get acquainted with our kindergartens and schools. When visiting a kindergarten they were quite surprised to see how the so-called «free games» were organized. Every child can do what he/she wants: to construct from toy blocks, to play with dolls, to do gymnastics or draw. In the view of our guests it was a complete chaos, no discipline at all because the teachers almost did not interfere with what the children were doing. Our guests criticized this method of education And we, their friends, tried to persuade them that it was done on purpose: the method aims at developing independence and initiative in children.

I have chosen this two examples to show the essence of our philosophy of education.

The educational objective besides independence and initiative includes the following two points.

II. HIGH QUALIFICATION AND APPROPRIATE DIPLOMA FOR EVERYBODY

1. The objective must be set: to ensure everybody (as far as possible) the opportunity to get high qualification at general and vocational school!

We believe it necessary that everybody should get the specialty he/she is cut out for, that is at first a basic professional training in the chosen field, then professional improvement, after that life-long learning in the system of continuous education. Qualification standards in vocational training and education are set by the state.

2. Equal opportunities for all:

Every child, every pupil, every young man or girl, every adult should have an opportunity to improve their qualification any time. In other words we have created the system of differentiated education which takes into account individual abilities and talents. Within the frames of this system everyone can change specialization and/or to continue training at a higher level. Our system of education is flexible and open. We hope to ensure through it equal opportunities for all. It comprises social maintenance for young people and adults with scanty means and also for people with deficiencies.

III. EVERYONE HAS THE RIGHT TO TAKE PART IN THE ADMINISTRATION OF EDUCATION SYSTEM

There are administrative boards in kindergartens which are chosen by parents and which help teachers. In schools schoolchildren are represented by the school parliament (consisting of schoolchildren) and the special representative from schoolchildren, as for parents they elect the representative board from parents. Self-government in vocational schools and in higher educational institutions is organized in the same way where students elect their representatives. There are boards of representatives at enterprises and in offices which participate in decision making relating to continuous professional training, in-service training and continuous education.

Parents also take part in decision making about a further form of education for their children, that is what secondary school he will be enrolled in after 4 years in primary school: general school (5-6 more years), general college (6 years), lycée (9 years) or polyvalent school.

As for the organizational structure schools are similar in all 16 lands of Federal Republic of Germany but they differ in educational contents, for example in the subjects taught and the methods used, in organizational work and interior regulations.

In the federal system of FRG school education is in the competence of the lands. The Federal government in Bonn is responsible for professional training at the place of work as well as the use of the Frame Law in higher education.

IV. THE SYSTEM OF EDUCATION IS BEING CONSTANTLY IMPROVED DUE TO THE REALIZATION OF RESEARCH AND PILOT PROJECTS

We are constantly improving our system of education, for example using multimedia in schools, in vocational training, in higher education and even in kindergartens. We are never satisfied with the progress we are making in the system of education! The latter being constantly improved on and it can never regarded completed.

V. THE IMPORTANT ROLE OF MULTIMEDIA IN VOCATIONAL TRAINING

1. Multimedia and competitiveness

Those countries which have small reserves of natural resources or none at all can occupy a proper position on the world market only due to inventions, intellectual achievements and products which can be sold.

The Federal Republic of Germany is one of them.

It is necessary that such countries should have a highly developed system of vocational training and continuous professional education. Nowadays it is only possible through the introduction of multimedia in education. High quality vocational training is a necessary conditions of the countries' economic advance and therefore of the welfare of its people.

The fact that the special knowledge on informatics should be renewed annually on technology - every 3 years, specialized vocational knowledge - every 5 years, knowledge acquired in university - every 10 years, at school - every 20 years is indicative of the necessity to use multimedia thanks to which one can quickly attain the proper level of qualification with due regard for modern requirements. Life-long education is taken for granted this days and multimedia make this process easier and become its decisive factor.

Both basic and continuous professional education can be considerably improved by using multimedia both in qualitative and quantitative aspects.

That is why should be actively integrated into educational process as soon as possible in secondary schools and in higher education institutions, in the system of inside-the-firm training and at the centers of vocational training. This process have already began first of all in higher education institutions. The integration of multimedia in education is a great interest and it considerably increases students' motivation. We know from experience that children and young people whose work on the computer is in the form of a game enjoy it immensely, and thus they have motivation.

Multimedia is a combined integrative use of various types of media in interactive mode (or with the opportunity to work in this mode) based on the application of digital technology. Multimedia broaden the traditional resources of communication, they accelerate the access to various data. One can select top quality information from a large array. It is accessible at any time irrespective of where you are at the moment. Neither work nor education depend on where the place of work or educational center is located. One can give the following reasons from the sphere of psychology in favor of the necessity to integrate multimedia:

- Multimedia activate all human senses.
- Motivation increases if forms and conditions of work change.
- The process of learning is activated due to interactivity.

This completely changes former organizational methods of basic and continuous professional education and conditions of work: the organization of these kinds of activities in time and space. It becomes possible to receive and to use the necessary information of the required quantity and quality when and where one needs it.

It means that:

An enterprise which has a large database can make this knowledge available through multimedia for all the stuff of the firm, it will enable everyone on the staff to get access to all technical data of the enterprise. It will sharply increase the potentialities of basic and continuous professional education and also the possibilities to create new kinds of production.

The first surveys concerning the use of multimedia technologies in basic an continuous professional education showed that these technologies have the following qualitative and quantitative advantages:

- reduction of costs due to the decentralization of places of education;
- reduction of the periods of education;
- reduction of expenses on the development and the extension of the courses;
- individualization of teaching: transfer of knowledge etc.;
- training at the place of work or nearby.

2. The realization of pilot projects of the Ministry of Education, Science and Technology in the area of multimedia - two examples:

2.1. The project «Integration of schools into computer networks» is the starting signal for the future development of the system of education in the Federal Republic of Germany

In 1995 not more than 2 % of population of the Federal Republic of Germany over 14 years old looked in the Internet from time to time, now the situation is different: because now about 50 % of secondary schools are using multimedia there will be the a sharp increase in the use of computer networks in the educational system within the next 3-5 years. Having trained all the students in managing multimedia we will be able to improve the quality of their training, and in the end these new opportunities will be used by the majority.

The Federal Ministry of Education, Science and Technology of the FRG in association with Deutsche Telecom and the administrations of the lands has made a decision to integrate about 10,000 schools into computer networks within the next 3-5 years. Implementing this project its sponsors expect the institutions of local government (communes) financing schools and also the parliaments of the lands responsible for local school education to contribute on a larger scale to the informatization and integration of schools into computer networks. We also expect that the number of enterprises willing to support this project financially and by giving the equipment will grow. The national company Deutsche Telecom has already allocated 36 million marks for the purpose. The Federal Government on its part has allocated 23 millions marks. German manufactures are also rendering a considerable financial support.

All state schools providing general education and vocational schools, all the lands and the teacher-training colleges financed from their budgets, all centers of vocational training and continuous education, continuous professional training of teachers inclusive, can put in applications to be integrated into computer networks. The cooperation with the outside partners (communes, enterprises providing multimedia, research institutes) is encouraged in every way.

This policy in the field of education and the given project includes the development of skills by students and other sections of population when working with the interactive technologies which are already integrated in other spheres (the organization of leisure and professional spheres), the development of international cooperation among students, teachers, schools, creative work on new educational programs, learning and self-education using multimedia technologies, the use of databases and libraries, the exchange of methods of education and didactic materials, mainly to reduce the teachers burden.

The project «Aqua Data» can serve as a good example of using the potentialities of telematics for technical education and other educational courses, it is connected with the teaching of biology, its purpose is to analyze the quality of water at practical lessons on protection of the environment.

The project makes it possible to analyze the quality of water. Students and teachers take samples and put the data in the computer linked to the central educational server, from which one can get the program of the analysis.

This educational server becomes *vade mecum* (Latin: guide) through the German educational computer network which is developing rapidly. It is also linked to regional (land) educational centers.

The central server sends educational materials to the Internet in a prepared and «readable» form, ensures their search with electronic references (the so-called *links).*

«Technology must serve pedagogics» - this is the main principle of the federal initiative «Integration of schools into computer networks». The main thing here is not the demonstration of technical potentialities but a didactic expediency: to arm teachers and students with the method of receiving and processing of information. In every single case the decision about financial help is made depending on the pedagogical quality of the project.

To make it possible for schools to participate of the realization of the projects connected with multimedia, they are allocated financial and technical resources (within the framework of the federal project mention above) to buy and to maintain the equipment. The following expenses are paid off:

- providing with special computers for network interaction,
- setting up a local school network for the interaction of the school computers,
- linking to the global network,
- network maintenance expenses including telephone charges,
- pay for databank use,
- training in using the whole technical infrastructure,
- aquisition of technical software.

2.2. Continuous professional education. The interactive program of computer (through CD-ROM) teaching of teachers at inside-the-firm sentence «Pedagogical Knowledge and Methods of Work».

In the Federal Republic of Germany there exists the so-called double system of professional education: theory is taught to pupils at schools (vocational schools) and practical skills are taught by teachers of inside-the-firm educational centers (at enterprises).

At present in Germany 5.3 mln. people are teaching in the system of inside-the-firm education (training at the enterprise), for 572.000 people teaching is their main job, and continuous professional education is a must for them. For the other teachers working in this system (about 4.7 mln.) teaching is by-work; 68 per cent of them are willing to be taught in the system of continuous teachers' education.

Teachers of vocational schools get basic pedagogical knowledges in colleges of education. However teachers at enterprises are selected from highly skilled and very efficient practical workers but having no pedagogical qualifications. They are included in the teachers' continuous education in Chambers of Commerce or attend some similar educational centers. The course lasts at the minimum for 120 hours and the purpose is to arm them with pedagogical knowledges and methods. This activity is regulated with a special decree of the Federal Government adopted within the framework of the Law about professional education.

The main task of this educational system is to provide highly skilled training of teachers conducting vocational training, so that they could pass good skills to their students. The better the working force is taught the higher is the quality of production both industrial and handicraft. At present the system of professional education is being equipped with the latest multimedia means in basic and continuous inside-the-firm professional education aimed at further improvement of teachers' education.

The special study «Advantages and risks of using multimedia interactive systems in the basic and continuous inside-the-firm professional education» carried out the Federal Ministry of Education, Science and Technology of the FRG in 1994 showed that the use of the computer enables to transfer information in a more flexible and efficient way. The computer may become an extremely important tool of basic and continuous professional education at the enterprise. However this report mentions that the didactic level of the working-outs is not sufficient yet. First of all the didactic preparation of materials should be improved on. There are virgin lands to be cultivated by teachers, designers of multimedia means, video- and audio-operators. At the present moment some exemplary multimedia programs should be developed for a limited number of groups of users to see which didactic means stimulate and motivate their active use.

The program «Practical training at enterprises: interactive program for teachers' education» has become the fist step in this direction. This program was financed by the Federal Ministry of Science and Technology of the FRG, and it was developed and tested by a «Siemens» Company in Munich. It is mainly for the teaching staff in the system of professional education who teach young people to operate machine-tools and other tools in working shop. In the FRG we call these staff «foremen teachers». They work at business and they know all the requirements of production. They are responsible not only for the teaching of new skills to their trainees which are indispensable for this particular job but also general technical knowledge and skills. The program under consideration can be used not only to train foremen teachers but to train teachers for vocational schools who study at universities and later will cooperate with foremen teachers in business.

The interactive program under consideration based on the application on several multimedia means comprises three parts (blocks):

a. the multimedia educational program for interactive automatized training (computer-based training) on the use of multimedia in education and the introduction to the problems of continuous professional education;
b. the program of professional teachers training in the given specialty intended for foremen teachers which materials can be presented on a paper carrier, and at last
c. instructions for teachers on the use of the program.

All the three parts are recorded on a CD-ROM. The expenses on its development were paid off by the Federal Ministry of Education, Science and Technology of the FRG and a «Siemens» Company.

The combine use by the teaching staff of the blocks (a) and a program (b) (we mean the introduction in the problems of industrial training and the training in use of multimedia as well as the program of professional teachers' training) makes it possible for foremen teachers to be and those who are professionally improving to have individual instructions depending on the particular problems which have to be solved. They choose the time and the duration of learning sessions themselves with regard to their demands and the situation at work. This method to «quantumise» learning sessions as the problems arise enables to connect them with particular situation; this connection is also provided through the set of videoclips introduced into the program and in which particular situations at business are shown, the foreman teacher can watch them and then show them to his trainees.

The block (a) has a module structure and comprises eight modules:

• The first module contains instructions explaining how to work on the computer and the principles how to organize continuous professional training.

• The second module gives the description of the advantages of cooperative training of students and the cooperation of teaching staff.

• The third module shows how to work out the outline of industrial training at a business.

• The fourth module gives the description of the main opportunities: how to acquire and improve ones qualification.

• The fifth module gives explanation to foremen teachers how to analyze the situation at work, to presented in the form of educational material, educational situations. It enables foremen teachers to single out jobs trainees can be instructed to do as industrial training.

• The sixth module shows to the foreman how to describe to the trainee the area of his future activity (the organization of introductory talk).

• The seventh module answers the question «How to choose the best method oftraining?».

• The last module «The Manual for Foremen Teachers» summarizes the program of continuous professional training and shows the prospects of further professional development for teachers: the working-out by the foreman teacher himself of his own methods of training.

Thus 8-module block (a) ensures that foremen teachers to be master basic pedagogical knowledge, necessary to prepare them for work.

Videoclips make it possible for foremen teachers to realize better what are the problems to be training of young people and how to solve them. Educational situations are rendered concrete by such means as cartoons, schemes, video and audio information. The films comprise questions and answers stimulating creative thinking over the situations by foremen teachers.

Block (b), the program of professional teacher training - comprises special exercises intended for foreman teachers who are to apply the acquired knowledge into a particular educational situation: the coordination of the working plan of a business or subdivision and the plan of industrial training; compiling of a question list for the first talk with the students. At the same time this manual is the foremen teachers' reference book which he can supplement with his own notes and thoughts.

Block (c) - instructions on the program's use for the teaching staff - enables to maximize the efficiency of foremen teachers' training. We have the post of the instructor on foremen teachers' training. These instructors' duty is to help foremen teachers, they also use in their work the materials of the block, that is the interactive program. Experts who have a great pedagogical and methodological experience in the sphere of industrial training work as instructors. They can answer questions from foremen teachers arising in the process of work or self-training. Instructors can help giving advice on how to organize training in small groups, how to work-out a time-table for it. They should carry on in-depth tasks and discussions with foremen teachers on all these issues. Their main task is to show to foremen teachers how to organize self-training of young people, including the use of multimedia.

This multimedia program of training of the teaching staff in business to be able to teach trainees on machine tools to work at the working shop arises great interest abroad. It can be used to train foremen teachers in any system of industrial training of a similar kind irrespective of the specific character of work. I always recommend that our visitors from abroad should get aquatinted with it to understand how our «two-storey» system of professional training is organized and how it works. By the way you can get a CD-ROM with this program free of charge at the Department of Public Relations of the Federal Ministry of Education, Science and Technology (FRG), whose address and fax number in Bonn I can give you now: Heinemannstrasse 2, 53175 Bonn; 0228/57 - 3917.

To use this block (a) of the multimedia program you need at the minimum AT compatible with PC 488-66 MHz with MS-DOS 6.0 and Windows 3.0 established, with a hard disk not less than 120 MB, a memory not less than 8 MB, two-speed CD-ROM drive, SVGA card for 256 colors, SoundBlaster audiocard with active speakers.

3. You can apply for the videocatalogue on professional training at the Federal Institute of Professional Training (address of the Institute: Bundesinstitut fur Berufsbildung, Fehlirbelliner Platz, 3, Berlin).

In the catalogue is the great number of video courses worked-out (and tested in practice) for the needs of basic and continuous professional training; there are, as a rule, supplemented with printed materials; they are made to train specialists in the following brunches of industry, science and management: building technologies, chemistry, physics and biology, electrical engineering, woodworking, road building, metal working, economics and management; they are for teachers and intended for training in business. The above mentioned catalogue of the Federal Institute of Professional Training contains the review of all this materials and all videocourses provided with annotations.

4. New professions come into being as a result of multimedia use.

Two new professions have come into being in the Federal Republic of Germany which are now officially registered, they are the audio- and videooperator and the film and video producer. Officially authorized training in them has been conducted since 1 August 1996 (it is listed in the state register). This professions have specializations in the development of multimedia means. In this connection the possibility of the introduction of new specialties in such areas as, for instance, information and telecommunication technologies is being discussed.

5. The Federal Government supports multimedia programs in professional training and general education stipulated by the documents of the European Union.

The Federal Government renders help to the Council of the European Union in the development and maintenance of the educational computer programs in professional and general education.

The Federal Government mentions with satisfaction that the cooperation has been established between teachers and producers of multimedia programs, it also approves of the decision to pay greater attention to what users (teachers) say at the development and adjustment stages. Research projects in the field should take into consideration the efficiency and quality of multimedia programs and their impact on teaching and learning.

It is expected that the multimedia programs which have already receive financial support will be examined first to define more clearly the policy of support and privileges.

The top quality programs which have received international approval will probably be translated into several European languages with financial support of the European Union, so that all member-countries of the European Union could make use of them.

The extension and modernization of the research computer network of the FRG, the plan to reequip it and to turn it into a high-speed network, joint (national and European Union) financing of computer networks inside universities - all these examples show how the requirements and recommendations of the Council of European Union concerning the informatization of education are implemented.

The original is presented in French

Commission II

TELECOMMUNICATION TECHNOLOGIES IN EDUCATION AND SCIENCE - THE PRESENT STATE AND DEVELOPMENT OUTLOOK

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INTRODUCTION

The spread of informatics in education, which is the subject of this Congress, cannot be viewed in isolation from the general development of information technologies. It is safe to state therefore that all developing and newly emerging information technologies are one way or another applied in education, this broad sphere of human activity so readily absorbing innovations.

I would like to review but briefly the history, the present state and the nearest prospect of the major component of modem information technologies, namely, telecommunications and network information computer technologies. I should like to present here a general picture to show what new possibilities can be provided by the development of some or other components of telecommunication network technologies. Technologies in this case mean the totality of computer hardware and software and the methods of their application for infonnation communication and control of big volumes of diverse data, including audio and video infonnation.

I think that one of the main objectives of this Congress precisely is to introduce to application experts new possibilities of basic technologies to be used for finding the best ways of applying these technologies in their Field, in this case in education.

1. THE PRESENT STATE AND DEVELOPMENT PROSPECT OF TELECOMMUNICATION TECHNOLOGIES

The approaching 21st century may safely be called an "information society" era. It is obvious that various states and public organisations are increasingly interested in the success of telecommunication technologies as a basis for establishing shared information space, or information infrastructure, of the globe. At present an information infrastructure is viewed as a major component of any kind of activity, as a totality of information resources and the hardware and software facilities of information technologies and telecommunication networks.

I would mention here the main factors having a political effect on the establishment of an information society:

• discussion of projects of establishing a global international information infrastructure at European Community commissions and Q-7 summits;

• EITO — European Information Technology Observatory — a large-scale European initiative designed to develop a comprehensive view on the European market of information technologies and services for a given industry for both individual users and public organisations;

• RACE — R&D in Advanced Communications Technologies in Europe — the all-European research program of developing advanced communication technologies;

• a program of establishing a U. S. National Infrastructure Plan (1993) and the 1996 U. S. Law on Telecommunications;

• a program for the development of the means of communication and informatics of Russia's Ministry of Communications, the Rostelecom projects (Central and Southern), the Interagency program of the Russian Academy of Sciences, the Ministry of Science, the State Committee for Higher Education, and the project of establishing a national network of computer telecommunications for science and higher schools. Telecommunication technologies play a key role in this sphere, determining the rate and "quality" of building an sphere, determining the rate and "quality" of building an information society.

Telecommunication technologies for building information transmission networks emerged as an individual notion only in the middle of the 20th century, and already at the end of this century we see them penetrating every sphere of human activity. There are several factors that have had a decisive effect on the development of telecommunication technologies. The first of them is progress in the microelectronics industry and the development of computer technology and the success scored of late in the technology of optical (fibre) systems.

Information transmission networks have made an immense breakthrough from telephone and telegraph networks in the first 30 years of the 20th century to integral digital networks transmitting all kinds of information (speech, data, video).

Telecommunication technologies have been progressing in parallel and were interconnected with the development of communication channels from analogue to high-speed digital optical-fibre communication lines and the total computerization of society.

The stages in the development of telecommunication technologies:

- telegraph and telephone (pre-computer epoch);
- data-transmission between individual computers along selected channels with the use of modems;
- data-transmission networks with packet switching — datagram or those using virtual links of the X.25 type;
- local computer networks (LCN) or local area networks (LAN), the most widespread of them being Token Ring and Ethernet;
- integral servicing digital nets (ISDN), broadband and later narrowband;
- high-speed parallel networks — Frame, Relay, SMDS, and ATM;
- high-speed local area networks — Fast Ethernet, FDDI, and FDDI II (the development of FDDI for simultaneous transmission of speech and video information);
- *information superhighways* (routes).

Most impressive breakthroughs in telecommunication technologies have been observed over the past 15 years.

The most significant achievements, in our view, are:

X.25. For quite long the most widespread approach to setting up data exchange networks was the one based on the ideology of space and time packet switching determined in keeping with MKKTT X.25 recommendations. Typical for this technology is packet transmission along temporarily arranged virtual channels and also fairly complex functions of controlling transmission processes to be done by a network to increase the reliability of information delivery to the user. This technology has been studied and improved many times, but it remains to be a basis for a broad class of telecommunication networks to this day. One of the reasons why such networks remain of significant practical use is their satisfactory functioning in the conditions when low and middle quality channels are used.

TCP/IP. Data-transmission in accordance with TCP/IP protocols is based on the datagram method of packet switching with independent packet routing. A number of special networks (a network of the U. S. Defense Department — ARPANET) were established with the help of this technology, which remains efficient and competes well with the virtual call method. A wide use of the TCP/IP in Internet is a good proof of this.

ISDN. To broaden the spectrum of services provided by a network, to improve their quality and to perfect the transmission of digital information, many countries began actively to develop in the mid-1980s integral servicing digital networks (ISDNs), first narrowband (N-ISDN) and later broadband (B-ISDN) ones. The main purpose of ISDNs is to transmit various types of information at a high speed, including transmission of speech, teletext, videotext, and electronic mail; and for B-ISDNs it is teleconference, transmission of TV images and parallel processing of information.

One of the main problems related to B-ISDNs was that of choosing a commutation method to be placed at the basis of such systems — commutation of channels (similar to the traditional commutation system used in an ordinary telephone network, in which a physical channel is established between a corresponding couple of subscribers for each link) or a variety of packet switching (in which a network transmits information organized in a special way into packets of data provided with an address of their destination).

The method of packet switching (commutation) is more flexible from the point of view of transmission speed and is more suitable for transmitting various types of traffic.

ATM. National and international organizations on standards have shown notable progress in the past few years in formulating the principles of a technology for transmitting diverse information. These organisations recommend for this a standardized technology of transfer, multipexing and commutation called Asynchronous Transfer Mode — ATM.

ATM is a variety of the packet switching method with virtual channels and it combines to a certain extent the advantages of channel switching and packet switching methods.

The basis for the ATM is a single digital format and common regulations of the transportation and commutation of all kinds of information, including service information.

SMDS. Switched Multimegabit Data Service is a high-speed commutation service of data-transmission, similar in its properties to the ATM, but, as distinct from the latter, it uses the datagram commutation method.

The current specification of the SMDS offers users access on a selected line with a speed of DS1 (1,544 Mbps) and DS3 (45 Mbps).

Frame Relay. The Frame Relay (FR) technology is a variant of the packet switching method. It emerged and developed as a technology designed precisely for transmitting data, but at present it is increasingly used for the exchange of speech and even video information.

A distinctive feature of the FR technology is partially refraining from complex procedures of spotting and correcting mistakes during the transmission of information along communication channels. This allows to make the most of the channels' capacity and of the resources of the commutation equipment.

The FR technology is an effective means of linking local networks. At the same time, the use of powerful mechanisms of multiplexing and controlling the flows used in the FR method makes it highly capable for integration and for increasing the efficiency of global and national networks, especially when there is a great variety of protocols, in accordance with which users transmit their information to a network.

10 BASE-T. Though the Ethernet technology appeared over a decade ago, it is the 10 Base-T standard, devised by the IEEE 802.3 committee, that led to its wide application in the late 1980s. The standard which determined the Ethernet development with the use of non-shielded twisted-pair lines changed the nature of the LANs.

The 10 Base-T standard specified the use of the topology of the "star" type and concentrators, which made networks more reliable and easy to control.

As soon as the industry recognized 10 Base-T as the main method of building Ethernet, the price of concentrators and network interface cards dropped a great deal, which encouraged the wider spread of this technology.

LAN Commutation. The appearance of commutation marked immense progress in LAN technology. As distinct from the technologies of parallel LANs, where a fixed capacity is divided among the devices connected to a LAN, commutators made it possible to give each port a capacity of 10 Mbps, greatly increasing the capacity of LANs and improving their characteristics.

The ATM technology has stimulated still more the development of LAN commutation. The ATM differs from other technologies in that it supports the transmission of speech, data and video information at the speed of hundreds of megabits per second. Possibly, the ATM will become the first technology used in local area and territorial networks.

Distributed Optical Fibre Networks. The use of optical fibre in distributed networks allows to guarantee practically unlimited speed of information transmission, its high quality and reliability. Companies owning remote communication networks use the technology of digital communication with optical fibre to rearrange their networks entirely. And so do Russian telecommunication companies.

The wide use of optical fibre has required new technologies of digital transmission of signals. The technology of synchronous digital hierarchy — SDH/SONET — proved the best. It gives standards for data-transmission at the speed of up to 2.4 Gbps with a possible increase up to 10 Gbps.

Wireless Networks of Mobile Subscribers. The achievements in the past decade in mobile and wireless communication systems (especially satellite and cellular ones) give users access to networks capable of transmitting data from any place, also during movement.

The most widespread technologies at present are those using the MPT, NMT-450, AMPS, and GSM standards.

These technologies are being developed and are improved. One of the more promising directions here is the use of the CDMA method — code division multiplex on the basis of the IS-95 document. This technology allows us to make a more rational use of the radio frequency spectrum of a channel.

Internet. I should like to dwell in greater detail on the successes of Internet. It is the most powerful and fast growing telecommunication network of the present time. Within a comparatively brief span of time Internet has made a big stride from a network of merely an institution or an agency to a worldwide information telecommunication infrastructure.

At present 75 countries of the world have access to Internet, and another 77 have been provided an opportunity to be connected through electronic mail to the worldwide Usenet news network, which allows subscribers to exchange information on different technical matters.

According to *Financial Times,* about 40 million users are linked by more than 40 thousand networks in Internet today. A new network is connected to Internet every 30 seconds, and 1 million users appear every month. It is most likely that by 2000 the number of Internet users will exceed the 100-million mark.

Internet appeared after a project was launched in the mid-1970s by the Defence Advanced Projects Agency DAPRA of the U.S. Defence Department. Invited for the project were the research and technological resources of the university, industrial and governmental laboratories of the United States. The telecommunication infrastructure was designed together with the National Scientific Foundation (NSF), the Department of Energy, the Defence Department, the Department of Health and Human Services, and the National Aerospace Agency (NASA). The international network which appeared as a result is called connected Internet, DAPRA/NSF Internet, TCP/IP Internet or just Internet.

Internet today is a transnational infrastructure uniting a large number of various computer networks working on most diverse protocols, linking various types of computers and effecting data-transmission along telephone cables, optical fibre, and radio or satellite channels.

The main criteria for a computer's access to Internet are the use of the TCP/IP protocol for inter-computer exchange, linking to any global network and observance of definite regulations on addressing and routing.

Internet is arranged according to a hierarchic principle. At the lower level of the hierarchy are the local area networks linking together the computers of individual users, and at the upper level is the global infrastructure called Internet with various networks within it consisting of millions of computers on all continents.

Internet has no administrative body controlling its entire infrastructure. There is only a number of fairly authoritative committees acting on a voluntary basis and formulating general recommendations on the principles of network operation.

Internet offers the following classes of services:

- electronic mail;
- news and conferences services;
- access to files;
- access to documents prepared according to the HTML standard (World Wide Web — WWW);
- remote processing of data.

Electronic Mail. Electronic mail has been in existence for over a decade, but only in the mid-1980 did it become widespread in the business world, in research and in education. By the end of that decade it already was one of the most widely used network applications.

According to a study conducted by the Association of Electronic Messaging Association, there were 23 million electronic mail users in 1994, and this number is expected to increase to 73 million by 2000.

WWW. A rapid increase in the number of Internet users in recent time has been largely caused by the development of a language used for describing hypertext HTML documents (Hyper Text Markup Language). The HTML allows to create documents of a flexible structure including text, table, graphic and sound information. The extended structure of an address in HTML references made it possible to place the pages of one and the same document in various Internet servers.

Precisely the mechanism of hypertext references made allowed to unite separate Internet servers into the World Wide Web.

The need to work more efficiently in the ever expanding information space of Internet required the development of special program means of navigation in this information ocean.

Such programs, called *browsers,* should today be installed in any computer linked to the World Wide Web. With their help the user gets access to the WWW servers and receives selected HTML documents at its working station, and viewing, editing and printing them.

Further evolution of telecommunication technologies will evidently be determined by the following factors:

- increase of the speed of information transmitting due to the ever increasing capability of broadband lines and the general use of optical channels;

- developing intelligence of information transmission networks;
- a growing number of users and their mobility caused by breakthroughs in the microelectronics industry and the resultant cheapening and miniaturization of terminal means and the use of wireless communication equipment.

Speed. High speed is necessary for transmitting images, including TV pictures, for integration of various types of information in the multimedia context, and for interconnection of local, city and territorial networks.

Intelligence. The growing intelligence of networks is ensured by the use of microelectronics and software in each individual network device. Such intelligence makes networks more flexible and reliable, increasing their capability and facilitating control of global networks even in different media.

An intelligent network makes it possible to use a large number of services both for the user and the network manager. One of the key factors is that a network offers an easy and dynamic system of orders and a configuration in keeping with the user's changing requirements. The user's role, too, is changing radically from a passive user to an active client.

A Large Number of Users and Their Mobility. Wireless means and miniaturization lead to a global spread and mobility of terminal equipment and terminals and, therefore, to global mobility and ubiquitousness for their users.

Wireless digital devices may have a great and decisive effect on the market which is still dominated by analogue devices. Digital devices, such as the CT2 (The Second generation of Cordless Telephone), the DECT (Digital European cordless telecommunications), the GSM (Group special mobile), the CDMA and the PCN (Personal computer network) have marked big progress towards data-transmission networks and multimedia. The miniaturization of electronic devices, the increasing spread of PCMCIA standards (Personal Computer Memory Card Industry Association) and cost reduction lead to the development and wider use of the terminal systems owned by users.

In mobile communication a growing role is played also by satellite systems. Some projects, as, for instance, the *Indium* project of the Motorola company, envisage establishing worldwide global communication networks on their basis.

Telecommunication (and information) technologies, which in the near future will have a decisive impact on the following developments:

- *Optical technologies* (SDH/SONET):
  — the increase of speed and lowering the cost of access to a network and, consequently, the increase in the number of users.
- *Broadband channels* (B-ISDN):
  — a possibility of transmitting diverse information along one and the same channel and, as a result, an increase of the speed of operation and intelligence of a network.
- *Single technology of multiplexing and commutation (ATM):*
  — the increase of network intelligence.
- *Methods of compressing information.* Methods of coding and compressing information will have a key role to play in the evolution of broadband networks, making it possible to increase immensely the number of transmitted information flows, thereby providing a possibility for transmitting multimedia, television and other information of high quality.

The following compression standards may be regarded as the most significant ones: MKKTT recommendations of the H series, JR.EG standards and the group of MPEG-1,2,3.4 standards.

- *Commutable LANs* (Fast Ethernet, FDDI, FDDI II, ATM)
  — the increase of network capability and intelligence.
- *Digital wireless communication*
  — the increase of mobility and the number of users.
- *Network inter-operability* (Java);
- *Universal access to Internet (WWW) services.*

2. DEVELOPMENT OF COMMUNICATION FACILITIES AND NETWORK INFORMATION TECHNOLOGIES IN RUSSIA

The Russian Federation is unique in size, in the variety of natural and climatic conditions, in the number of ethnic groups living in it and in the spread of communication means. The territory of Russia, 17.1 million sq. kilometres large, has 11 time belts and 6 climatic zones. It is populated by about 200 nationalities and ethnic groups numbering 150 million people.

Russia's education system, one of the world's largest, comprises 69,000 general education schools, over 2,600 specialised secondary educational establishments and about 800 institutions of higher education. On the whole, about 40 million people (teachers, students scholars and researchers) are in the education system of this country.

For decades the communications and their infrastructure in Russia have been developing according to the priorities in maintaining the country's sufficient defense capability. For that reason communications were provided, above all, for state administration bodies, the Armed Forces, the law-enforcement bodies, and the military-industrial complex. In was not until the second half of the 1980s that the development of communication networks for common use was looked upon as a priority. At that time also data-transmission networks accessible for the general public appeared in Russia. At present, dozens of such networks are at work in Russia, some of them are of a national level and are linked to the general telecommunication system of the globe.

In the middle of 1996 telephone network density in the Russian Federation (a sign of a development level of any country) reached 17 telephone numbers per 100 people, which corresponds to the present economic level of this country. To compare: telephone density in industrialized countries is, on the average, 47 per 100 people.

To establish a modern telecommunication infrastructure on a vast territory of Russia is hard indeed. This task is being accomplished in three directions:

- work on large-scale national projects;
- development of, and support for, regional telecommunication projects;
- activities of non-state organisations in this sphere.

Russia's primary communication network is being developed in accordance with the "Inter-Related Communication System" concept of the Ministry of Communications, the Rostelecom projects for digital channels being its major component. It is safe to say even now that, as soon as the construction of the Russia-Denmark, Russia-Japan-South Korea and Italy-Turkey-Ukraine-Russia telephone lines and the Moscow-Khabarovsk digital radio-relay line should be completed, Russia will be in the world telecommunication circle.

The fulfilment of the inter-agency program "Establishment of a National Network of Computer Telecommunications for Science and Higher Education" is of major significance for education and science. Taking part in the program are the Ministry of Science, the State Committee for Higher Education, the Russian Academy of Sciences and the Russian Fundamental Studies Foundation. The programme is to be carried out by 1998. Its purpose is to create a basic telecommunication computer hardware and software medium ensuring a rational integration of the operating computer networks and providing conditions for mass access to national and world information resources and ensuring an efficient exchange of information flows and the development of national information resources, including databases for priority directions of fundamental science and higher education.

The program includes over 100 projects and its total financing is over 200 billion rubles.

The carrying out of this program and of the initiative of George Soros on connecting major peripheral universities of Russia to Internet will result in establishing telecommunication networks for research and higher education in a large number of Russia's regions.

In the framework of this program a Moscow Support Network is being established in the Russian capital. It will consist of Northern and Southern parts. The latter, uniting mainly research and educational centres, is already in operation.

Linking to a support network can be effected by different methods, depending on the available resources and equipment:

• through commutable and selected channels of a common-use telephone network (speed up to 28.8 Kbps);

• through specially arranged selected digital channels (the speed, 64 to 2,048 Kbps);

• through a segment of a local area network LAN (the speed, 10 Mbps).

These methods may be regarded as standard for connecting research and educational organizations to regional networks.

The association of Russian research and educational organizations that are the users of the electronic data-transmission networks established in 1992 - RELARN (Russian Electronic Academic & Research Network) - is developing telecommunications for research and education. Payment for traffic for the association's member organisations is subsidised by the Ministry of Science and other agencies. The subscription points of the RELARN association are connected mainly to the Russian section of Internet (Relcom, Demos), due to which subscribers may have access to the international resources of these networks. At present RELARN has about 1,000 connected subscribers.

Now I would like to go over to regional telecommunication projects. The interest in establishing regional information and telecommunication computer systems was beginning to show in 1992, and in 1994 it was clearly pronounced. This interest was encouraged by the growth of market-economy relations in Russia, which sharply increased the need for reliable information delivered in due time.

At present such networks operate commercially in 10 to 15 regions of Russia. Most of the equipment installed in them use the X.25 Protocol. As a rule, a standard set of information services is offered in these networks — electronic mail, remote access to databases, file transmission, and linking to other networks. The subscribers of these networks are regional banks, state administrative services, some commercial organisations, and users. Networks of this kind are fairly profitable, and their cost is compensated within 18 to 24 months.

The practice of using regional networks shows that already after 6 to 12 months the demand for the quality and the amount of information services increases. This pertains, above all, to the time during which information reaches the subscriber and also to access to Internet. As a rule, most subscribers prefer to get information on-line.

The development of the market of telecommunications in Russia is notably influenced by the activities of non-state organizations, and also foreign firms. Thus, the Italian Italtel firm is active in developing the telephone network in Siberia, the Swedish Ericsson is supplying telephone stations for Russia's regions, and German Siemens is modernising the telephone network in Kaluga.

About a dozen data-transmission networks using various primary networks (satellite, wire and radio-relay communication channels) have been established largely through the efforts of non-state organizations. Among the bigger ones are Sprint, Infotel, Rosnet, Rospak, Relcom, and some others. The Business Networks of Russia project is at a blueprint stage. Most of the networks used are purely commercial, providing information services for a fairly high price. The most popular network offering services for a moderate pay is Relcom.

The communication systems and telecommunications in Russia are developed with the use of advanced Western telecommunication technologies. At the same time, national technologies, which have become accessible due to conversion of defense facilities and are adapted to Russia's conditions, are used extensively in this country.

CONCLUSION

In my speech I wanted to draw your attention to the idea that all the latest achievements of modern information telecommunication technologies, which I have tried to describe here, should be used in disseminating informatics in science and education.

At the same time, I should like to stress that the experience of Russian experts in the development and application of telecommunication technologies may prove useful for other countries having common specifics with Russia, such as vast distances between populated areas, insufficiently developed networks of primary communication channels, and the need rapidly to reach the level of advanced telecommunication development.

The original is presented in Russian

TELEVISION-COMPUTER INFORMATION TECHNOLOGIES AND DISTANCE EDUCATION

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The continuing advance of information technologies has led to an increasing number of higher educational institutions using these technologies in the learning process. Apart from those, recently, television-computer information technologies have come to be applied, which extensively utilize television facilities of information processing and communication.

The present report reviews the results and experience accumulated by the Tomsk State Academy of Control Systems and Radio-Electronics *(TASUR,* Russia) in the course of its research in this field conducted with a special view to distance education.

The intended goal is extending the market for educational services in the West Siberia region by setting up a distributed network of branches and organizing in-house training process for the first and second year students. At present, the Academy has branches functioning in seven cities: Surgut, Nizhnevartovsk, Sayanogorsk, Yakutsk, Yurga, Noyabrsk, and Nefteyugansk, with the total enrollment in the full-time and correspondence courses exceeding 500. The biggest branch is in Surgut, with the number of students around 250.

The technical base for implementing distance education comprises:

- the Academy corporate computer network CCN TASUR (information-communications unit in three academic buildings, local computer networks in these buildings, local computer networks and remote terminals in the Academy branches);
- a television-computer system complete with the facilities for building and transmitting Teletext programmes and computer data via television communication channels;
- a satellite television receiving and transmitting complex.

The basic link within CCN-TASUR are the information and communications blocks which integrate local circuits into a common informational environment and are a gateway into CCN-TASUR and the global networks. Each block includes a file-server controlled by OS Novell Netware 3.12, a communication UNIX-system controlled by OS UNIXFreeBSD 2.0.5, and learning UNIX-systems controlled by SCO UNIX.

The communications UNIX-system provides for interaction between CCN-TASUR information-communications unit and between these units and the communications units of other networks, and acts as a gateway between the LAN of each of the academic buildings and the other networks with an access to Internet.

Apart from the above functions, one of the information-communication units is responsible for external interaction with other networks. It also comprises a modem control panel for remote access over switched circuits, circuits for the city-area informational environment, IP-circuit to Novosibirsk and Moscow, *Iceberg* facilities of the *Inmarsat* network with a satellite telephone line, a node of the international non-commercial FIDO telephone network. The network nodes are linked together via three replicated variants - a telephone line through shortmodems on the basis of TCP/IP protocols; a 10 Mbit/sec transmission speed radio channel; switched telephone circuits using standard Hays-modems on the basis of UUCP protocols.

The internal circuit infrastructure of each academic building's LAN is two-level: inter-server segments of the local network link the servers of the Academy sections and classrooms. All local networks within each building are running on the Internet basis and using the protocols IPX/SPX and TCP/IP.

The total number of currently operating local subnets of CCN-TASUR is 25, and the number of workstations is around 320.

The creation of the software and technical platform for the numerous informational resources supporting the educational process allows us to speak of a possibility of their extensive and effective application for the needs of the learning process, in particular, for organizing elements of distance education (DE).

The following facilities are available to the users of the local networks (with respective rights of access, needless to say):

- access to all LAN files and UNIX-servers;
- access to electronic mail: local (within an academic building) and global;
- access to Internet and FIDO via the gateway;
- using ETELNET protocol for linking a remote terminal to any UNIX-system within a local network or Internet;
- operation in the FTP mode for exchanging information (data files) with the clients linked to Internet;
- access to the electronic board bulletin (NET BBS);
- using the multimedia distributed information system on the basis of the World Wide Webserver.

Given appropriate computer hardware and software resources, WWW technology is a very good structural kernel for a DE system, extending by far the BBS qualitative and quantitative characteristics.

DE accessible electronic communications external with regard to the local networks could be broken down into the following three categories:

• using Internet services and protocols;

• using FIDO-NET mail;

• using direct modem links over switched circuits (UUCP protocol support).

A learner chooses one of the electronic communications channels proceeding from its technical capabilities, while the TASUR communication nodes potential allows to support all the above listed communication categories on the basis of available facilities. From the point of view of scope of possibilities and availability of all the protocols and communication technologies (WWW included), the application of IP protocols is preferable. The network users linked to FIDO can use FIDO electronic male to exchange information with a remote educational service irrespective of the territorial location. If a direct modem link is used, the user can work with the educational network BBS via its modem input and has available an information-reference system and two-way data files transfer.

Of special interest nowadays would be research toward finding a way to increase the number of computer data users. This concerns, in part, dissemination of information over Internet networks to many users simultaneously. Most of the communication channels today use telephone lines. However, considering the requirements placed upon communication transmission channels, such as high transmission speed, great volumes of transmitted information, stability/reliability of the communication channels, etc., it is possible to find ways of using television communication channels for the transfer of additional educational information (AI). This will not raise its cost or affect the quality of data communication services. A distinctive feature of the existing television broadcasting network in Russia is its high centralization degree and hierarchical structure, which corresponds to the structure of information flows in the radial dissemination of computer data flows.

As computer technologies find ever more applications in television broadcasting, the two become increasingly convergent. The trend for convergence can be traced in a number of advanced technologies, such, for example, as *Intercast*, *Smartcast*, *DirectPC* and others, which take advantage of Internet's interactivity and the high communication capacity of the television broadcasting channels.

According to expert estimates, as soon as by the end of this year a considerable number of personal computers will be equipped with facilities for receiving additional information over television channels, and a number of major television broadcasting companies, CNN and MTV among them, have announced their support for the Intercast technology of additional data transmission.

The Academy based its research into the technology of radial computer data transfer on the information system TELETEXT. Its advantage is high transmission speed, simultaneous communication with a considerable number of nodes, long-established standard for data transmission. By this day, the Academy has developed two basic components of the system.

1. A trasmitting centre located at a short distance from the broadcasting television centre and possessing a distributed communication network, with information coming over telephone, telegraph and other communication channels. Apart from the computer equipment and communication services, the facilities include some specialized devices providing for the coding and input of the transmitted information into the television signal.

2. The network nodes, equipped with receivers on the basis of the personal computers with specialized receiving-decoding units. Receiving is possible in any location within the region, provided that television broadcasting can extend to this region in general.

General features of the system:

• transmission of data over an ordinary broadcasting television channel by inserting data during the blanking pulse of the frame scan interval of the television scan (up to 16 lines per frame are occupied), with the transmission of additional data occurring in one frame with the main signal, but with no interference whatever;

• high transmission speed;

• simultaneous data reception by all the network users;

• transmission of great volumes of data (up to tens of megabytes an hour) combined with a high communication reliability;

• a distributed network and high automation level of the information collection process at the transmitting centre, including over telephone lines;

• full support to information transmission and reception in the teletext frame standard (WST, level 1.5);

• permanent feedback control over the transmission quality, exercised by decoding device;

• possibility of dedicated transmission.

Another and relatively independent application of this technology provided by the use of air and cable television for data transmittal and reception in the system of distance education. In this case, data is available to a student over telephone broadcasting channels in a specified mode or as ordinary teletext programmes transmitted eiyther together with standard television programmes or as video-films. By using an ordinary television receiver linked to the data source, it is possible to create an interactive mode of student's communication with data bases and other information, the choice of which becomes available to this student via the system's feedback.

Let us make a brief review of the television-and-computer system created by the Academy researchers for data formulation and transmittal over telephone lines.

The configuration of this television-and-computer system is comprised of facilities for the formation and transmission of teletext and computer data, local area network, video-studios for on-line and off-line editing, a computer graphics studio for building and broadcasting multimedia programmes in the *Invision* mode, television cameras for recording and archiving of teaching courses segments, and a television receivers network with a system for receiving additional text information of the teletext type. Data communication to the users' television receivers can be carried out either over a cable network or in the air broadcasting mode (with the feedback achieved over telephone lines).

The system integrates the best of television, computer technologies, and educational facilities, and provides for the operation of the following distance education functions:

• regular educational programmes for school children, students, and adult learners using the video materials banks currently available in Russia;

• video courses for extra-mural preparation for university entrance examinations;

• discussions, informational advertising, and other programmes of scientific and educational character;

• compilation and transmission in the teletext frame standard of various informational, scientific and educational blocks for organizations and the general public.

At its simplest level, the technical equipment of any user of this system must include a television receiver with a decoding unit. This type of workplace allows to browse videocasts and retrieve additional information via teletext options.

The possibilities are far greater for a workplace equipped with a personal computer besides the above devices. They include archiving, fast search, processing and reproduction of great volumes of data.

The fully equipped working place, while providing most of the functional possibilities, comprises such additional equipment as a modem for data exchange with the Academy corporation computer network. A user, in this case, can order specified types of educational materials, send back the results of educational assignments, etc.

Presently, TASUR specialists in Tomsk, working with the assistance of the independent *TV-2* network, have launched a DM wave-band television channel (Channel 22). A programming-machinery complex has been set up on this basis of this channel for transmission of additional information (teletext and computer data) over television broadcasting channels. Beginning with 1995, the receiving devices have been in exploitation at two television channels of the city of Tomsk. The complex uses data transmission speed of up to 100 Kbit/sec.

The satellite television transmission-and-receiving centre provides for transmission and receiving of the television signal from the geostationary orbit satellites. It comprises a hypersensitive receiving device, a 1.5 Kwt/h, and a 4.5 m parabolic antenna.

Today, the centre presents an integrated satellite telecommunications node comprised of *Galaktika-1* receiving and transmission complex, the terminal *Iceberg* of the *Inmarsat* satellite communications system, the DM wave-band transmission television centre (Channel 22) and an antenna field receiving signals in different wave-bands, an information studio, and a programmes studio of the city of Tomsk as an interregional science and education centre.

Since the inception of the technical centre, in 1993, the TASUR employees have actively contributed to the development of the regional satellite television project *Yenissey-Sibir*, and together with the US firm *Datron*, they were employed in the international expertise of the regional satellite communications system Sibnet international project. They are currently working jointly with the company STS (Moscow) on putting in operation of a digital television complex of MPEG-2 standard via a satellite retranslator *Gorizont* (53° EL). The centre also provides for retranslation of the programmes run by various television companies to the audience in Tomsk via the centre's own transmission node.

This television-and-computer technology, together with the supporting facilities, have the potential for setting up a full and extensive system of distance education in the Siberia Region.

The distance education system combines the basic principles and approaches of correspondence education with the elements of full-time (day-time) education. The principal stress is put on the learners' independent studies of the subjects of education. However, despite the general similarity, the proposed education technology is cardinally different from the system of correspondence education. This difference lies in the fact that a DE user can be in permanent communication with a college or university, obtain information in desired field on request, and get fast advice if a need arises to address a problem, while the tutor can check on the learner's results at any given moment.

It is pertinent to single out two principal sets of problems to be addressed in the establishment of an educational process: education organization and the methods and techniques applied.

The problems of organizational character stem from the need to ensure a synthesis of the specific system of control over the learners efforts, a synthesis of the structure and algorithms of DE functioning which ensures optimal learning conditions for the learners and teachers alike. Much importance attaches to the matters of administrative character designed to ensure effective and reliable functioning of the DE system.

The DE system is organized as a base educational centre (TASUR), regional users (branches and individual learners), and a technical communication system.

The base centre comprises the following divisions:

• the methods and techniques division - responsible for development of instruction methods and specific automated study courses;

• the consultation division - for support of the "hot lines" (including television lines) in the real time;

• the organization division - comprising the personnel department, accountants, etc.

Similar groups may be set up within the branches if a need for them arises.

The programme system *Administrator* occupies a special place in the DE system. Its function is control of the educational process, management of data bases and flows pertaining to the process and methods of education, and adaptation of the instruction process to the growth of the learners' knowledge and providing the users with information at the desired level.

Below we describe a version of the *Administrator* system, including the following functions:

• the teacher's compiling of assignments;
• the transfer of the assignments to the student;
• the student's fulfilment of the assignments;
• the teacher's checking the results;
• the teacher's comments and evaluation;
• delivery of the evaluation results to the student;
• recording the student's mark in the progress register.

The system's authors formulated the principal requirements placed upon its operation as follows:

• the learner's answers to the offered tests and assignments should be transmitted via electronic mail as the most universal means for the assignments and answers transfer;

• the learners' answers may be transferred as an archivised file, containing the executable files as well as the textual and graphical comments;

• the system should register the fact of transmission and reception of an assignment and the student's answers;

• the text results of the student's work should be preserved together with the teacher's comments;

• the message text (the teacher's answer) contains the student's answers and the teacher's comments;

• the qualitative evaluation of the student's results can be made using various criteria depending on the weights assigned by the teacher;

• the results' evaluation (of the rating type or in accordance with the accepted five-mark grading system) is entered in a specific discipline's progress register;

• the maintenance of an electronic progress register should envisage the following functions: editing of the disciplines, topics, study groups, student enrollment, task numbers and respective rating assessments, as well as review of the register and search for any crosssection information (subject, theme, group, individual students);

• the formulation of an assignment for a student means that the teacher can introduce a test assignment in any subject or discipline;

• the results should be chacked against the correct answers which the teacher keeps in a separate data base.

Stemming from the requirements as described above, the system's programme implementation provides for the realization of the following functions:

- e-mail analysis;
- accepting the learners' answers to the tests or problems;
- registering of the teacher's comments on the learners' answers;
- formulation of the teacher's reply;
- maintaining progress registers by particular disciplines;
- formulation of test assignments for control and questioning;
- maintaining a general achievements register.

Work with the personal mail-box begins with message cracking by an analyser which sorts out the messages received via electronic mail. The algorithm of message handling is based on checking the letter's header and the system data accompanying any E-mail message.

If the sender's name is found in the learners base, the message contents is analysed.

The executable files or graphic frames are entered in the special teacher's directory for subsequent verification in respective media. The teacher's personal mail remains in the mail-box for individual review.

The student's answers may be presented as one of the three types of answers or a combination of the three: segments of a text, set of graphical frames, or executable file.

The teacher checks the student's answers in his own time by choosing the data processing option. This function allows to scan the student's message on the screen and insert the teacher's comments.

The checked test together with inserted comments is presented as the teacher's reply to the learner. The test results are entered in the electronic learner's progress register. The identification of the learner, subject, assignment number, and grading system is carried out automatically. Achievement registering includes all the functions designed to support data verification and validation. It allows the teacher to do the following:

- add new assignments, sets of assignments, disciplines and topics, and decide on the maximal assessment rating for each of the assignments;
- add new groups of learners;
- edit any of the above-listed objects;
- purge any object while preserving the archived results;
- scan the crossection results in any of the chosen objects and get a printout of the document.

The express-testing information technology relies oh the idea of building a base of test assignments and learners' answers. The answers may be kept separately from the system, in the teacher's disk, for example. The assignments can be entered at the crossection of disciplines and topics of the chosen subjects. The testing pattern of questioning and evaluating the answers allows to decide on the number of points (the grade) scored by the learner in accordance with the chosen evaluation scale.

The questioning procedure begins with the learner's identification and ends with the entering the scored mark in the progress register. The testing system is useful as an instrument of the learner's self-training and of express-assessment of the learners' achievements in individual subjects of the teaching programme.

When performing an individual assignment, a learner can apply to informational resources of various types. With this purpose in view, TASUR have developed a specialised *Feya* source system intended for creating various programmed instruction senvices (PIS), computer manuals, practical studies aids, control tests, examinators, etc.

The system's functional structure comprises:

- a graphic vector editor for the input and editing of the graphic teaching information with availability of inserting PIC and PCX format pictures;
- a paragraph editor operating in the graphic mode and providing for changing paragraph size and layout, line interval, font and colouring, for paragraph formatting, and for importing text files created by other editors;
- a menu installing editor providing for creating menus of various kinds (5 types of the menu cursor, menu elements of various sizes and screen layout, - practically unlimited number of elements in a menu);
- testing and benchmarking editor allowing to create test questions with three answer versions: injector (keyboard answers input), menu, viewport;
- object management editor for organization of various branching, cycles and transfers depending on a learner's answers or menu options;
- music editor;
- compositor programme;
- executive programme.

Methodologically, an educational programming system within the *Feya* system is an aggregation of interrelated frames. Each frame is comprised of a fixed number of various objects - graphic, text, music, supervision, etc. (some 80 object types altogether). A frame proper presents a succession of actions, a programme describing one act of the overall script of education. The basic idea behind the system's operation lies in the fact that a user applies various processors to create a programme without any implicit recording of this programme. For example, he applies the graphic editor to draw rectangles, ellipses, and lines, requests viewports, etc., while the system automatically records these actions in a frame. Thus, we can talk of two types of viewing for the user: *the first* is external, with the data presented at the terminal display, i.e., the educational information frame, and *the second is* internal, i.e., constitutes a programme describing certain actions leading to the compiling and use of the educational information. This approach to educational information organization allows to achieve the following:

- ensure that the users who are not familiar with programming can compile computer tutorials, while the users who are familiar with programming can create relatively sophisticated educational scenarios;
- obtain a fairly compact presentation of the educational material, which is rather important in view of the fact that the educational materials can be of a fairly considerable volume.

Due to these two features of the *Feya* system has an advantage over similar systems. The main stages in the technology of developing a programmed instruction system present themselves as follows:

- determining PIS goals and objectives;
- creating a general scenario, partitioning of subjects, topics and lessons;
- breaking down the general scenario into elementary acts and their presentation as frames;
- initial stage in PIS implementation on the basis of the system:

a) font review and selection;

b) selection of an interface for scrolling, access and transfer to subjects and topics;

c) selection of the evaluation system;

- compiling an archive for application in the course of the learning process.

The described version of the system:

- ensures the network mode operation of the executive programme in the local area network, with a special protocol, maintained for every learner, for recording the learner's name, surname, and patronymic, date and time of the start and completion of the operations, the contents and length of time taken by each answer, and the resulting mark scored by the learner;
- is supplied with security means protecting the PIS developers' copyright and making the correct answers and protocols secure against any access by the learners;
- possesses an extensive methods and techniques support: a special practical aid was developed specially for the purpose of considering the practical examples demonstrating the system's possibilities.

The technology of developing a programmed instructional system is incorporated in TASUR and was handed over for implementation in a number of higher educational institutions in the sities of Tomsk, Novossibirsk, Krasnoyarsk, and Abakan.

The results presented in this report pertain to the initial stage in the introduction of television-and-computer technologies to support distance education. In our view, further research should sign priority to mastering and application of the WWW and BBS technologies for providing a remote access to the information resources and education support programmes; to enhancing Teletext *programmes transfer rate; to providing organizational support and the development of the methods and techniques required for distance education and to building up informational resources in various fields, subjects and disciplines*

The original is presented in Russian

Commission III

REGIONAL COOPERATION IN THE CONSTRUCTION OF INFORMATION NETWORKS

Ella Kiesi

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NATIONAL BOARD OF EDUCATION
(FINLAND)

The goal in Finland is to link all schools and educational establishments directly to international information networks. Schools have used telecommunication links since 1986. This link has mainly been a slow modem linked to one of the school computers. Its advantage was that it demanded only a very small initial investment. But the use of telephone lines is costly and may amount to considerable sums, if kept open for several hours each day.

Another thing is that one link per school is not very useful in teaching. It was soon realised that of the school wanted to make use of telecommunications and Internet in teaching, it bad to have several computers linked to a network. But the fact that costs grow with each minute limits their use very efficiently. Therefore the aim was set at fixed monthly costs.

Schools should not be only users of information in the Internet, they must also produce information. To make this possible, schools need servers of their own. Direct links, with their routes, servers and running costs, are so expensive, however, that all schools cannot afford them. This is why we started to develop a model in which several educational institutions arc linked into a regional network. It was not seen necessary to create a nation-wide school network, because there are many commercial networks which operate on the national scale.

At first, regional networks evolved around technical colleges, because they had better hardware than others, for instance UNIX computers. Similarly, they had Access to the expertise needed for the use, of information networks and for systems maintenance.

A network is created when local school networks arc linked directly to a server via routes. Distant schools can use ISDN links. Even an ordinary modern may be enough for smaller schools. The school which is the main server is linked to a commercial network via routes. At present the links are mostly wideband ATM links. As the cost is shared, it remains reasonable for each participating school. A network may also have several servers, but it is best to start with only one and acquire new ones according to need.

Practice has shown that a regional network also promotes other forms of cooperation. For instance, institutes can arrange joint in-service training for teachers. In the same way, schools can pool resources in computer maintenance; it would be far too expensive for each school to hire a technician for the purpose. Networking also encourages schools to set up joint projects for exploring new ways to use computers in teaching.

The first regional networks were set up in northern Finland a few years ago. Now every fourth educational establishment is linked to a regional or other major network. There are some twenty regional networks in Finland, and plans for at least another twenty. Their size varies from 20 institutions to 70. Most school networking in the future will be done by means of regional networks. The state subsidies to be granted for networking from 1995 to 1998 will be largely used to create regional networks.

The original is presented in English

COMMUNICATION INFORMATION AND TECHNOLOGICAL INFRASTRUCTURES IN UKRAINE IN THE TRANSITION PERIOD

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The paper addresses intelligence in educational technologies for the conventional and remote case, and the tendency and need for cooperation. This study was supported by the European Commissions, Copernicus Program in cooperation with the Twente University (Netherlands), the Exeter University (UK), the Sofia University (Bulgaria) and the Kaunas University (Lithuania).

I would like primarily to state the Ukrainian position regarding education and informatics. The Ukrainian position is transitional between developing countries, whose objective in the informatization of education are limited, and the developed countries, which pursue complex or advanced goals. In particular, our problems are associated with introduction of intelligence in educational informatics, with the development of theories and introduction of some sophisticated technologies in education. The facts is that our Institute in Kiev, Ukraine, has a long computer record. In 1951 on the basis of the Computer Center of the Academy of Sciences, from which our Institute later grew, the first computer in Europe was developed, and in 1963 the *«Mir»* computer, which in our opinion, was the first personal computer. Hence, our studies in informatics and education, on the one had, need the development of infrastructure and injection of communication and information technologies, and, on the other, hand, in case the available resources of educators, scientists and teachers are supported, we are ready to develop some fairly complicated technologies of education and introduce them. My paper will be, on the one had, an introduction into the existing problems, and, on the other, demonstration of the potential of the countries of the former Soviet Union in the development of informatics in education.

Thus, the Ukrainian national program of informatization has the following top priorities: Internet literacy and support of communication and information technologies, establishment of a network of research centers supporting distance education, creation of computer-based didactic laboratories for uninterrupted training and retraining of teachers, more exactly, attachment of teachers to such laboratories, and, finally, one the Ukrainian priorities are intellectual technologies for the conventional and distance education.

What is intellectuality in education? This is primarily a combination of technological and spiritual aspects in the study subjects. In particular, the Chairman of our Congress *Professor Kinelev discussed in detail* ecological literacy, which can represent the unity of technological and spiritual aspects in general education. A very important point is national aspects in international education. Educational simulation of subject areas is also a manifestation in intelligence in education. The new aspects of cognizing activities are primarily the development of data bases and expert systems by students for the study fields, i.e., a student is not to solve a problem or to answer a teacher's question, but is rather to develop a small expert system of his own, which reflects his knowledge of the study material rather merely solves a problem in a conventional manner or answers the teacher's question. Subsequently, the teacher assesses the knowledge of the student on the basis of the efficiency of the operation of the assessment system that he developed. This project was supported by UNESCO and was implemented in schools and higher educational establishments of Ukraine, Syria, Kazakhstan and Azerbaijan.

Another interesting trend associated with new cognitive activities is the conceptualization of vizualization of knowledge models performed by the students. Very essential in this cases is the multimedia representation of the study material. These problems are still open, and I could only give you the above examples.

Intelligence in the education method is adaptive testing and learning of students. We are now doing some interesting work jointly with Osaka University (Japan) on the ontology of study problems and on the development of student models.

Another point of intelligence in learning methods is the dialog method of education when both the student and the teacher control the process of learning. Some the these Intelligence indices are implemented in a remote module course in communication and information technologies, which is based on the use of WWW. This work is also performed on the Copernicus project, involving the Netherlands, United Kingdom, Bulgaria, Lithuania and Ukraine. This course as it is can be turned to in the Web and take a look at it. It will be implemented, more exactly, subscription to it will be in September. The module nature of this course is manifested in the following. This is merely "Internet literacy", then come course for engineers and a module for the teacher. To give you an idea of this course, I shall refer to Vladimir Kinelev, who said in his address that the time of fundamental knowledge has also come in education. We have been working along these lines too, and for this course we have developed a model of flexible distance education, which I shall try to show you. A general concept of intelligence in education and informatics has also been developed.

The model is the following. I heave no time to discuss each section of the model, but it has 5 basic parameters, including the basic communication system, being used, educational media, flexibility parameter, organization situation, and teaching and learning parameter. As you see, these parameters have, in their turn, their subparameters and values. This model is only the first attempt. Let us illustrate this with the «educational media» parameter. The parameter values have already been stated- For instance the text-based educational media comprises printed material, electronic mail, text-based computer conference. Interestingly, the tendency is text-based in multiple media, i.e., when there exist different representations of the same study material but in integral form, multimedia is integral. And, here I cannot deny myself the pleasure of mentioning cognitive graphics as a media, which was developed in Russia by Dmitrii Pospelov and used in Ukraine by Yurii Valtnekh. Here is the idea of cognitive graphics implemented. In this model this classification has been completed. What is it needed for? Why do we need a model of the above-described type? Firstly, for the unification of the description of the existing courses, in order to see, more or less definitely, what type of remote learning or education has been implemented in a definite course. As shown by experience, this model is a good support for designing and development of new course. This model permits designing a more accurate experimental research of courses, when we establish exactly what parameters in the control and experimental group would be similar and what parameters will differ. For the countries in transition as is Ukraine, such precise techniques of educational research are somewhat new. Finally, this model can be used for the designing of the data base structure of some assessment system, which would be helpful to teachers and designers of the new course in developing new remote techniques suitable to the specific purposes of learning and teaching.

Another line along which we continue working — we cooperate with the Research Institute of Higher Education of Russia — is the development of the general concept of inclusion of intellectual properties in educational technologies. This concept is stated below. Module, multifunctional and multimedia exposure, representation and designing as well as effective local and remote dissemination of knowledge to attain limited and integrated objective of the education, in particular for the provision of cognitive and creative capacities of the students. In contrast to Prof. Kinelev, I believe that this course, is, presumably, more efficient than writing a fundamental education theory in each subject. Perhaps, it would be better to develop the cognitive and creative capacities of the student, who would later gain an insight in the subject under study at the needed level, teaching cooperative skills, providing interaction between work, research and training. These and similar points are stated in a number of our publications, unfortunately in Russian. These are primarily the dictionary *Computer Technologies for Education* a two volume publication, which put together over 600 papers from 120 specialists from Ukraine, Russia, Poland, Germany, Chekhia, Slovakia, Rumania, Cuba, Hungary, Bulgaria and other countries. It was published in 1992 under the auspices of UNESCO, but the theoretical part and the main approaches, which I stated today, in principle remained at a good level. Other publications have been prepared, I will distribute to you information about these works with pleasure. This is in English: *Media and Telematic? Technology for Education in East European Countries.* This is a sort of follow-up of this reference book, which can be demonstrated by my colleagues from the Institute of Higher Education of Russia Yu.I.Lobanov, who is present here. As to me, I am ready to distribute, by way of souvenir, the volumes to all who understand Russian. There are also four copies of my paper available, but in a more complex form.

The original is presented in Russian

RUSSIAN INTERNET AND NEW TECHNOLOGIES IN EDUCATION

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1. MAIN GOALS OF TELECOMMUNICATIONS DEVELOPMENT IN THE FIELD OF EDUCATION

Globalization and internationalization constitute one of the crucial trends of world science development today. At present, the most significant research projects in the field of space, informatics and ecology, biotechnology and nuclear physics unite the leading specialists and research centers worldwide. Presentation and rapid exchange of results, the possibility of manipulating the data in a form similar to their natural occurrence in a particular area are becoming some of the most pressing tasks whose solution determines the rate of progress of science and engineering. Higher school is called upon to train specialists for novel scientific areas; not only should they be receptive to new technologies: they must be forerunners of adopting and promoting such technologies. Higher education should not be confined to the training of top-skills personnel at elitist universities: the entire scientific-and-educational community must be given access to knowledge and experience of the leading research schools. Effective solution of these problems lies in the area of using newest technologies currently promoted by the Internet global network.

Information technologies of Internet, using audio, video and hypertext, provide for scientists, lecturers and students access to non-traditional sources of information at any point of the globe as well as to the means of data presentation and manipulation. Computer technologies transform the forms of extra-mural (correspondence) education and a system of upgrading one's skills, develop self-education habits crucial for the entire system of continuous education. The gap between science and education is being closed, the professional level of specialists is rising.

2. STATUS OF INTERNET IN RUSSIA

Computer telecommunications are relatively new in Russia, but they have registered a spectacular growth. The process was initiated at the end of the 1980s by a few projects launched by major research-and-educational centers (Kurchatov Institute, Institute of Space Research, Lomonosov Moscow State University (MSU), VNIIPAS) backed by state bodies (Ministry of Communications, Ministry for Science and Technical Policy, Russian Academy of Sciences, State Committee for Higher Education). The projects grew in number, part of them went commercial, others, financed by the state, were oriented to solving problems for the benefit of science and higher education.

Relcom, Rosnet, IASnet, Demos are among the computer networks that developed on commercial principles. The first academic networks were Freenet, RSSI, Radio-MSU, MSUnet (networks associated with MSU).

However, all these projects lacked coordination, had no proper state financing for academic networks or profit for commercial networks to be able to establish a fundamental environment, basic infrastructure that would allow to promote on that basis a major nationwide project. This circumstance held back the rate of Internet growth in Russia.

The end of 1993 - beginning of 1994 may be considered a turning point in this process, when projects were prepared and began to be implemented aimed at building high-speed channels (over 64 Kbps) linking major research-and-educational institutions, economic regions of Russia, towns or campuses of universities and research centers.

Such projects include RUNNet, Moscow basic network (ISF and RFFI), main network of MSU, Institute of Space Research, Radio-MSU Russia-German Project and, of course, the 50x50 Project of AO "Rostelecom": building a digital fiber optic channel to provide communication among Russia's largest economic regions. Most of these projects were financed by the state.

In 1994-1995, within the framework of these projects effort was made to establish the main transport environment (including the systems of satellite communication, fiber-optic and radio-relay lines), to set up an infrastructure of major computer telecommunication facilities servicing these channels for data transmission across Russia's vast territory.

3. GATES TO FOREIGN NETWORKS

Alongside the development of the base infrastructure, the following supporting gates to major foreign computer networks were set up in Russia: EUnet (Relcom, 1 Mbps), Ebone (MSUnet/RUNNet, 256 Kbps), Dante-Europanet (Radio-MSU, 0.5 - 1 Mbps satellite link, 128 Kbps ground-based), Nordunet (RUNNet, 256 Kbps). Today, these gates constitute the basis for integrating Russia's networks into a global Internet.

4. INTERNET IN EDUCATION

The current computer infrastructure of telecommunications provides conditions for developing fundamentally different information technologies on this basis, capable of enhancing the efficiency of training and research. For example, the use of unique expensive equipment (including high-capacity computers) installed at research and educational centers for studies and training purposes in any of the regional centers in a remote access mode yields a direct economic effect.

The crucial program whose implementation is based on an extensive system of computer telecommunications is the Program of Setting up a Universal System of Distance Education in Russia. Using the best traditions, forms and methods of extra-mural training at a stage of pre-university education, university self-education and a system of post-graduate education; upgrading and re-training of personnel, Russia's system of distance education produces methodologically and technically distributed environment for lifelong education.

Multimedia and intermedia technologies constitute one of the most promising areas of developing information technologies in education based on computer telecommunications. Unlike the traditional linear technologies using data banks and data bases, packages of applied programs providing for purpose-oriented processing of data and presentation of data in a form close to the one used in a particular field, multimedia integrates the aforesaid technologies and incorporate text, graphics, video and sound.

An example of the most promising means of data exchange in science and education in global networks is WWW (World Wide Web) - an information distributed multimedia system based on hypertext. At present, this is the most powerful means on the basis of which distributed information systems in particular fields of science and engineering, teaching supplements, virtual libraries are created.

An important aspect of developing computer technologies for education is organizing interaction in a mode of audio, video and multimedia conferences, using the global networks infrastructure for data transmission. For lecturers of higher educational establishments and heads of the leading scientific schools video-conferences provide an opportunity for disseminating knowledge, views, ideas among the broad transnational audience, research centers and institutions of learning linked by computer networks for data transmission. Movement in this direction is a real step towards expanding the sphere of active impact of science and higher education on the progress of science and engineering worldwide. This is a practical answer to the processes of internationalization and globalization of science and higher education without detriment to national interests of the parties involved, an answer aimed at mutual enrichment of scientific schools and educational systems of different countries.

Multimedia conferences in Russia are still in the making. One of the first was video-conference Moscow (MSU) - Novosibirsk (Novosibirsk State University - NSU) organized on the basis of the satellite RUNNet channel, using free software distributed within the framework of the "Multicast Backbone" (MBone) Project. A few days ago, we organized a video-conference at the request on the Ministry of Education.

MBone tecyhnology is one of the propitious, rapidly developing technologies of Internet. In Russia, this technology began to be adopted actively in the Southern segment of Moscow base network. The first results of this activity were regular translations from the "Computer Networks" Workshop (Institute of Space Research of the Russian Academy of Sciences), a full-scale translation of the IVth Congress of the Russian Union of Rectors (MSU). At present, this work is continued in Novosibirsk, Yekaterinburg, St.Petersburg. However, a full-scale functioining of MBone calls for channels of at least 500 Kbps carrying capacity. The existing transporting structure of Russia's research-and-educational networks restrict She spread of this technology.

5.FUTURE: NATIONAL RBNET NETWORK

Even a brief analysis of the requirements of science and higher education as far as promising information technologies are concerned, indicates the crucil, fundamental importance of promoting the base infrastructure of the National Network of Computer Telecommunications RBnet (Russian Backbone Network). Success in resolving this problem determines the rate of National Netwoks Computer Telecommunication of Science and Higher Education (NNCT SHE) establishment, development and firther promotion of contemporary information technologies.

Many of the currently operated data transmission computer networks use as internal system-forming mains traditional telephone cable lines, usually leased from AO "Rostelecom". Such lines provide a satisfactory coverage of the entire country, yet they are expensive, fail to secure a dependable quality of transmission and, what is more important, high speeds over long distances (maximum 28.2 Kbps, but usually - 19.2 Kbps). Considering the traffic structure and requirements of Russia's research-and-educational centers (including audio, video and multimedia information, text databases and knowledge bases, computer resources), we realize that RBnet requires a transport medium with a speed of data transmission of at least 256 Kbps and with a possibility of its rapid (as the need arises and information resource becomes available) increase of up to 512 Kbps and more.

Analysis of the existing transport medium of Russia's active data transmission networks indicates that at present RBnet structure may use radio-relay and fiber optic lines of AO "Rostelecom", high-speed interregional channels of particular telecommunication companies operating in Russia (Macomnet, Petrocom, Rosnet, etc.), RUNnet and Radio-MSU satellite channels. At present, all necessary conditions are available for establishing on the basis of these segments a base infrastructure of the network on a nation-wide scale: communication among the largest economic regions is provided to a greater or lesser extent, but there are reserves for setting up regional networks, skilled personnel become available capable of promoting and maintaining these networks.

Of crucial importance for the NNCT SHE Project is the concept of base access points. In fact, these structures are analogs of North American NAPs (Network Access Points), i.e. network complexes providing for local exchange of traffic among various service providers as well as (at a subsequent stage) for coordination of routing policy based on the use of route servers.

A distinctive feature of NAPs dealt with in the Program is their close integration with the main units of RBnet. While securing an interregional exchange of traffic, RBnet channels virtually tie up a series of base access points, of which the following are specified at the first stage: St. Petersburg, Moscow, Yekaterinburg, Novosibirsk, Khabarovsk.

A transparent access of regional networks to RBnet and, via RBnet, to global networks is attained through an institutional-and-technical structure, which, using Internet terminology, is called Internet Exchange (IX), i.e. a point for reciprocal exchange of traffic. At present, already operational is Moscow IX located at trunk exchange M9; St. Petersburg IX (Lenenergo) is going through the launching stage. Together, the base access points (including IX and RBnet unit) and the aforesaid main channels are to ensure an optimum mechanism of intra- and interregional traffic transmission within Russia as well as a duplicated escape to international base networks.

The structuring, operation and development of NNCT SHE base infrastructure will largely depend on how effectively foreign experience of networks building and development is accumulated and taken into account, and on the results of implementing Russia's own telecom projects for science and higher education.

6. INTERNATIONAL COOPERATION IN THE FIELD OF DISTANCE EDUCATION

Internet plays an increasingly crucial role in education. As we know, there are several distance education technologies based on the use of specialized satellite networks, ISDN channels and other technologies. Yet, none of these systems has a worldwide coverage comparable with the current state of Internet. Internet is best suited for internationalization of education. It is an open secret that some countries boast an excellent system of teaching a particular subject; for example, Russia has long been famous for its math schools. With Internet, our western colleagues may be given an opportunity of having Russia's leading professors teach math to them; likewise, our students could study physics at Stanford and Berkeley, etc. Because such system of worldwide education through Internet makes it possible to choose the best all countries can offer, it makes it mutually beneficial. This system should constitute yet another big stride towards realizing an open society concept. An intense daily exchange of information will make it possible to render irreversible the processes of democratization in all the countries as universal human values will be proclaimed as having priority over the ideological dogmas. To be able to solve these problems successfully, there must be a well developed Internet infrastructure in Russia and the rest of the world. Technically, Internet provides all opportunities of comfortable work, including multimedia, for such training, but in reality the low capacity of base communication channels are a major constraint. Much has been done in this area lately. In Europe and USA, projects of setting up a 34 - 45 MB infrastructure are at an advanced stage of implementation. Some segments of this infrastructure already function as part of worldwide base networks. In Russia, too, there have been some changes for the better. For example, at the close of last year, Russia's first access point of the European base network Ebone was installed at MSU. Besides, MSU is also a base point of Europe's second largest base network - 1BDNS (formerly, Europanet). As a result, in terms of capacity of international channels, MSU Internet is Russia's largest Internet provider, with channel capacity of 1.5 MBps. Maintaining these two channels calls for considerable financial inputs, but MSU and the Ministry of Science and Technical Policy, realizing the importance of promoting Internet, make appropriate financial contributions accommodating quite a few Internet clients in Russia. The fairly high for Russia level of Internet development at MSU would have been impossible without relations of partnership with the French academic Renater network and the German Institute for High Energy Physics DESY, which, in association with Russian institutions, share financial responsibility for communication channels. Regrettably, the initiative of the aforesaid organizations has so far been ignored by International institutions, such as UNESCO, European Commission, and others. Strange as it may seem, finance allocated by these organizations to support network projects in East European countries more often than not are used by Russian organizations that are not involved directly in promoting the network infrastructure. Moreover, we ourselves, on more than one occasion, have witnessed a situation where EC network project contractors use free of charge the unique (for Russia) infrastructure set up at MSU, without contributing anything to its growth. The situation is exactly the same with other Russian providers of Internet. Unfortunately, Interment calls for heavy financial investments and the only way out seems accumulation of all available resources (Russian and international) in the hands of providers on a nation-wide scale. A contribution of international institutions would be most welcome as this kind of support would expedite early involvement of Russia's leading professors in the system of world remote education.

The original is presented in Russian

Part V
Theme 4
SOCIAL, ECONOMIC and CULTURAL ISSUES

PLENARY

THE PENETRATION OF NEW TECHNOLOGIES INTO DEVELOPIG COUNTRIES: CULTURAL HEGEMONY OR MUTUAL EXCHANGE

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INTRODUCTION

The presence of a representative from the Republic of South Africa at this international congress signals the re-entry of our country into the fold of nations of the world. We are very excited and pleased to be invited to make a contribution to the deliberations of this august body. This is more so because we are from one of the poorest Provinces of our country where the legacy of apartheid has left a trail of suffering, poverty, ignorance and death.

Although we are new in the business of reconstructing a country, we are faced with a passionate expectation from our people, from the African continent and from the international community to bring into existence solutions that will remove this legacy speedily and serviceably. In doing so we are determined to employ combinations of approaches that have been used by other countries, with the careful scrutiny that ensures that the context of our country in not disregarded. The use of new information technologies is one of the measures we are keenly focusing on. Before one can delve into that, this conference needs to be appraised of the situation that prevails in South Africa after forty years of apartheid rule and three hundred years of colonial subjugation.

To illustrate that point, I will tell you about the situation of education in my country in general and in my Province in particular. It is a story of searing poverty and degradation and a story of sterling resistance and fortitude. The architects of the apartheid system had an obscene if not blasphemous strategic vision. They set out to destroy the brain, the mind and the very soul of our people. South Africa will suffer for many years to come with the legacy of "Bantu Education" - arguably one of the most successful and pernicious educational interventions and social engineering constructs of the 20th century. Its designer, H. F. Verwoerd - himself the architect of "Grande Apartheid" - stated categorically that no black person should ever be educated to a level where he or she became anything above a menial labourer. The consequences of this legislative imposition led to a concerted policy of statutory neglect of educational provision for black people on the one hand, and a progressive dismantling of all semblance of quality schooling which had existed on the other. The church schools and, in particular, the Catholic schools run by nuns and monks, fell into the latter category.

Little State provision was made to keep pace with the burgeoning numbers of black children through the. 60s, 70s and 80s. While there was some effort in the late 80s to reverse this trend, the damage had been done. Black education, even after two years of democratic rule, remains characterised by:

- *complete underprovision of resources such as classrooms, libraries, laboratory equipment, etc.;*
- *poorly-trained and underqualified teachers, tacking in motivation;*
- *the absence of Science, Mathematics and Technology, and the paralysing fear which our people experience whenever these subjects are mentioned;*
- *poor school-leaving results after 12 years of continuous schooling;*
- *poor success rates at tertiary level;*
- *complete inefficiency in expenditure of available resources.*

You might have heard about the apartheid Bantu education but you have not seen or understood it until you hear the story of the Northern Province of South Africa.

When we took power in April 1994 and I was appointed Minister, I thought that in the first five years of our new government I will be able to do away with at least the most grotesque scars of Bantu education. Two years down the line to date, I have gone only as far as to begin to understand the depth of the problems of education in my Province. It is an intricately woven bequest of oppression.

The most visible is the absence of physical facilities. The apartheid government's grand twin to Bantu education was the "Bantustans", alternatively known as the homelands. These were areas which were demarcated to be given to our people whenever they clamoured for freedom. There were ten of them and they made a total of only thirteen per cent of the whole of South Africa. The most common characteristics among them was the way they were demarcated: all of them were barren pieces of land with no means to sustain life.

Since they were to be for people who are "free" or "self governing", the apartheid regime argued that the people who live there will take charge of their own affairs, including building of schools, with their own resources. Now, when you first ensure that you put a person in a place with no resources and then turn around to say "use your own resources to build schools", what will be the result? The result will be that there wilt be no schools. The whole of South Africa is short of sixty thousand classrooms. Of these sixty thousand, thirty five thousand are needed in the Northern Province, if we are to avoid having our children attend schools in all the dilapidated structures we use.

Students were promoted from class to class regardless of their achievement, until arriving at the externally set matriculation exam - and this is where the trouble started. Failing the matriculation examination is a general norm in my Province. Last year seventy six percent of our standard tens failed. When we calculated we found that they totalled about 80,000 students. More than a quarter of all matriculates in South Africa are in the Northern Province. Among them are a significant number who have been stuck at this level up to four, five, six years or even more.

The performance of those that do obtain a pass is far below the standards required for acceptance into tertiary institutions. Since this has been going on over many years, students accumulated who had left school and who had nowhere else to go. To solve this problem, the "Bantustans" started setting up a myriad of teacher training colleges which could accept these students with poor results. They continued doing this until 1994, when the figure of teacher training colleges stood at unacceptably high levels, unacceptable even for standards of "Bantu Education" itself. These colleges have been churning out inappropriately qualified teachers who far exceed demand.

But these are not our only problems. Another legacy is maladministration. By the time we took over power, inefficiency, truancy, corruption, sloppiness and laziness had become the work ethic. In our Province this is especially significant because we have had to integrate three "Bantustans" into the new provincial government.

From time to time, countries are forced to declare disaster areas after freak phenomena like earthquakes, storms and floods, drought and epidemic outbreaks. When such declarations are made the whole country and the world are mobilised for assistance. Deputy President Thabo Mbeki visited our schools early this year. During that visit, he did the most unusual thing: he declared our Province an education disaster area. Perhaps we are the only Province in the whole world where a President of a country found it appropriate to declare an area as experiencing a disaster in education.

WHERE DOES THE USE OF TECHNOLOGY COME IN?

What I have just outlined is surely a disaster in human development. To redress this disaster, we have to be even more sophisticated than those perpetrators who conjured up this inhuman tapestry. We are fervent in our conviction that a mixture of cutting-edge technology and committed politicians, administrators and civil society will make the Northern Province an example of educational reconstruction.

There are fears and concerns and I have heard a lot of them at this very conference, too, that an unchecked introduction of technology could alienate people in underdeveloped countries from their own cultures. We want to argue that, if this happens, it will not be because of technological advances. Rather it will be because of the wrong policies adopted by politicians. Let me illustrate what I mean. In my Province there are six indigenous languages, yet only two could be shown in any form on TV, whether as news, debating programs, comedies, etc. And this, of course, did have the effect of alienating the people from their own cultures because they then regard themselves and their cultures as unimportant. But as you can see, we wish to emphasise that this was not because of the technology but rather it was a deliberate political exclusion of particular groups of people within South Africa from the benefits that modern technology can bring.

Indeed, since the demise of apartheid, the reconstruction of the South African Broadcasting System has brought these alienated communities on board. And it is interesting to note that people are now using technology to display cultures which were presumed to be long dead under colonial rule. This shows that our indigenous cultures are particularly strong, and it further suggests that, had we not been excluded from mainstream technology, our cultures might have flourished more than they do now. Indeed, we are afraid that further exclusion from the mainstream world technologies might tend to render these cultures extinct. So we believe that the important thing is to make sure that appropriate technology is introduced in an equitable manner at an appropriate pace.

For example, it is relatively easy and tempting to continually provide education of some quality in well-resourced urban environments, as was the practice under apartheid South Africa. There was more and more reluctance, however, to move into impoverished black townships and rural environments. Again, this was no fault of technology itself - technology is culturally neutral - problems arise from how technology is used by people. It is essential that any technology programme focuses on these intransigent education problems rather than simply expand the elite.

In my Province there are several main thrusts we are concentrating on:

- the shift of paradigms towards a more learner-centred instructional methodology and re-orienting our education system away from the apartheid "Bantu Education";
- improving the quality of our teachers;
- bringing the teaching and learning of Mathematics, Science and Technology to the forefront of the whole education process;
- modernising management systems and reshaping

our human resources to be in line with advanced and scientific approaches;

- improving material resources and facilities in the entire system.

In all these thrusts the strategy will be to rely heavily on the employment of New Information Technologies (NITs). This is especially urgent as it is becoming more and more apparent that the present educators can no longer cope with the increasing volume of people, children and adults alike, whom we would like to educate. And this situation is most urgent in the rural areas, and specifically in my Province where the human resources development index is the lowest in the country - we have to rely on technology to enhance the effectiveness of the relatively small pool of educators.

TEACHER EDUCATION

At the beginning of this year, we took a radical step and discontinued first year intake into two thirds of our colleges of education. Our intention is to gradually turn these rationalised institutions into technical schools, technicons and other facilities which can produce resources needed by the economy. The unemployment figure in my Province is the highest in the country, at 47 %. Already in ten of these colleges, we are running a mathematics and science bridging programme which is aimed at assisting students who have passed standard ten but whose performance falls below what is required in tertiary institutions or technical employment. Through the extensive use of technology, these students will be leapfrogged into the modem world.

Apartheid education made an all-out effort to ensure that the black population is kept as far away from science and technology as possible. This is in keeping with the Verwoerd statement in Parliament in 1953 during the debate on "Bantu Education" that "there is no need to teach a "Bantu" child Science and Mathematics, because the government will not allow him or her to use it".

We see it as our duty to reverse this destructive policy which in the past forty years has proved to be extremely successful. To this end, we have developed the concept of a Mathematics, Science and Technology Education College (MASTEC) whose aim is to improve the quality of education in these fields and to foster an atmosphere of excellence. This college will be dedicated to the production of Maths, Science and Technology teachers of a high quality. MASTEC will pioneer an innovative approach to teacher training where teacher trainees will be taught in the way we want them to teach their students. Pedagogy and subject content acquisition will be highly integrated; school experience will start in the first year of the student teachers' training and go through all four years. They will work on projects designed to provide hands-on experiences that can form the basis of their own learning, and inform the way they will conduct their classes. Co-operative group work and brain-storming class discussions will provide these teacher trainees with the opportunity to master the language of science and acquire science process skills.

And all this will take place in a computer rich environment, where technology such as Microcomputer-Based Laboratories will enhance the acquisition of physics concepts, and where productivity tools such as word processors, spreadsheets, and data base software will bring students into the 21st century.

EDUCATION MANAGEMENT

To create an effective decision support system, it will be necessary to integrate data from different racial and tribal groups which were held in disparate databases in keeping with the then official policy of segregation. Not only is there the problem of technical incompatibility but also political extremism among officials in charge of these databases, who owed allegiance to the old regime. Since data leads to empowering information, it is not surprising that this gave rise to gatekeepers of all sorts - a clear example of how technological dependence could lead to the worst form of oppression.

The approach we are adopting, under the auspices of the Independent Development Trust (IDT) - the largest NGO in the country, is to develop what we are calling an Education Management Information System (EMIS) that meets the basic requirements of a computer data processing system. This entails the gathering of inputs, processing them, and producing outputs. In addition, those who had historically been excluded from the process of information gathering and evaluation will be slowly empowered to become information workers in their own right. Another obvious improvement is the time taken before the processed results are available. Previously, this was 12-18 months - with this new approach, it will take a maximum of one month. For people who take technology for granted, this might not mean very much. But for my people in the rural Province this represents a great revolution in both cultural and economic terms.

Previously a newly employed teacher could wait up to six months before getting his or her first paycheque! In fact, I must confess that when I was young, I thought this was a natural phenomenon, because I was born into a family of teachers for whom this was a normal feature of life. Imagine what excitement will be created when people get their paycheques on time.

The main elements for implementing this approach would be:

- training the lower level management in the Education Ministry to be computer literate;
- installing computers in all the remote offices and networking these with simple dial-up telephone lines;
- developing software to support this distributed model of computing (shifting from centralised mainframes to distributed PCs);
- producing sophisticated Decision Support Systems for all levels of educational management.

To achieve these objectives, it is obvious that massive resources will be required. The IDT and REACH and TEACH (another prominent NGO), in partnership with my Province, have set about developing a framework for co-operation to achieve these goals.

REACH AND TEACH has been tasked with the infrastructure aspects of this assignment - the installation of computers at deep rural circuit and area offices, as well as supplying the training of basic computer literacy. This has involved some novel approaches, since many areas do not have electricity. The use of solar panels for this purpose has been tested and found to work effectively. In areas where no telephone communications exist, the option of using either satellite or high-frequency radio telephones is being investigated. In this way, we will reverse the marginalisation experienced by these communities.

The consultants from IDT have been tasked with developing the software to split the workload of capturing and assimilating the data between the remote sites and the head office. The first phase of this development will be a system to complete the "Annual Return of Schools" data at the remote (circuit) offices.

With a sophisticated communications network in place, a steady two-way stream of information can be maintained. This would be particularly useful for future requirements for tighter control of school provisioning, textbook deliveries at remote offices, etc. Again for people who take technology for granted, this might hot seem very important, but gross inefficiency brought about by lack of information on, for instance, how many textbooks are needed, will make this particular change seem like another revolution to the education department in my Province.

A government committee to oversee the implementation of EMIS has been established. The installation of computers at the various offices is ongoing, networked with modem access and e-mail. A training programme is being finalised and many officials will receive such training before the end of August 1996. During late August or early September 1996, the entire Province will be involved with a data capture exercise to record all the schools enrolment data.

It is the intention of my Ministry that the means to address the most marginalised of communities must be the most modern technology. Thus in a rural area like the Northern Province we will be using computers with solar panelling and in the near future satellite links for communication. What appears on the surface to be almost anomalous, we intend to make the norm.

COMPUTERS IN THE CLASSROOM

The consistent use of technology throughout the administration will make it much easier to introduce computers into classrooms. In so doing, it also becomes possible to use the technology to change the existing approach and apply a more learner-centred instruction methodology in a resource-based learning environment. Seymour Papert, in a recent book called "The Children's Machine", writes about the intransigence of educational systems to change. He indicates that the school operating today does so in very much the same way as it did some fifty years ago and this, in spite of the tremendous amount of technological innovation that has taken place.

There are a number of well-established principles for reforming education that are known internationally. These include the following:

1. Changes need to be both top-down and bottom-up. This implies that both the bureaucracy which manages education and the school itself need to be involved in any kind of reform agenda. The time is clearly ripe in South Africa for something of this nature to happen given the fact that we are one of the few countries in the world where a total restructuring of the educational bureaucracy is at present underway while, at the same time, there is tremendous disaffection at grassroots level with the quality of education delivered by the schools.

2. It is essential to view school as the entity for reform. This implies that:
   - there must be proper structures for governance which create community involvement with the school;
   - all parts of the school need to be involved in the reform. This is not something that is for teachers or for children only, but is something in which the entire school from the principal through to the pupils need to be involved in and share. This implies also a mutually shared vision for the school.

3. It is essential to create a learning environment that supports effective teaching and learning. This in its turn implies:
   - a programme of training principals and their deputies in the principles of school management, as well as equipping them to support the educational changes being introduced;
   - the creation of a resource-based learning environment so that the teacher is not the only resource available but that small group interactions become an integral part of the learning environment within the classroom;
   - within this environment it is essential to integrate technology and, in particular, computers and multimedia to support learning.

To actualise a programme of this nature it is essential to establish an infrastructure which can support it. The essence of the programme in the Northern Province is to establish Educational Resource Centres (ERCs) which can serve as the engine driving the education reconstruction process. It is envisaged that these centres will be not only the administrative home of the programme but also places at which high-tech equipment such as computers and other multimedia can be placed. The ERCs will be used to train teachers throughout the Province in the use of this methodology which, at the same time, will enable them to become computer-literate. Each ERC will thus form a hub of education activity for the schools surrounding it.

Finally, a major problem which has confronted the Northern Province is the one mentioned above about students who are repeating their school-leaving examination at standard-ten level many times. At the end of 1995, the Ministry took decisive action to remove many of these students from the former schooling system. This was essential to prevent them from clogging up the system and serving a blockage to further education reforms within the schools. All these students were offered the opportunity of what has now come to be called "Finishing Schools", which presently house some 30,000 pupils. Clearly, if they are taught in the same way as was the case in the past, then their success rate will again be minimal. So. together with the IDT and REACH and TEACH, the Ministry is planning to mount a programme to use technology within some of these finishing classrooms to help those in particular attempting to pass Physical Sciences, Biology and Mathematics, in particular.

In conclusion, I trust that you now have gathered some insight into the problems we are confronted with in my country in general and in the Province in particular, and our plans for using the new information technologies to address these problems. I hope that next time when we meet, I will be able to declare that education in my Province is no longer a disaster area -this can only be achieved with the support and help from all who attach importance to nurturing the new democracy which South Africa is today.

I hope I have made it clear that you will agree that the penetration of technology in developing countries may not be a cultural hegemony. In fact, we are having discussions with representatives from various countries who wish to connect schools in their countries with schools in my Province, so that Russian, American, South African, and students elsewhere can learn from each other, thus forming the nucleus of a mutual cultural exchange.

The original is presented in English

NEW INFORMATION TECHNOLOGIES AS A CHALLENGE FOR GENERAL EDUCATION AND VOCATIONAL TRAINING: CHANCES FOR INTERNATIONAL CO-OPERATION FROM THE POINT OF VIEW OF THE FEDERAL REPUBLIC OF GERMANY

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I thank the organisers of this Second International Congress on Education and Informatics for the opportunity of introducing and making a few general comments about today's topic of discussion - Social, Economic and Cultural Issues.

Obviously these come from the point of view of a representative of an industrialised nation. This means there is a risk that various viewpoints which representatives of other countries will undoubtedly wish to be considered cannot be addressed by myself. Therefore I ask this to borne in mind. I will nevertheless try not to place too much emphasis on the narrow German viewpoint, but will instead discuss a few questions about the international situation and draw some conclusions from my perspective.

It seems to me to be appropriate for the topic to be placed in a wider context followed by a discussion of concrete action undertaken in the Federal Republic of Germany. I will conclude by repeating the question of which policies UNESCO offers its members, that is to say which forms of reciprocal exchange in which areas would be of most interest to all.

About ten years ago a director of the IBM company compared the developments in the area of new Information Technology like this: The flow of information from America to Europe a few years ago was like sending a Jumbo Jet at 500 miles per hour over the Atlantic. Now one could send the same amount of information at many times the speed of sound in a mode of transport the size of a fly. If one wished to continue this development then today's form of transport would be barely seen under the microscope and its speed would come close to the speed of light.

This picture of increasing rates of development is closely connected with the growth of knowledge in our world. More than half of all the scientists that ever lived, are living today and the length of time that their scientific developments are valid - or indeed go out of date, and are overtaken - has been reduced to a timespan of between three to five years.

Yet on the other hand the ability for Man to come to terms with and understand this new knowledge has practically not changed. I know of no medical work that shows Man's brain has got noticeably bigger or that the speed of its comprehension has increased. And sadly one must also take into account that there have never been so many wars in the world as since World War Two, that daily, people die from hunger on this Earth and that damage to the environment has never before been witnessed on such a scale.

The challenges for politics and in particular for the politics of education, which follow from this many-faceted development in technology on the one hand and society on the other, are therefore to be answered comprehensively.

In doing so, it is important for me for the focus of my discussion not to dwell on technological problems and possibilities but rather on the needs of society and to ask whether this new technology can provide solutions and if so in which ways. Obviously it is not possible here to discuss all the problems of the world, but only those which can be solved with the help of these new technologies.

Peace, freedom, social equality and personal well-being are without doubt some of the ideal principles which all peoples and all nations strive for.

Important foundations for the fulfilment of these aims are understanding between peoples, the safeguarding of nutritional resources, the development of well-being, the economic prosperity of nations and the potential for the individual to develop him or herself.

Much effort has already been put into all these areas; the striven for development and intensification and consolidation of this work is, and remains, the central task for shaping our future.

Here the information and communication technology can and must perform a central role, if it is not only to be viewed economically or technologically.

It seems clear that the NITs can perform the task of teaching knowledge and understanding very well, because they can carry information and opinions world-wide, quickly and efficiently. However the Main Document of this conference points out that this technology and the information it carries is a product of western thought. Hence the contents of this information does not necessarily correspond to the traditions of thought and the cultural heritage of different nations, not to mention the fact that most of the content is in the English language.

Therefore it can have a negative influence on the conservation of each nation's culture. New problems in mutual understanding can occur due to the direct confrontation between different cultures which without this technology would not have had happened.

The overall dominance of American, Brazilian, Australian or Japanese films and video games which determine the world market have brought forth not only positive reactions. More significant for example is the introduction of a quota of European material in the European TV schedule in an effort to protect European heritage from the American competition.

However in Europe there is not yet licensing for software. The production of many software products from Japan and the USA shows however that even in the area of digital technology one can see influences on cultural tradition. A not inconsiderable influence can be expected on the educational process due to the fact that these products (especially computer games) are aimed in most cases at children and young adults. Through this new divisions could be created between cultures which would work against the possibility of mutual understanding.

If this is already a problem between developed countries then it can be expected that especially between developed and developing countries an even bigger divide threatens. To prevent new cases of conflict close co-operation between countries is of special importance. New technology can be again useful in this quest: new technological possibilities between cooperating parties can widen and intensify this co-operation. This can be achieved without the problems of long, costly teamwork; sometimes impossible journeys or even complicated production techniques.

Inadequate social conditions in the different countries give countries a great challenge - within and between themselves. The gap between rich and poor in many cases does not seem to be getting smaller and is even increasing in parts. The reduction in these inequalities must be in the interests of all states and all governments.

In addition considerable to these economically-oriented disparities are new disparities which can be best described as the gap between the information rich and the information poor. Due to lack of financial resources and insufficient training new information technologies cannot be used in the most efficient way. This divide appears more and more not to be a problem as much between developed and developing nations but more within the country itself with its attendant difficulties.

Less developed regions within developed countries have similar problems as exist between developing and developed countries: a reduced participation in the development of society, reduced income growth or even setbacks in overall development for example high unemployment etc.

The new information and communication technology maintains existing imbalances and strengthens these. Of course the possibility exists that this technology, if an opportunity of equal access existed, can eliminate these imbalances. Where previously information technology was open to a few it is now available to many who allow themselves to work with independent strategies and beliefs and enter competition of a new structure.

Nevertheless this requires making this available for all and that the necessary skills are provided. This again requires the improvement of general training which need to be developed further.

This new technology is as much a challenge as it is a possible way of overcoming social disparities. They connect nations in previously little known ways for the task of preventing the gap between the information rich and the information poor becoming greater with the subsequent consequences. New co-operation possibilities are presented which though they come from different sides can lead to a mutual goal.

The welfare of the individual is greatly dependent on his or her health and income. Income is necessary for the purchasing of food and other important products. Health is dependent on sufficient food and the provision of these other products necessary for life, health is required for the individual to earn an income through his or her own labour.

Though new technology can make the production of these products necessary for life easier, and can sometimes optimise it, its implementation is dependent on sufficient resources being available to gain this new technology.

New technology can contribute to the development of medical care and treatment, it can make necessary information for diagnosis and therapy ready and available on a wide scale. Again there is a requirement that sufficient financial resources are made available to purchase this technology and to train its users so that information is relevant and useful. For example constant data access on the internet is only of use to those who understand how to deal with this information. Another example are satellite television courses about new treatment procedures which are only available to those who have satellite dishes.

The possible role for this new technology in solving these aforementioned problems of health care and availability of food and other important products can be assessed thus: it is dependent that sufficient financial and training resources are available.

This new technology has obvious connections with economics. The development of economies is brought about through the constant adaptation to changing requirements of national and international kind. New products, new methods, new trading partners are important vehicles for development which leads to new jobs and new income.

In this area new technology has led to revolutionary changes in the past years, or at least has contributed to them coming about. The positions of entire industries have changed due to the new possibilities for development which have been realised - changes to products and their production, as well as new markets and marketing strategies. The new technology has itself been the vehicle for change and have had a significant impact on other technology.

In the Federal Republic of Germany one estimates that in recent times there has been a 50 per cent increase in the number of jobs in the information processing sector. This information sector is itself a significant market area and production and marketing is economically important.

In my region of North Rhine Westfalia with its well known Ruhr area, the European centre of coal and steel, the number of those employed in the media sector has recently become twice as many as that in mining sector and comes close to the figure of those involved in the steel industry. Companies like Mannesmann have built up large telecommunication enterprises and more will follow.

The change from industrial society to an information society is in full swing and requires a greater effort from all those involved.

Nevertheless many challenges are connected with this which need to be mentioned: changes in work organisation, the decline in qualifications, and the necessity to offer new types of qualifications to the many young adults of today, unemployment, increasing expectations of quality in work and in the product, increasing competition etc.

From the above it can be shown that this new information and communication technology has had many consequences on general development in the social sphere. Therefore a discussion of the effects that this technology has is too brief if one concentrates on isolated economic or social areas.

For it is to be assumed that the increased use of this technology will lead to changes in economic and social structures, and one can already see roughly this development taking place. For now the question of further developments in social security systems interest us, in addition to the questions about the future workplace, the question about the soda! contribution, the question about economic competition potential and the question of new training possibilities as well as the future of the new organisational structures in government and business.

A number of experts on all levels are working on papers, imagining new scenarios and possible lines of development. They are suggesting consequences of further political action and are giving encouragement to the various institutions.

These groundbreaking actions and their subsequent effects are not only tasks for national organisations and businesses but are to a greater extent challenges which extend over national boundaries and are being faced by the European Union, having been given highest priority.

The great consequences of this technology and subsequent strategies has a clear impact in the education sphere: a concentration on one subject or area is just as pointless as restrictions regarding age or even entrance to vocational training.

If one wishes to assess the possibilities and problems of NITs then this can only be possible if many differing aspects in all their variety are borne in mind and are considered. At the same time this means not only a concentration on making this technology available but also on comprehensive understanding of its possibilities and problems.

Therefore we already had begun in Germany in the mid 1980s to give pupils in secondary level 1 a basic qualification in information and communication technology. At the same time it was ensured that in other subjects pupils could experience the different practical uses of the new technology in their projects.

Using concrete exercises such as the production of a school newspaper allow pupils to experience the possibilities of word processing as well as allowing them to identify and discuss the problem of copyright. Using the model of a survey on a subject of school life allow the opportunity of using tables and calculations and presenting these in a graphical form. In addition to the object of this teaching, the question of data security and its misuse should be addressed. Through the use of CAD and CAM programmes real products can be created but other issues must also be considered such as the impact on employment, the agreement of management and other questions regarding the workplace.

In later school life there is an opportunity for the pupil to widen and deepen the basic knowledge gained - in the compulsory optional section of secondary level one and in the subject of information studies in secondary level two. Since a few months ago, under the title of *'Schulen ans Netz'* ('Schools to the net'), we have been giving schools in Germany the opportunity to test new forms of preparation and teaching of lessons via the internet. Large German and international firms as well as state governments have offered their help in this. Within three years we wish to build up and firmly establish these numerous opportunities in the schools.

In past years the attitudes to this new technology have changed so that increasingly the whole technology and not separate pieces have found their way into the classroom. That the skills and the technologies which go along with them. has grown together through digitalisation confirms the views. This is an overview of the introduction which has shown how this technology can be used and transmitted and how this is more important than individual pieces of technology. In this way the contents of information have grown, especially with the growth of new telecommunication possibilities such as the internet, which connect them together to form a new competence - the media competence.

Parallel developments have occurred in vocational training. A few years ago definite skills were demanded which young people could use in daily work. Now the new skills demanded can be better described as key qualifications. These skills are available and can be strengthened in general education as well as in specialised training. General skills such as organisational and planning skills, communication and co-operation willingness, mastery of thinking and learning strategies, independence and willingness to assume responsibility as well as responsibility in different situations.

This comes about due to the ever-changing challenges which are placed on the individual in modern working life. One must react flexibly to these challenges especially as vocational knowledge goes out of date rapidly. The aforementioned key qualifications are the requirements for the constant adaptation to the challenges, this has been shown for example through the new structure of vocational training for metal and electrical trades. Several hundred training programmes were brought together and general requirements were established. Only then did specialisation occur, specialist knowledge being defined and teaching contents set out.

The aforementioned key qualifications show clearly that the previous division between the role of general and vocational training has become increasingly flexible. There is now little difference between the basic qualification requirements. Thus one can understand the view that for those seeking employment vocational qualifications have the same weight and quality as those of a general nature.

However this means also that topics must be considered in the vocational field which although of equal importance are nonetheless different. It is of importance, just as in field of more general education, that the orientation of future discussion for young people when addressing and solving general problems concerning projects, must be on the end product.

To make this clear I will give five examples which illustrate the aforementioned discussion and conclusion.

In a number of vocational schools in Germany a series of projects were completed between 1992 and 1995 under the title of *'Integration neuer Technologien in den Unterricht berufsbildener Schulen und Kollegschulen unter besonderer Berücksichtigung der Leitidee der sozial- und umweltvertraeglichen Gestaltung von Arbeit und Technik'* ('Integration of new technologies in the vocational schools considering the leading idea that labour and techniques should be adequately adapted to social and environmental aims'). It did not concern itself overtly with the provision of new technology but instead dealt with the modern technology as a tool and in comparison to the lessons of the vocational schools.

In the first project production economy was discussed, that is to say production, storage, transport as well as the sale of goods in the face of competition - but also with the background of raw material shortages and environmental pressure.

Nowadays such production economy systems can only be achieved using modern technology, in every case expenditure is calculated with this technology, prices and delivery times are calculated, transport tasks are given and production and its requirements are defined. In most cases this expenditure occurs with the needs of the individual company in mind, never - or seldom - are such decisions made when economic or manpower problems threaten.

With the help of scenario-techniques and mind-mapping, pupils worked on alternatives for an environmentally friendly production economy system. They also discussed the new challenges which would face the employees of this new system. For example it was worked out that although scanner-tills were an efficient way of ensuring fresh deliveries, that at the same time it was not possible for the till operator to have an overview on daily income and on the economic position of the company. Their task and their wish to witness their companies success through their own work thus becomes difficult. There exists the danger too that their motivation to work will suffer due to their lack of this overview.

The goals of these lessons were to understand simultaneously the different types of new technology and in equal measure their effects on the individual and on society.

In a second project of the same series the young people were asked to redesign their teaching room and to give directions and planning as concerned building and equipping the room. Software programmes available to all helped in drawing of plans and the necessary text. Thus work, educational and economical questions were central, the new technology had an instrumental character. They helped in calculating and presenting work results in a most convincing manner.

Beside vocational skills which are required for the construction of a work bench, drill or other tool, there communication and co-operation willingness stand as important key qualifications in the centre of teaching. Of course a reflection of the possibilities of the new technology was needed to solve this task. Thus it shows that available software was suitable to begin to work out solutions independently and that it is difficult to develop vocational knowledge and computer skills at a similar rate.

In a third project in northern Germany these similar self teaching possibilities were tested with the help of new media of technology. In a teaching centre the pupils of a vocational training school had the opportunity of extending their knowledge of the available resources through independent research and analysis. Different technology and information were available in a room of its own. Teaching programmes and courses using PCs allowed pupils to practice skills and allowed them also to research databases.

Of interest is that this teaching centre was not only available to the pupils of the school but also to interested parties outside the school. Thus a bridge could be built between academic training and further training available outside the school. The teacher in this teaching centre clearly had other tasks from the classroom teacher. He or she is no longer the source of knowledge but rather the trainer or coach of those who wish to work independently.

From past experience it has been shown that not only a narrow range of databases and materials must be made available to those in self-learning who are working on a specific task such as a metal work product. Business help must also be available, for example dictionaries when preparations are made for the manufacturing and sale of products abroad, if teaching success is to be achieved.

Such connections are required if one is to remain faithful to the goal of vocational training - a training which gives general key qualifications.

In addition to these key qualifications belongs the preparation for a life long learning. To learn to learn is one of the most important qualifications of the future because even as an adult one is required to gain new knowledge independently. Not only the many opportunities of vocational and general education, which are offered by chambers of industry and commerce and vocational schools, serve this goal but also the teaching programmes which industry develops and offers its students.

A very recent example is the PC aided self learn programme of the SIEMENS company which was developed in partnership with the German ministry of education and science, research and technology. *'Lernen in der betrieblichen Praxis'* ('Learning and working in practice') is a course which can be studied independently by trainees and the basic skills of the learning processes can be utilised on the job.

This programme is entirely on CD-ROM and allows the development of basic skills in each of the formative vocational trainings. It is interesting to note that not only can specific knowledge be offered but a certificate is awarded after the successful completion of training. The computer itself checks if the trainee has acquired all the necessary knowledge and then produces a certificate on the result of the training.

A final example shows the numerous uses of NITs in the acquisition of knowledge and skills for the adult.

Since more than twenty five years the public broadcasting, vocational schools, colleges and the ministry of education have been working together to give adults a second chance to reach a higher level school exam. The school qualifications available in the Telekolleg is recognised by the state authorities for entrance to a higher education course of study. Broadcasting stations beam out daily several educational programmes regarding various school subjects. The students work independently with corresponding written material and since recently with software which allows them to practice. Approximately every two weeks there is an extended tutorial at the educational establishment where remaining questions can be addressed and discussed. Internet connections between the students give the opportunity to discuss open questions. During the two year course exams are taken step by step in a total of thirteen different general and vocational subjects. Thus finally a qualification is awarded. The new technology are offered in and in addition to the vocational training.

In total fifty thousand people have repeated their end of school qualifications in such a way and can now undertake study. Today those who have finished Telekolleg became teachers and now teach the new students.

These examples of the utilisation of new technology show clearly that in Germany there already is comprehensive experience of their use in general and vocational education. Hence I would like to suggest a few possibilities for working together on an international scale.

It seems to me to be important to make mention of the reciprocal exchange of information and resources. This can be done electronically or using the more traditional method of documents and papers. In doing so one must ensure that these resources are not only of use to one culture but must be adapted to the needs and circumstances of partner countries. So real fresh partnerships can be established. Because this new technology is an area of international competition a danger exists that not all information will be made available. This appears to me to be particularly inappropriate and unfair in the area of education. Especially those countries which are still in the development stage require comprehensive support to be able to master their problems in the future. Industrial nations are called upon, within their capabilities, to provide this wide ranging help.

A dear setting of targets and realisation of the problems heightens the possibility of mutual exchange of ideas and can lead to countries working together.

Besides exchange of information about programmes the exchange of people with their experience is of utmost importance. In the framework of existing cultural and economic agreement between nations all possibilities should be grasped and used effectively, thus supporting, through contact between people, the exchange of experiences. In addition bilateral and multilateral meetings are possible and sensible. They should take place on a regular basis and should rely on existing structures. Congresses and conferences and their accompanying exhibitions are especially important because here the education and business partners can discuss areas of mutual interest.

Such actions seem particularly fruitful when joint training is planned and put into action. On a European scale the programmes of the EU have already borne fruit. They should be encouraged to be implemented by other multilateral communities. We in Germany have had very good experiences in working together with the Pacific area and are willing to widen this to other countries and establish new contacts. Joint projects organised from government as well as joint actions from non-governmental organisations are of great importance. Especially in the area of vocational training contacts between companies from different countries are possible. I am willing to be of assistance in this aim.

We have in Germany a series of institutions which develop multimedia products for vocational training. They also have multimedia products which could be of great interest to other countries. I would be happy to see other countries benefiting from this experience. Business exchanges as well as assistance in making and using the products can be initiated. At one of the institutions in our country educational software in German is tested. From more than four thousand tested programmes, which are offered to the German market, less than eighty could be suitably utilised. I am willing to make known our criticisms and results and thus give an impetus for the improvement of these products.

It seems to be necessary, due to easier means of international communication via the Internet, that international forums be set up to deal with the experiences of this new technology. I would be happy if it were possible to create such a forum not only on the level of individual institutions and training programmes but instead to begin discussions on the level of responsible co-ordination of this co-operation. I would thus welcome a move from UNESCO in this direction.

Nevertheless it is important to make available the material resources for a wider uptake of this new technology. The governments are asked to overcome barriers with their strength. It would be scarcely thinkable however that these great challenges are given solely to governments. I am convinced that it is in the interests of national and international organisations and companies to create possibilities, in a public-private partnership, so that conditions can exist for the peoples of various countries to play a part in improved development. Other international organisations and the availability of finance can contribute through encouragement and programmes so that new possibilities for development can be created.

Ladies and Gentlemen, I thank you for your attention and I am most willing to discuss further details with you afterwards.

The original is presented in English

Commission I

HUMANITARIAN EDUCATION ON THE EDGE OF 20 th - 21 th CENTURIES IN A NEW INFORMATION ENVIRONMENT

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1.EDUCATION INFORMATIZATION AS A GLOBAL PROBLEM ON THE EDGE OF CENTURIES

The edge of centuries in the history of humankind has repeatedly been associated with global change in the understanding of the world: reformation on the edge of the 16 th -17 th centuries, Renaissance on the edge of the 18 th - 19 th centuries, search for the methods for the management of matter and natural forces on the edge of the 19 th - 20 th centuries. Before our epoch science was concerned with multiplication and accumulation of knowledge, whereas today it essentially focuses on the methods for mastering of the accumulated knowledge and has recognized the global role of informatics in its further development.

In addition to the mystic expectations common for such a chronological period and prophecies, the 20 th century brought quite realistic and explainable problems and crises, both global and local. Among the global problems, the most serious appears to be the issue of education as a whole. Its ideals and goals, the content, the method and technology appear to lose the usual stability, and occasionally they lose polarity. The humanitarian education is an inseparable part of education as such, and these painful vibration are quite specific for it. But - «where there is danger, there is saving».

My understanding is that the most essential thing today is to provide an adequate insight into the nature of knowledge, which has drastically changed over the last decades. Without that we could hardly define coherently the place and the role of new technologies in the humanitarian education. It appears to me that we should take into account the fact that computerization of a humanities school, i.e., filling of the educational space with computers and its informatization, i.e., a drastic increase in information resources and respective technologies are not the external factors of the education process. These processes are the least likely what is called aids to teaching humanities. This is a completely new information environment - a new dynamic form of knowledge per se, and, concurrently, a new form of humanitarian education, the form obliterating distinctions between scientific research) and study knowledge, or fundamental and applied knowledge. A rapprochement of humanities and natural science knowledge is under way, and the artificiality and conventionality of the disciplinary structure of both study and scientific knowledge becomes evident. In the new information environment, knowledge is a single dynamic system, alias «living knowledge».

Surprisingly, the new information environment fully meets the most essential needs of humanities education. It not only permits avoiding the mass and average nature of education - this merely becomes impossible - the new information environment in the humanities institution can only be used to the full individually.

This is in a way «submergence» into the system of integral knowledge and it personal experience. Understandably, being creative this submergence calls for thorough and abundant preparation.

This understanding of knowledge makes it possible for us to speak in terms of a principally new concept of humanitarian education.

2. THE PLACE OF RUSSIAN IN THE DEVELOPMENT OF INFORMATION TECHNOLOGIES

Such a representative form as the UNESCO Congress on the relationship between informatics and education is held in Russia, and I shall discuss, if only briefly, the Russian situation in information technologies.

There are three points of common knowledge:

• There have always been excellent programmers in Russia.

• The standards of Russian-made computers have always been very low (Russian-made computers are practically non-existent).

• During the recent years, the computer market in Russia has sharply increased from zero, and the number of computers being sold has considerably increased accordingly. With respect to this index, Russian approaches the European leaders. How can this situation be commented on? On the one hand, we appear to be doing well. However, I am not optimistic with respect to further prospects. Firstly, if Russia claims to be a great power, it would not exist on imported equipment, no matter how good, for a long time.

We need high technologies in terms of the creation and production of the entire computer complex. Secondly, the relationship between the level of programming and its logistic support is by far more complicated than the more computers - the higher education level postulate. True enough, the economic and research and technological policy in computer sphere is not my specialty.

Thus, we see a sharp growth of computer sales in Russia. But the software products are sold to a by far less extent - alas, it is used illegally, to put it mildly. But despite that, and also despite the fact that the majority of the computer equipment sold in Russia are of «yellow» or unknown assembly, this is an undoubted advantage. Although nobody can say *what and where* all these computers are engaged in. What I have in mind is not a census, but rather lack of ides as to the actual informatization of the most essential aspects of social activities. My suspicion is that the bulk of the computer fleet of Russia comprises game machines, typewriters, or occasionally, a fashionable element of the office design. Perhaps, this is natural in our conditions - massive informatization in Russia has just started and they need to get used to it.

But on the other hand, the very possibility of retaining the level of computer equipment sales in Russia is dubious. The initial needs have been met, and further movement is only possible due to the distribution of computers among individual users. And, are there many personal computers in Russian apartments? Is it a purely economic problem? Of course, not.

I shall dare say that computer culture in Russia is so far low, and new information technologies are subconsciously rejected. The reason for that is a separate exciting topic. But for those of us who are associated with humanitarian education in Russia, our objective is self-evident. We are to cultivate this computer culture and to patiently demonstrate what can be accomplished through information technologies, and how they can bring us to a new intellectual level, and how it will expand our personal liberty and personal creative potential.

3. ON HUMANITARIAN EDUCATION PROPER

Understandably, even the most essential issues of humanitarian education cannot be merely listed, hence, I would like to dwell upon those that I am most concerned with.

Reflecting on humanitarian education, its present state and, particularly, of its future, I come to the conclusion that the problem of education is secondary. The primary problem is: what will a specialist in humanities be like tomorrow (thanks God, we gradually reject the «what should be like» modality). What can we envisage? And, what we cannot imagine even in principle?

To be quite frank, when I meet five-six-graders of today I can hardly fancy them becoming specialists in humanities in 10 - 12 years. But my professional and civil duty require my making decisions that would concern them as early as today. True enough, it is impossible and unnecessary to change many of the things in humanitarian education: the general structure of specialties, the traditions of the leading research and educational schools, efficient technologies...But along with that it is evident that schoolchildren of today will live in an essentially different world, which, I am afraid, will be no less dramatic and cruel.

The need for humanitarian culture will increase. To retain and, all the more so, develop humanitarian culture is only possible for free creative people. Of course, they can live and work *only in a democratic society.* But this is not enough - in addition to certain political conditions, they will need professional creative freedom. Respectful of any authorities, they will not be dependent on them. And, the most important independence is *informational.* By gaining access to modern data bases, the future specialist in humanities would be able to build *his own* information space, develop his original concepts and models of the phenomena and processes studied. The information freedom is thus a condition and, concurrently, a form of political and creative freedom. *Providing that freedom is exactly the point of informatization of humanitarian education.*

But not everything is that simple. Liberating oneself from the dependence on the «classic» authorities, the future specialist in humanities risks becoming dependent on developers of data bases, software products and merely on computers with their queer attractiveness.

There does not seem to be any other way to avoid this danger other than to *teach a humanitarian to develop data bases and critically assess the available programs on his own. He may not be able to develop programs on his own but he should be able to select the most suitable ones.* In other words, he must master this form of culture. And, for the humanitarian education as a whole, the goal is adequate rationalization of the humanitarian knowledge, assimilation of the available knowledge and development of new methods for stricter tackling the available knowledge. That is why the problem of informatization in humanitarian education becomes dominant, including the selection of developmental strategies of humanitarian education as a whole as:

- incorporation of humanitarian schools into modern information networks;
- development and mastery of new information technologies in education;
- rapprochement of research and study process on the basis of new information technologies.

I think that development of the tools for humanitarian sciences using modern methods for work with information is quite humanitarian, deserving a profound and unhurried discussion. This problem is multi-faceted. This comprises development of information data bases, statistical analysis, graphic representation of information and many other things. But presumably the main and the most difficult problem will be the one of the application of mathematics, mathematical models and the application of the method of models with the traditional instruments of humanitarian sciences.

It is exactly now that new possibilities and new ideas of the use of mathematics, the ideas of the unity of formal methods created by mathematics with the technology of analysis traditional for the humanitarian sciences originate . And, very importantly, that these ideas acquire the necessary hardware and software support. They open up the prospects of this symbiosis.

Still another issue is noteworthy. Are we often concerned with the social role of a specialist in humanities? He is to keep and multiply humanitarian knowledge, humanitarian culture. But is he to do it for himself only or is he to enter in contact with other forms of culture, is he to fight those who endanger culture *per se*. And, if he is to struggle then in what way?

I don't think anyone would seriously doubt that excessive scientization and technization, in other words, hyperbolized rationalization of our life is hazardous to the very existence of humankind, the roots of this excessiveness, alas, lie in the system of natural scientific and engineering and technological education. The most acute social problem *humanization and humanitarization of this system of education* has long become self-evident. It is also self-evident that *this problem is beyond natural scientists and engineers alone.* But a mechanical introduction of humanitarian disciplines in such schools is hardly productive as shown by experience. The problem is stated but is not being solved.

A sort of «internal» humanization and humanitarization of natural and scientific and engineering and technological education is necessary. The most responsible goal of humanitarian education is the reform or saving of another part of education. To some degree it is a problem of self-saving for humanitarians.

From this point of view of great interest is a system of study courses on the history of science as technology as a natural humanitarian basis of professional scientific and technological education. In the Russian State University for the Humanities we are now attempting to develop such a basis, using the most sophisticated information technologies.

4. EDUCATION AND INFORMATIZATION IN THE RUSSIAN STATE HUMANITARIAN UNIVERSITY

I wish to briefly discuss the Russian State University for the Humanities project. Not only because this University is close and deer to me - I could show concretely what we are doing, what are our plans and problems.

As you know, Russia is now passing through the complicated transition period with great difficulty. The entire system of Russian education is now having a tough time. We are also having a tough time. But we constantly attempt to move forward.

During the recent years we have managed to increase the computer fleet to 470 units. 13 computer study classes with a general number of computers of about 140 units are operative. The computers have also been installed at the faculties, departments, in the libraries and administrative units.

Today, a computer network is operating in the University, including computer classes, free access classes, computer network of the library, individual computers, installed in different University units. Being created on the basis of this network is a single information system, which is to unite all computers and information resources of the Universe. This system is designed for the maintenance of the major trends of activity, namely, organization of the study process, research, operative monitoring and administration. The University network is connected to the world INTERNET to provide access to world information resources. A University WWW-server has been organized, which has a constantly updated information about the University and also an electronic publication *Vestnik Gumanitarnoi Nauki* («Herald of Humanitarian Sciences»). Work is being done on the development of University information resources and providing free access to them.

A MultiMedia Center has been established in the University, provided with the sophisticated equipment to implement full technology on the production of multimedia products and quality video films. The technical equipment includes the graphic stations Silicon Graphics, video equipment Betacam, a digital system for the montage of video films Media 100, etc. During the year of its existence, the MultiMedia Center of the Russian State Humanitarian University has produced two CD-ROMs on the contract of the State Committee for Higher Education, Russian Federation «The Old Images of Moskovia» and «The Higher School of Russia». «Russian Computer Technology». This work is part of a larger project «The Culture of Russian Province», which proposes the production of a whole series of CD-ROMs, video films and books.

In the University library the library information process has been automated on the basis of two *network library systems* TINLIB and MARC for 70 work stations. In 1995 the processes associated with the acquisition and cataloging of the literature have been rendered automatic from *placing an order to a printout of the catalog card.* In 1996 the library and university networks were merged, which made it possible for the readers to use Internet, and the provided access to the data bases of the library to the faculty and the students. Today, work is being done to open a meadiateque for several work stations, each having multi-media equipment for independent studies (computer, CD-ROM, TV-set, video recorder, etc.).

Each graduate of the Russian State University for the Humanities is to know *two foreign languages and to be able to use the computer.* But the informatics education of a specialist in humanities and informatics (working in a humanitarian area) is based on the fundamental courses of theoretic foundations of informatics differ.

The variety of the problems resolved *by all* University graduates presupposes the knowledge of a number of software products, whose mastery provides a definite level of computer literacy. These include, for example, the operational systems and media and text and table processors. The level of information literacy is ensured by such courses as «Systems of the Management of Data Bases» and «Information and Linguistic Support of Information Retrieval Systems, «Expert Systems», «Computer Systems and Networks» (including Internet), and also special courses in linguistics and automatic processing of the text.

Practical classes rely on sophisticated software, including Windows 95, Lotus Notes (a system of collective work, document rotation and management of the University), Microsoft Office, etc.

Along with the education of *specialists in humanities,* the University educates highly-qualified specialists in:

- information systems, technologies and resources;
- intellectual information systems;
- automatic archive technologies.

The following programming languages are studied: C++, Pascal, Java, HTML, Visual Basic, etc. Among concrete network technologies Unix, Windows, and Novell are used.

The University graduates are prepared to work in such increasingly required areas as information systems, data banks and data bases, system of enterprise management, etc. But the level of the problems they solve depends not only on their education but also on their individual capabilities and inclinations.

We pin certain hopes on the recently established Study and Research Center *The History of Science and New Education Technologies.* The computer equipment of the Center makes it possible to work on a highly professional level. As early as today we can provide our data bases and original methods and schemes of the education processes and original software products.

I am glad to tell you that we manage to do something in our conditions, but I primarily want to state that the University is ready for serious cooperation with the world centers of humanitarian education. I would think that I am not wasting your time if I could convince you, esteemed members of the UNESCO Congress, that partner relations with our University would be interesting and useful to them.

In summary, I would like to invite Congress members to the seminar «Information Technologies and Humanitarian Education in the Russian State University for the Humanities» at 14.30 hours. We shall try to tell you and demonstrate at this seminar how new information technologies are applied in humanitarian studies and education.

The original is presented in Russian

Commission II

THE EVOLUTION OF INTERACTIVE MULTIMEDIA: MOTIVE FORCES, USERS, PRODUCERS

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ON THE DEVELOPMENT OF MULTIMEDIA

INTRODUCTION

The concept of interactive multimedia of operative access and independent or electronic editing is based on the variety of methods to derive and use information.

This variety is quite obvious in the area of tutoring and learning games: on the one hand as two ways to receive information both collective and individual and two ways of use (educational classes close to the traditional form, centers of documentation and information (CDI), libraries, home computers), on the other hand as two modes to receive information - on-line and off-line.

THE EVOLUTION OF INTERACTIVE MULTIMEDIA

The concept of interactive multimedia is not new. These means have been used in the process of teaching and learning in various ways depending on the given subject since 1970s. Computer tutoring is the most striking example of the possibilities of using technical means in originating new methods to transfer knowledge. This applied training tool enabled at various stages of its application to develop models for students to carry on dialogues to be adapted to the given level of knowledge. Computer tutoring which first appeared in '80s was widely applied in medicine, engineering, vocational training, especially in the cases when the use of visual methods was essential. At the same time the potentialities of personal computers made it possible to develop interactive programs including multiple-choice quizes. The text information was removed from carriers to monitors of personal computers linked to the external sources of image and sound. This type of combined multimedia presented certain difficulties and consequently it was discarded.

When hardware came into use which are capable to integrate the text, graphics and sound and a little later the fixed image as well as peripheral devices for data retrieval and the author's tools, independent integrated multimedia technology came into existence. The new conception has many advantages:

- the author's tools enable to carry out specific developments and to adapt the contents for the needs of learning, and at the same time they grant him more freedom to create;
- convenient in use uniform carriers (CD-ROM, CD-I, Photo CD, Portfolio) ensure a high degree of independence;
- excepted standards guarantee an opportunity to use any reading device.

Nowadays integrated multimedia technology is widely used both in tutoring and developing of teaching games.

However, despite the numerous advantages of application of this technology in the sphere of education its possibilities are limited. A number of researches conducted in the USA and Europe in the CERN Institute (Geneva), in particular aimed to solve the problem which worried scientists all over the world: to grant access to information in on-line regime. Thus Internet came into being. Created for purely scientific purposes, later it spread to the area of education.

Operating in on-line mode interactive multimedia technology is the result of the transfer of the hypertext to information networks. Since recently the extension of HTML-share used in Internet as compared with units which collect only documentary information given opportunity to make interactive and applied pedagogical means compatible.

The main advantages of operatively accessible multimedia technology in comparison with interactive multimedia lie in the possibility of remote data transfer to a great number of users and the possibility to work in on-line mode. At present it is mostly used for distance tutoring and also in search for documental information.

WHAT STANDARD FOR WHAT SOFTWARE

Whichever are the methods of operation of software is it possible for it to meet identical requirements in various kinds of use?

The designers try to take into account the whole set of generated need offering in particular new production standards for example for high-density compact disks (DVD) which will enable to remove a number of existing technical restrictions including those for video. But the role of professionals in this field is reduced to suggesting alternative approaches, whereas it is the market that has the right to make a final choice. In this connection expectations placed by the teachers on the developed standards and means to transfer information are of particular interest for electronics. What hopes do the teachers have concerning applied interactive multimedia programs operating independently which are granted by networks such as Internet with such independent carriers as CD-ROM, CD-I, Video CD, Photo CD? Do they have the needs similar to those of general public and professionals?

Can the transfer of information in operative mode by Internet become the working tool for the teacher or does such use only remain within the bounds of search for the necessary documents?

The possibilities of using Photo CD for tutoring as well as using CD-I in the field of vocational training have been discussed more than once but the final answer seems not to have been found yet.

CD-ROM and Internet are probably the best among the carriers existing today but new standards of technical maintenance, which are sure to appear before long, should meet the following requirements: speed and low costs of modernization, 'friendly' interface, the possibility to be used without special training, the capability to combine sound, fixed and moving images, high-resolution and also the quality comparable of magnetic tape record. All this presupposes that future digital parameters will exceed todays' performances of compact disks and telecommunication networks with high throughput by ten times.

THE CONTENTS AND THE PURPOSES

The contents of multimedia products have become the subject of frequent critical discussions. We should doughtless contribute to the collective speculation on the topic in a more constructive way. Nowadays the market offers hardware and software means the quality of which is constantly improving, but the share of products with the author's contents and those meeting the needs of learning and vocational training remains limited. The character of multipurpose product testifies to a rather vague knowledge of real needs in the field of teaching and learning among professionals in software, i.e. software creators, designers and producers.

What are the requirements of educational sphere to software/hardware of general use and of special use, in particular? Which of them are best brought into line with the concrete conditions of teaching? Will optical carriers be more often used in the classroom (or in its future substitutes) or will they be mostly preserved in centers of information and documentation or in libraries? Is the traditional way to create training appliances for secondary and high schools suitable for electronic means, and will it help to individualize education and to begin working life?

LEARNING MULTIMEDIA

In view of such complicated and ambiguous situation the designers of electronic means are confronted with the problem of choice of a possible strategy.

First of all it should be specified which carriers are more suited to application in education and for which uses. This is very important because when commercial purposes are not quite definite it impossible to plan the strategy of production.

Passportization is another important point. Is the given project intended for home use? Does it present any interest for pedagogical purposes, for teaching and learning? There are no criteria which enable to answer these questions.

There is another question. Does education need the so called «vertical» applications similar to those which are used by professionals? Can we speak about an application strictly suited to the definite pedagogical need which is created for education in cooperation with professionals? There is no quite definite answer to the question, but teachers might take part in there development as has always been the case when schoolbooks are published. The international character of the multimedia market should also be taken into account, it can not be ignored.

21st century will be the age of interactive multimedia and, first and foremost, the age of electronic communications on a world scale. The whole world will be able to communicate as well large family either through networks or with the help of independent means. As for the sphere of education successful development of learning multimedia products will probably depend on there ability to ensure individual approach in teaching and learning the individualization of educational courses presents a serious problem for teaching and learning. Which means wilL be offered to schoolchildren and to students in the future? How to ensure an individual approach in education?

The original is presented in French

USE OF TELECOMMUNICATIONS IN EDUCATION AND SCIENCE IN THE REPUBLIC OF BELARUS

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The acquiring of sovereignty by the Republic of Belarus and its economy transition to the market principles challenged the changing of the traditional principles of the society's organization. This has touched the system of information supply of educational and scientific and research sphere. Higher educational institutions, academic and branch institutions have to agree the level of their developments with the world achievements. There has appeared the need for a new system of information services, based on the up-to-date means and new information technologies.

The introduction and use of new means of computer telecommunications in education and science is very important for the Republic of Belarus. Computer telecommunications provide a unique opportunity of the overcoming of informational and organizational separation of scientific and research organizations and the problems in the publication and dissemination of scientific results and ideas and integration of the Republic into a world system of education and science.

Computer telecommunications are an efficient and fairly cheap means of information exchange, which permit development and exploitation of the national intellectual potential and provide access to global information resources.

At present, there are a number of global computer networks operating in the Republic of Belarus as BelPAK, RELCOM, SPRINT and others. However these networks are not designed for education and science and their services are either expensive or limited.

Taking into account the needs of science and education the UNIBEL network is being developed in Belarus, which unites the leading research and education establishments and offers major communication and information services to provide a basis for the development of scientific and educational networks in the Republic.

The UNIBEL network is based on a hierarchical approach. The infrastructure nucleus is the central node (in the long run it should be a powerful multiprotocol network node), which provides uninterrupted operation of the network, routing, links with international global networks, primarily with Internet. An important place in the UNIBEL structure is occupied by regional nodes, which form a second level of hierarchical structure. The regional nodes are created on the basis of the most advanced higher education establishments so that to ensure the operation of the other network nodes and terminal users. It is proposed that just these regional nodes will become centers of the distribution and introduction of computer telecommunication and network Internet technologies in education and science spheres.

To provide access of higher educational establishments and organizations to information resources of the Internet global network in Minsk has initiated, being supported by the Soros Foundation, implementation of the project on the establishment of the fiber-optic BACKBONE. In accordance with the given project, the terminal equipment will be installed in city telephone stations, which will provide optimal conditions for the connection of the users. The Project also envisages a satellite communication channel for entry into Internet.

Establishment of telecommunications in education and science system of Belarus is impossible without a pre-development of local computer networks. The most illustrative example of this approach is the Belarus State University.

One of the key issues to the development of the Belarus State University is the refining of its information infrastructure. The information structure of the University is to develop along the following directions:

- development of a high-speed University network of data transfer to link the rector office, dean's offices, departments, library, classrooms and integration of this network into Internet;
- development of methods of distance education;

• development of an automated system of University management.

The development of the united general-University high-speed information network of data transfer being the first priority, the University has stated the following objective of the establishment of the united computer network:

- provision of a quick access to Internet to researchers, graduate students and students of all departments;
- development of the united University information system with information exchange between the computers and access to general University data bases and electronic bibliography catalogs at the rate of up to 100 Mbit/sec;
- provision of the operation of an automated system of University management and development of a paper-free technology of information transfer;
- obtaining of technical base for the teaching modern network computer technologies to students and graduate students;
- access of teaching computer classes to network software and also information exchange between the networks of classes.

The concept of the united University computer network comprises integration into the Internet international computer network; integrated solution of the problems of teaching information support, research and management on the basis of the united computer network; free access to information resources of the network of teachers, researchers, graduates and students, using software and hardware for delimitation of access rights.

The data bases currently available to the University network users, the software used in the network are designed to solve the problems of information support of education and researches and also the operation of the automated system of University management, one of the best developed in Belarus.

A teaching classroom for to study modern network computer technologies is connected to the network. The workplaces of this class have Internet access in the on-line regime. One projects implemented on the basis of this classroom is concerned with the development of teaching courses on the system of Oracle data base management.

An important aspect of support of the educational and research activity of the University is access to research and educational information. Library workers maintain electronic catalogs of books, periodicals and subscriptions. The file server also maintains a periodically updated copy of electronic catalog of the library of the Moscow State University. This information is accessible to all the network users, including workstations in the bibliographical hall of the library. In addition, thanks to the support of the European Communities in frame of the TEMPUS project an optic juke box of 6 CD-ROM drivers is installed as well as a constantly replenished set of laser disks of the institute of Science and Technological Information (INIST), France, available to all the network users.

The main principles of the development and operation of the automatic system of University management elaborated since 1991 are:

- introduction of paper-free technology of information transfer in University services;
- provision of automated management system workstations to personnel of all levels: from rector to a personnel department inspector;
- joint technology of the use of information by different university services, excluding duplication of the entry of information and providing its integrity and authenticity.

Today the automated University management system has the following network subsystems:

A) *«Matriculant», «Dean's Office - Students», «Scholarship».* These network subsystems ensure a bound technological cycle of the processing of information about University students, including the feeding of data on University entrants and the results of the entrance examination, preparation of an order of the enrollment of students and handing over the list of students to the faculties. At the faculties student personal card and progress data of students are maintained over the entire study period, and scholarships are issued. On the basis of this information, the accounts department calculates scholarships, indexing and other payments, handing over information to the accounts center of Belbisnessbank to credit student's accounts.

B) *«Staff», «Salary».* Information about University members is maintained in the Personnel Department in the «Staff» subsystem, which permits maintaining individual forms, salaries, bonuses, combining of jobs, etc. This information is used in the «Salary»;
subsystem.

C) *Information subsystems.* This group includes subsystems, which permits the Rector's Office to have urgent access to information and taking justified decisions. There are the following subsystems operating in the network: «Registration of Incoming and Outgoing Documents, Control of the execution of Orders and Instruction», «Registration of Material Values», «Registration and Payment for Telephone Conversations», «Foreign Students, Graduate Students and Fellows» and a number of others.

The set of organizational measures is of great importance — without them an introduction of an automated system of management is inefficient. These primarily include reduction of the managerial personnel by dismissal of unqualified officials and training of the personnel modern computer technologies.

The existing possibilities of the University network do not permit access to all subdivisions and interested persons to international and university information databases. For that high-speed communication channels are needed both within the campus and between remote units. The University Computer Center studied the needs of services and units for access to information, the information flows were analyzed and a project envisaging integrated development of the University Computer network was worked out. The following basic lines of developed are proposed under this project:

- in each faculty (building) workstations are merged into a single or several local networks. The topology of each of these networks is so designed that it can be readily expanded with an increase of the computer equipment stock. In case a server is absent or is deemed unfeasible to install it in the building, the workstation can be merged into individual segments;
- all the University buildings located at a distance of up to 2 km from the main building are connected to the main building with a fiber-optic cable to ensure the rate of information exchange up to 100 Mbit/sec. The terminal fiber-optic equipment in each building is an intellectual bridge that would ensure connection of local networks and individual segments to the backbone and cable and the distribution of network traffic;
- the buildings in the University branch, which is 7 km away from the main building in a straight line. are united using radiomodems;

- integration of the University local computer network into Internet, ensuring its connection to the UNIBEL network via fiber-optic channel.

Taking into account a considerable research and technical educational and industrial potential, Belarus has a good chance of entering the world information space, and it can become an enjoying full rights participant of the world community of global computer networks.

The original is presented in Russian

Discussion

NEW EDUCATIONAL TECHNOLOGIES AND THEIR PROSPECTIVE EVOLUTION

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1. NEW EDUCATIONAL TECHNOLOGIES: DEVELOPING REALITY

Since the middle 60s experts in the field of education have begun to associate the terms «technology» and «education». Doing so, they sometimes mix two conceptions: the conception of technology in education, which presupposes the use of computers and technical means in the process of learning, and the conception of technology of education when scientific principles are worked out for improving the efficiency of learning. The first interpretation began to be introduced in the 70s especially as result of the introduction of informatics as an additional pedagogical means. This tendency is reflected in a great number of examples. The great spreading of microcomputers caused in the beginning of the 80s the abbreviation EAO (*Enseignement Assistée par Ordinateur* - computer education) and its derivatives, such as FAO, EIAO (*Formation Assistée, Enseignement Intelligement Assistée*). In the middle 80s the Anglo-Saxon term «New Information Technology» (NIT) translated into French coined the expression *«Nouvelles Technologies Educatives»* (NTE)(New educational technologies). In a way we have come to use again the terms of the 60s. Despite these changes in terminology one should hope that the language used or the newly coined words make it clear for those who use them that the global approach is essential in education taking into account how complicated the process of learning is.

Taking into account what was said above the abbreviation NTE will stand for practical performances, statements, methods, means and skills *(Technologies)*, including means of communication, the creation and exchange of information which are developing now *(Nouvelles* - new) such as telecommunication networks, and digital or analog devices used as educational tools.

2. HOW TELEEDUCATION IS ORGANIZED IN CNAM, PAYS DE LA LOIRE REGION. FRAGMENT OF OBSERVATION

In April, 1987 The Regional Center *(Centre Régional Pays de la Loire)* CNAM made the first entry about the first 'telestudents'. Since then more than 2,000 people have become 'telegraduates' with the help of the organization which is now the Center of tele-education and pedagogical innovations *(Centre de Télé-Enseignement et d'Innovations Pédagogiques - CTEIP)*. The reasons for the creation of such an original Center and its development are worthy to be given a brief description.

Considering the special group of population which uses this form of education (it mainly consists of those working in offices and enterprises) an educational institution usually conducts evening classes. This limitation often requires of the students to be able to use their intellectual potential after a working day. Besides, when using educational stations the students should be able to meet their professional demands; the geographical distance should also be taken into account.

CTEIP was set up to ensure any user who lived far from big city centers (where CNAM centers - *Centres du CNAM* - are mainly operating) the access to high-quality education to be able to receive a diploma. It was founded with a video that the originators of the project coned 'cultivate' the territory in educational terms.

Actually, technological improvements have led to the ideas about new approaches to education in the regional center CNAM. At the present moment these ideas are exerting influence on the set of friends of the Center's activities. The development of the new methods which grant more initiative to the student and enable him/her to chose their own rhythm and strategy of learning, have soon become an important objective for the CTEIP administration. These methods are to ensure more efficient education than by traditional methods when students are actually present in the classroom.

2.1. Principles of operation

Breaking with the «traditional» distance education method and its pedagogical shortcomings, CTEIP's executives have developed the method which uses five situations in the process of learning. The student and ... the teacher make their choice of the alternatives. The variety of such situation is intended to keep up the motivations for learning, includes 'transfer', 'reception' and 'exchange' in the process of learning. Their brief description is given below.

Individual self-training: once a week students meet each other in a classroom located nearly, which is granted to them by CTEIP. Such collective meetings give an opportunity to exchange knowledge, to look through the contents of work set for everybody and also to support each other. The classroom are equipped with computers, and during their meetings the students work on them. In this case they have access to the main educational software used in the interactive mode and which is centered in CTEIP, through communication software which is called TeleSITE. Such method of learning without the teacher enables the student himself/herself to evaluate how well he/she knows the material and represent some conceptions visually. Despite the fact that following this method a student works on his own, it gives him a chance of collective discussions and finding answers to important problems.

Telemanagement: students receive additional information through TeleSITE (individually and collectively) from the teacher and from some other groups. These explanations are supplemented by the exchange of multimedia information and the possibility for teacher to receive information on the remote display. Such method of telemanagement is realized in on-line mode or in off-line mode (when messages are sent).

Distance conferences: integrating audioconferences and the simultaneous transfer of information to several working stations equipped with computers enables the teacher to give concise explanations of some difficult points in the teaching materials. (The conferences lasting 30 minutes each are conducted for six weeks).

Joint groups of teachers and students: such joint groups organized every eight weeks, seek to maintain contacts created in the process of 'teletutoring' (they are marked by relaxed atmosphere, spontaneity of exchange, etc.). This brief description shows the mixed nature of the system (isolation - regrouping - presence) offered by CTEIP which is based on the concept of «accompanied self-training» *(«d'autoformation accompagnée»).*

2.2. Practical performances

To ensure its operation in real economic conditions CTEIP employs local people to operate equipment (machines, rooms) which are easily accessible for students. These people are on the stuff in lycees, other educational establishments, mediateques, commercial structures. Relying on their help STEIP can offer tutoring everybody who wants to get using modes 2,3 described earlier. These local associations are CTEIP's branches *('antennes',* the so-called 'antennas').

The branches can accept 12 students at a time, they are equipped with personal computers which enable to work in Windows, are integrated to the local network Ethernet. The set of equipment also includes the monochrome scanner and two or three printers. These local networks are connected to the network ISDN through the gates. The equipment can also operate in the mode 'isolated computer'.

The center CTEIP is equipped with the local network with the «tutor»-stations, linked to «pedagogical» server. This complex itself is connected to the network *«Numéris»* through the gates. To reduce potential difficulties connected with the device which makes it possible for the fourteen remote branches to be simultaneously linked with the server.

By individual self-training students accumulate knowledge from various sections of the course. Using this method of learning they receive printed materials (more seldom in electronic form), printed materials can be the book selected by the teacher, supplemented by the outline of lectures or by a special document worked out especially for distance learning. At the collective self-training lessons students use learning interactive software, which are kept at the central server in Nant. This software is intended for:

- the presentation in dynamic mode some investigated problems with the help of printing equipment;
- automatic evaluation of knowledge using sets of questions, instructions and answers.

During this sessions students ask the teacher to explain or to give additional information pertaining to the subject - matter they are learning. If the teacher is free, the telephone conversation begins; if it is necessary this talk is supplemented with the exchange (through TeleSITE) or digital documents (for example, to interfere in the development of the program), the teacher undertakes the control of a remote computer.

In case the teacher is busy (for example, engaged by another station), the student can transfer messages to inform the teacher about the difficulties and to let him know that he wants to communicate with him. This asynchronous mode of transfer is also used in any cases when the exchange of information is not urgent. Students can use educational stations when they are free, at the time which is not allocated to the given subject. In this case they use educational data base which is kept in the mailbox of e-mail.

3 THE DEVELOPMENT AND OPERATION OF NTE IN CTEIP INCLUDING USERS BEHAVIOR

Then, within the framework of research work we pass to the analysis of the operational modes and the usage of NTE, especially on CTEIP's territories. The purpose of this research is to single out the considerable improvements which can be ensured when NTE are used, to develop an algorithm of the users' work or to find out the «borderline» level of competence (as compared with the level of competence which is set for continuous education). Although this research is far from being completed and its results cannot be presented, however it maybe interesting to give some information about the work which has been done mentioning the people taking part.

3.1. Students

First, we shall note what specific skills can the student get and develop in case he uses NTE and to what activities are this technologies applied.

One characteristic feature of NTE is that they are used for self-training. This method to acquire knowledge mobilizes self-control to be able to organize one's learning, to define one's aims, to analyze one's difficulties, to find a solution and, at last, to make a decision depending on the circumstances. Besides, depending on the educational means offered the student can find himself in a situation when he has to decide upon his own approaches to learning (the choice of the method of reading of printed materials, of listening to the audiotape, the use of software). Thus, he can optimize the rate and the time of learning. In this case he «seas» his process of learning and consequently can develop metacognitive abilities.

As the student consciously begins to include some functions into the process of acquiring knowledge the operation of NTE can result in the need to have the function of evaluation and critical discussion; this functions can be realized by the system itself of by external elements. Even if NTE can really help the student in the evaluation of the acquired knowledge (for example through the interactive software) the student who is learning on his own should also define and introduce his own methods and algorithms of evaluation (asking questions in automatic mode, reformulation, etc.). At another level educational materials themselves can bethe source of exercises for the analysis of information: the task of 'decoding' of the videoprogram's images at the rate they are received can serve as a very good exercise in educational and methodological terms. Nowadays, in technical terms certain standard algorithms of information coding are used and therefore the unique access devices of the unique type are used as a very good exercise in educational and methodological terms. Nowadays in technical terms certain standard algorithms of information coding are used and, therefore, the only type of access devices is used, i.e. multimedia stations. Used for learning, for distance learning in particular, this means has no limitations. In this case one should ask himself, if this equipment, apart from mere technical skills, stimulates the student's thinking. The computer can offer, for example, to simulate the reality or represent the 'virtual' worlds for the user to travel in. These new situations which do not necessarily make the person to use his imagination, result in the need to use special control in accordance with the reality, and it should be born in mind when implementating the conception of educational equipment. At the same time the sphere of application of software remains limited for the user because of technical difficulties, although it is open for new scenarios. This situation is unavoidable when the situation is real and its nature is more complicated than the nature of the educational scenario, the student has to identify, to use accumulated knowledge and to analyze information which is necessarily new to him.

NTE also makes it necessary to define and take into consideration new types of relationships between the students. In the cases of collective self-education (independent working groups using a centralized resource), organization of virtual groups (through telecommunication networks), organization of teleclasses the nature of relationships between the participants in the process of learning acquires a specific character, particularly concerning the required means.

The results of the analysis of the working process show that there hardly is the 'student' in the classical sense. The variety of the learning environment, individual situations and the personalities of the students presupposes the necessity to make groups of students according to their abilities to solve some problems mentioned above.

3.2. Teachers

Now let us consider the relationships between the teacher and NTE. The use of NTE certainly changes the student's learning, but the teacher can also acquire skills in some areas.

Therefore, to organize the educational process when NTE are used, the teacher should engage his store of knowledge to evaluate the potentialities of a technology, for example, to be able to choose a suitable one. The traditional learning and the learning using NTE differ both in the stages of preparation and in the stages of the transfer of educational data. At the preparatory stage when the teacher is thinking about how to present the material he should, of course, work in cooperation with the group of professionals on informatics, ergonomics etc. (the members of the group can come and go as need arises), to get with their help an efficient «translation» (the representation of the material being taught) which is in accordance with the pedagogical criteria. In this case a large volume and the difference in the levels of qualifications result in the necessity to clearly define the areas of work. In some cases the teacher has to supervise in development of the system himself and consequently to be at the head of the project. Besides, if hardware is used in the project to represent the contents of the material then the processes of teaching and learning become asynchronized. The situation demands a priori to define the scenarios how to transfer knowledge, this process cannot be adapted at the stage of teaching because of the chosen method. From this point of view the main qualities required of the teacher-designer are creative abilities and punctuality. The implementation of educational means is long process. The teacher-designer have also to integrate devices, scenarios, production developed by other professionals, and this process seems to be more complicated than when traditional teaching is realized. The stages of education, choice and then the integration in one's own strategies can be regarded as a new kind of activity.

If telecommunication networks are used, at the stage of transfer the teacher should learn to take into account the influence of such parameter as the distance: for example, to adapt his speech even if he cannot see his student. If to master a material it would be better to use hardware the teacher or the educational institution should also solve the problems of support. That is realized depending on pedagogical and psychological situations and on motivation. Another point which should be considered is granting the teacher the opportunity to conduct distance .teaching due to the use of technical means: in this case he does not transfer his own knowledge directly, but he can supervise the process of learning and the realization of pedagogical strategies which he chooses.

At least, the teacher will use NTE to develop new methods to evaluate acquired knowledge and new methods of teaching. It should be noted, that from the teacher's point of view the use of NTE divides his job into a number of different functions.

3.3. Educational Institution

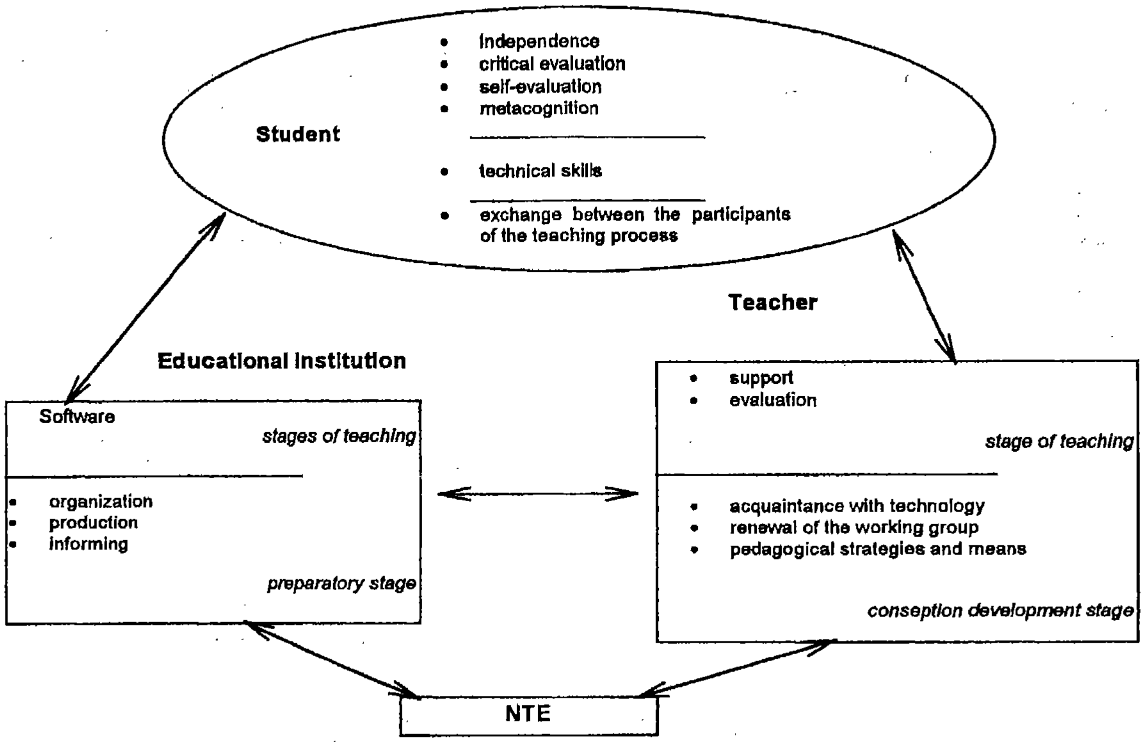
In the case of 'traditional' education the role of an educational institution in the process of teaching is mainly connected with the organizational problems and evaluation of the results. The use of NTE changes its areas of participation in education. The role of an educational institution is determined equally by the chosen operative model, production or the integration of educational means, as well as by the methods to transfer data to the students. When using NTE, besides non-pedagogical function, which are present in the classical system, there are additional functions of managing the relationships between the participants in the process of learning, monitoring software, and setting technical problems.

First of all when a decision about the use of NTE an educational institutions often examines economical issues: initial investments, the cost of maintenance, the expected savings of funds, which makes it necessary to develop methods to evaluate the results and the influence of parameters on the results.

The main functions considered above are given on the scheme, we are well aware of the fact that the set of functions is not exhaustive.

4. THE EXTENSION OF THE AREA OF NTE APPLICATIONS

In recent months the use of new technologies in education has been on the increase very much, especially in offices and at business. The number of congresses and seminars devoted to the subject, the realization of European and national programs in support and development of the 'technology and education' projects, the fact, that new commercial structures in ever increasing numbers emerge on the market of educational technologies are indicative of the process. A very fast extension of Internet, good access to devices which use these technologies (multimedia computers), considerable progress in ergonomics to improve the user's interface partly explain such extension. We believe that nowadays an ever increasing number of people responsible for decision making and executives in the field of education would be interested to get 'extra' profits from NTE applications. It explains why at present many projects which are at the design stage pass to the stage of realization.



The original is presented in French

INFORMATICS IN THE SYSTEM OF ADVANCED EDUCATION

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1. THE WELFARE OF THE NATION AND ADVANCED TECHNOLOGIES

The conditions in which people live at the turn of 21st century call for a new strategy in the evolution of mankind based on knowledge and highly developed advanced technologies. Information technologies should be given the top priority, because it is these technologies that serve a catalyst to speed up the process of scientific, technical, social, economical and intellectual development of the community.

The level of technological development of the community determines not only its ability to turn out high-quality production using minimum raw materials and energy, but it gives economic power and social stability to the developed countries and determines the living standards of the overwhelming majority of their population [1].

The powerful stimuli for the advance in technologies in modern society are the ever increasing automatization of industry, wide-scale cooperation and international division of labour, stiff competition between manufactures. Increasing labour productivity and the impact on the output of production, as well as on the new kind of the world market - the market of technologies, advanced technologies not only enable to produce the needed amount of high-quality production, but also create an important social effect, that is the saving of the social time of the community. In other words, people enjoy more freedom introducing new technologies, because thus they make more time for other activities. What are the main conditions for successful development and introduction of advanced technologies? First and foremost, it is the advance of science, general and special education, and of the intellectual development of the community. It is these problems that should be given the top priority in the national policy of any state. Those countries which fail to ensure this priority will find themselves at the periphery of the world technological progress as outsiders.

2. INFORMATION TECHNOLOGIES AS CATALYSTS OF THE ADVANCE IN MODERN SOCIETY

As for the need to give priority to the advance in information technologies, it is determined by the fact that these technologies play the leading role not only in the global informatizatiori of the community, but also are «the intellectual components» of other technologies - industrial and social [2].

The most important trends in the social impact of information technologies on modern society are the following:

- making information resources of the community more active,
- making information sphere more efficient,
- changes in the population employment scheme,
- making other technologies (industrial and social) more «intellectual»,
- development of information communications,
- making the community more intellectual, which is the main condition to create a new and safe model of its development based on knowledge.

The importance of information technologies in the solution of the problems connected with national security, from global modeling to fighting crime, is extremely great [3]. The problem of information security of man and society should be given special attention. This is a new and serious problem, which has not been properly studied yet, and which faces humanity in the transition period to information society.

The impact of information technologies in solving cultural problems is increasing. The most important are the problems of preservation of society's cultural heritage, the informatization of creative processes and also new problems connected with building up of cinema culture and cinema art.

The above mentioned characteristics of information technologies are unique and extremly important in the life of modem society. That is why today information technologies are given the top priority.

3. THE CONCEPTION OF ADVANCED EDUCATION

One of the most important and constructive ideas in the strategy of further development of the modem system of education is the idea of advanced education. The main point here is not only to ensure an ever advancing development in the system of education on the background of other factors of social, economical and cultural development of society, but principally to help people from such abilities that will enable them to adapt, live and work successively under new conditions of the coming 21st century. The most important among these abilities are:

- noospheric consiousness,
- system thinking,
- ecological culture,
- information culture,
- creative ability,
- tolerance,
- high morals.

We believe that it is these abilities that will ensure the survival and further steady evolution of civilization. That is why they should be te main goals of the advanced education system [3]. The idea of advanced education belongs to the Russian philosopher, academician A. D. Ursul [4] and it ensues from his philosophic conclusion necessitating the priority of consciousness over existence in the community's transition period to the steady development and controlled process of creation of the noospheric civilization [5]. This idea is especially important and timely for Russia nowadays when the Conception of transition of the Russian Federation to the steady development is adopted and the strategy of the country's steady development is being carried out. The idea of advanced education was touched upon in the National Report of Russia at the Second International congress of UNESCO «Education and Informatics» [6] and it will be assumed as a basis for the state policy of Russia in education. It is essential that not only scientists and experts in the field .of education but statesmen and politicans as well ought to realize the actual need to give the system of education an added characteristic of advanced development which is only natural at this stage of evolution of our civilization. It is on their attitude and practical activities that the implementation of this main idea will largely depend [7].

4. INFORMATICS IN THE SYSTEM OF ADVANCED EDUCATION

At the turn of the 21st century we should be aware of the fact that humanity enters a new era - the era of information. The stability and welfare of human society will mainly depend on how efficiently we will be able to use information as a means of development of our civilization. In other words it is the question of the increased social role of informatics in the life of society, faster technological cultivation of social sphere and, in this connection, the need to use new approaches to informatics in the education system. We should remember that today informatics is not only an important means to support pedagogical process, it is not only a highly efficient teacher's tool, but it is also an important and necessary educational subject.

Born in the depths of science about managing of processes - cybernetics, modem informatics is rapidly expanding its sphere of application. We are the witnesses how from the technical subject about the methods of processing data using computer systems and other information means, informatics is changing into a fundamental brunch of natural science about information and information processes in nature and human society. Today informatics is the most long-term and growing sphere of science in the world, the whole complex of new sciences about informatics is now being centered around it. This complex will form a scientific basis of the coming information society [8]. That is why in the long-term system of education new approaches to training informatics in technical as well as in humanitarian [arts] educational institutions, lycees and colleges are necessary [9].

5. NEW PRINCIPLES OF TRAINING INFORMATICS IN THE LONG-TERM SYSTEM OF EDUCATION

In the National Report of Russia at this Congress the general outline of the new long-term course «Fundamentals of Informatics» was given for the system of advanced education. The course falls into four sections: «Theory of Informatics», «Means of Informatization», «Information Technologies» and «Social Informatics».

All sections have units and comprise several problem units, the organizational structure and contents of which can vary depending on the specialization of the given educational institution. This, for instance, the section «Theory of Informatics» includes six units:

- Philosophic principles of informatics;
- Principles of general theory of informatics;
- Principles of computer cemantics;
- Principles of informational modeling;
- Intellectual information systems;
- Information and knowledge.

This section of the course aims to help students to form modern scientific world outlook, which regards information as a fundamental semantic characteristic of nature, and information processes as the most important components of any technical, social or natural systems.

The second and third sections of the «Means of Informatization» and «Information Technologies» course contain problem units, which consider functional possibilities and the prospects of development of the modem means of informatization in society, their information support, as well as basic and applied information technologies. The material is organized in such a way as to give specialists not only pragmatical knowledge, but a general view about information technology as a new science dealing with the rational organization of information processes. The need to create such science is becoming more and more obvious. The fourth section of the «Social Informatics» course includes four problem units:

- Information resources;
- Information Potential of Society;
- Information society;
- Man in Information Society.

The main purpose of this unit is to give students a full system knowledge about the information character of the development of modern society, as well as about accompaning information problems and the ways to solve them using information approach method and the potentialities of information technologies.

6. RUSSIA'S EXPERIENCE IN THE DEVELOPMENT AND STUDY OF THE PROBLEMS OF SOCIAL INFORMATICS

The «Social Informatics» section is basically new in the given course on the principles of informatics. This course is particularly important for students and postgraduates of universities, humanitarian educational institutions as well as for teachers and listeners in the system of additional higher education.

Social informatics as a separate scientific and educational discipline was first established in Russia, and since 1989 it has been gaining an increasingly wide recognition in the system of higher education. Thus, for example, problem-oriented departments of social informatics have been set up in a number of state universities in Russia and they are operating successfully. There is also a course of social informatics in the system of additional higher education - in Moscow State Social University and in the Russian Academy of State Service under the President of the Russian Federation. Since 1989 scientific seminars and conferences on scientific and educational problems of social informatics have been held every year, and the collections of proceedings «Social Informatics» and «Problems of social Informatics» are published regularly. All this is indicative of the fact that a certain scientific school has been established in Russia to study the problems of social informatics, its activities undoubtedly contribute to the practical realization of the ideas and methods of social informatics in education [10].

7. THE CONTRIBUTION OF RUSSIAN SCIENTISTS IN THE DEVELOPMENT OF INFORMATICS AS A FUNDAMENTAL SCIENCE

In recent years Russian scientists have been active conducting fundamental research both in the theory of informatics and in information problems of the evolution of society. They also encompass philosophic problems analysing the role of information and scientific knowledge in the further evolution of modern civilization and the transition to the stage of steady development of human society. The basis of this research is the noospheric conception of the evolution of biosphere, which is the result of research work of such Russian scientists known all over the world as Tsiolkovsky, Vernadsky, Chizhevsky, Timofeyev-Resovsky. Nowadays this conception is being further developed in the studies of academicians Ursul, Moiseev, Yanshin and other Russian scientists [5].

As for the development of theoretical principles of informatics in recent years, first of all one should mention the studies of such Russian academicians as N.N. Moiseev, A. A. Samarsky, A. D. Ursul, D. A. Pospelov, A. I. Rakitov, R. F. Avdeev and also professors Yu. I. Shemakin, L. A. Tsymbal, and a few others. Serious research in the field is also being carried out by the scientists of the Ukrainian Academy of Informatics.

All this is the illustration of significant results in research in Russia today, which can and must be te subject of systematic studies in the long-term system of education. It is these results that should be the basis of problem units in the «Theory of Information» section which will be a part of a new course «Fundamentals of Informatics».

8. THE INTERNATIONAL PROJECT FOR THE SYSTEM OF EDUCATION «INFORMATICS - 2000»

It would be good idea to carry out a special complex international project «Informatics - 2000» under the auspices of UNESCO to unite the efforts of experts from all over the world to develop and to put into practice new methods of learning informatics in the system of advanced education.

The purpose of the project is to create basic programs for the units in the «Fundamentals of Informatics» course various links of the long-term systems of education using the results of research of fundamental problems in informatics and the teachers' experience gained when using these results in higher and additional higher education.

In the process of the realization of the project the following is to be carried out:

- basic programs for the units of the new course in higher and further education, as well as in additional higher education;

• general program for the units intended for adults;
• manuals dealing with the main sections of the new course.

The project is supposed to comprise a course of lectures (on video cassettes and computer optical disks), by the leading experts in particular problem units of the new course.

The project should be realized with the help of the leading scientists, teachers and experts in informatics, philosophy and sociology from various countries, which have already made some scientific and educational studies in technical and social informatics. It is most important that professors and teachers from universities, technical and humanitarian higher educational institutions and colleges of Western and Eastern Europe, the USA, Canada and Japan should participate in the project. Their experience and knowledge pooled to form basic programs in long-term course of informatics and oriented to train people who will live in information .society would make these programs useful and necessary for the world community.

The development of such programs and their distribution through UNESCO is an important step on the way to practical realization of the idea of advanced education, which is a necessary condition of a further safe and steady evolution of our civilization.

Fundamentals of Informatics

Section 1. Theoretical informatics	Section 3. Information technologies
Problem modules:	*Problem modules:*
1.1. Philosophical fundamentals of informatics	3.1. Basical information technologies
1.2. Principles of the general theory of informatics	3.2. Applied information technologies
1.3. Principles of computer semantics	
1.4. Principles of information modeling	
1.5. Intellectual information systems	
1.6. Information and cognition	

Section 2. Means of informatization	Section 4. Social informatics
Problem modules:	*Problem modules:*
2.1. Technical means of iformatization	4.1. Information resources
2.2. Programmatic means of informatization	4.2. Information potential of society
2.3. Means of informational supply	4.3. Informational society
	4.4. Individual in an informational society

Figure 1. Module structure of the subject field of the new training course «Fundamentals of Informatics»

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The original is presented in Russian

INTERNATIONAL COMMUNITY OF THE DEAF: EDUCATION AND NEW TECHNOLOGIES

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VIDEO-COMMUNICATION PROJECT

INTRODUCTION

As noted in tne Introduction to the Education and Informatics: Proceedings of the Second International Congress *(held in Moscow, Russian Federation, on 1-5 July 1998), recent years have witnessed "remarkable development in information and communication technologies, whereby hardware and software 'generations' have rapidly succeeded each other and, in the most innovative manner, have converged with other technologies. "*

Since new information technologies (NIT) can lead to the design of a practically unlimited number of new information channels and networks, particularly through the use of digital and informational combinatorial devices which allow for communication of large volumes of visual information, and also considering the fact that the universal type of communication for the deaf people is visual communication (primarily the sign language), new information technologies are called upon to play a significantly important role in the transformation of the traditional methods of education of the deaf.

The international community of the deaf people numbers some 200 million people (children and adults, suffering congenital or caused hearing impairment, born of deaf or hearing parents).

In the early 1990s, the only information communication channels that the community of the deaf people had at their disposal were the devices for telephone sound recording - of the TTY type in the USA and Minitel in France. The community was, therefore, cut out from the majority of audio-visual information and communication channels used in the hearing world.

Now that we are approaching the beginning of.the third millennium, the advent of new communication networks (video-conferences, dialogue television, computerised workstations, pictorial languages, direct communication via Internet, etc.) has made it possible for the deaf people, for the first ever time in history, to communicate and express themselves by means of VISIBLE SPEECH, VISUALLY at the planetary scale.

This profound change taking place in the international community of the deaf signifies a total rejection of old the system of education of the deaf. Adopted at the 1880 Milan Congress, which has become inadequate for the purposes of teaching using new information technologies.

NEW INFORMATION TECHNOLOGIES - A HISTORIC CHANCE FOR THE INTERNATIONAL COMMUNITY OF THE DEAF PEOPLE

The development of new information technologies has led to a fundamental change in the methods of conveying knowledge the deaf people in the process of their education, the significance of which is comparable to the change in the methods of knowledge transfer that the appearance of the printing press had for the hearing world.

Deaf people, as is well known, communicate with the help of sign languages which have developed over many centuries, and which have certain regional and national distinctions.

Just as the speech of the hearing community, sign languages, possessing their own vocabulary, syntax, grammar and variety of styles, can in full the requirement for self-expression and communication among the deaf people.

Since the deaf people's perception of the world is entirely visual, the combination of signals and the syntactic rules used to produce communication are radically different from the rules governing the production of spoken communication by the hearing people. The sequence of signs is dictated by the logic of perception and inception of concepts, instead of the existing structured logic of the hearing, people language.

It had taken nearly a hundred years after the International Congress of 1880 in Milan, where the majority of the participants, comprising hearing teachers of the deaf, adopted a barbaric decision to prohibit the deaf the use of their own language and any form of cultural self-expression using their language, for the hearing community to admit, at last, the fallacy of the approach based on cruel and ill-fitting methods of forceful integration of the deaf into the hearing world.

We might say that at present the historical opposition between the proponents of speech education, on the one hand, and education based on sign language, on the other, has abated.

Most of the current policies toward the education of the deaf, whether regional, national or international, are based on the concept of dual culture seeking to bring the two worlds together.

As more and more communication and information bridges are built between the world of the deaf and the world of the hearing, it becomes increasingly clear that the progress of new information provides a historical chance of overcoming the gap which has always divided the two worlds.

TECHNOLOGICAL DEVICES AND THE DEAF

Now that we can make use of "information auto-routes" (some of which, like, for example, Internet, are based on recurrent dynamic information routing over telephone circuits), it is pertinent to draw attention to the fact that we have to thank Alexander Graham Bell, Scottish-born scientist and teacher, for the invention of the first information channel - the telephone, which had been prompt by his desire to find a means that would allow communication between hearing and deaf people.

Alexander Bell was born on March 3, 1847, of a deaf mother, communicating with the world with the help of lipreading and sign language, and a hearing father, an authority on elocution and speech correction, whose desire was to develop a universal language allowing unhindered communication of all people, hearing and deaf alike.

In 1871, Bell started lecturing in Boston on teaching speech to the deaf. He later fell in love with one of his deaf students, Mabel Hubbard, the daughter of a powerful man, the Massachusetts senator, who was later to become his wife. His future father-in-law assisted Bell financially in his research toward creation of an instrument for the transmission of words.

We owe Bell several inventions and innovations, among them a multiple telegraph, following which, in March 1876, he patented "the method of, and apparatus for, transmitting .... sounds telegraphically by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds". This signified the invention of the telephone.

Working on the telephone, Alexander Bell had in mind an instrument that was to make him closer to his deaf wife, but ironically, achieved quite the opposite, instead, for the invention of the telephone increased the distinction between the hearing and the deaf, just as the operation of the Bell Telephone Company, one of the most powerful in the world, further widened the gap between the world of the hearing and the world of the deaf.

It happened, first of all, due to the deaf people's inability to use a telephone. But also because the Alexander Graham Bell association for the Deaf promoted a new policy toward the education of the deaf, adopted by the 1880 Milan Congress.

As a result, the community of the deaf had for over a hundred years been barred from the use of communications based on new visual technologies. Now again they are facing a new world which was brought about by the development of new information technologies.

The deaf community are challenged by the appearance of new technologies in the area of information and communication.

The degree to which the new technologies can ensure video-communication over short or long distance is the degree to which, for the first ever time in history, the knowledge accumulated by the hearing community becomes available to the deaf.

Even now, the application of new information technologies makes it possible for the deaf to introduce radical changes in the social and cultural system of their vast community.

This historic development in the culture of humankind must speak to the conscience of those in the hearing community who are in charge of the development and implementation of the policies toward the education and training of the deaf. But even more so, this refers to those in the deaf community who are responsible for the cultural heritage of their own community.

DIRECT COMMUNICATION BETWEEN DEAF PEOPLE OF DIFFERENT NATIONALITIES

Unlike the hearing, the deaf can communicate without the assistance of a translator. This possibility of communication in an internationally understood language is one of a real treasures owned by the international community of the deaf. Indeed, all the languages of bodily movements employed by the deaf community of the world have five shared parameters: configuration, direction, position, facial expression, movement of the hands.

Since every national language of bodily movements comprises several thousand signs falling within this linguistic law of parameters, it is easy to understand *how* great are the possibilities of communication through bodily movements familiar to all.

Such an international language of bodily movements can include:

- original, close to mime, movements (which are often the first sign language elements to appear in any national sign language; thus, a hand movement uniting the mouth and the ear is universally understood as the sign pointing to deafness);
- movements common to the majority of countries;
- spontaneous movements, meaningful only within a specific context;
- drawing movements;
- signs and phrases loaned from the interlocutor's language (as when a deaf Chinese uses a Chinese sign during a communication with a deaf Frenchman: if the latter cannot understand the used sign, he would ask the Chinese to explain its meaning or to choose an equivalent sign; if he does understand the sign, he would right away introduce it into their communication);
- non-verbal communication signs, such as silence or exchange of glances).

For the deaf of the world the sequence of signs in a "phrase" has less significance than their spatial position and the accompanying movements. The deaf nearly never use the subject-predicate-object phrase structure commonly used by the hearing speaking Romanic and Slavic languages. The deaf tend to use the subject-object-predicate structure (most commonly), as in the Turkish and Japanese languages, or the object-predicate-subject structure, as in the Malagasy and Polynesian languages.

While the same syntactic combinations are used by the deaf world over, the finger signs are dissimilar in different nationalities.

The finger alphabets of the French, Americans, Belgians, Dutch, Swiss, Nanes, Swedes, Italians, Portuguese, Argentines, and Brazilians requires the use of the fingers of one hand, while the. English, Irish and Australians use the fingers of both hands.

Written alphabets differ from country to country. The number of finger signs used is 24 in Greece, 26 in China and in the countries of Romanic languages, 32 in Russia, 33 in Iran, 39 in Poland, 43 in Israel, 46 in Japan, etc. In 1973, the Sign Unification Commission of the World federation of the Deaf attempted to code these international movements within one international system - the GESTUNO language.

Currently, the Federation upholds the view that the wealth of communication means employed by the deaf does not allow to codify them within a single international language, and is therefore inclined to leave it to the community of the deaf to decide the destiny of of this language of international communication which is undergoing constant change and transformation. It is clear that rapid progress of the new informational technologies will in the years to come produce a veritable "leap" in the development of the international language of the deaf community. Already, there are there exist numerous international circuits within Internet for communication of deaf people of different countries (such as, for example DVWV). Still, the communication via these channels is carried out using written languages of the hearing (primarily English and French).

In future, due to the transfer of images via new information auto-routes, deaf people will be able to communicate using the movement language (input of video-data in the network, direct information exchange by real time processing, dialogue television networks, etc.).

As for the practical availability of required equipment, training and access to NIT for national communities of the deaf, it must be admitted that some of them employ the opening possibilities of using new information technologies in full.

In view of this, final documents of the present Congress must contain recommendations worked out by the persons, hearing and deaf, employed in the teaching of the deaf, concerning the establishment of international cooperation in the effort toward providing an access to NIT networks for the entire community of the deaf.

1VL PROJECT INTERNATIONAL VIDEO-LINK APPLICATION OF VARIOUS DATA INPUT, PROCESSING, AND TRANSFER FACILITIES WITHIN THE FRAMEWORK OF THE INTERNATIONAL COMMUNITY OF THE DEAF

The IVL Project of 1995 provides for the application of various video interchange devices for facilitating communication among the deaf of the world.

The establishment of IVL is intended to:

- facilitate communication among increasingly great numbers of deaf people (through the sign language or icons), establish communication links between the deaf of different countries and cultures;
- set up and develop various educational, research and cultural programs within these networks;
- use NIT for training teachers with hearing impairment in the countries with insufficient number of teachers for the deaf;
- assist the hearing parents of deaf children in the learning of appropriate national sign language;
- ensure that the deaf children can communicate with deaf adults using NIT;
- make it possible for the hearing people wishing to become interpreters of the sign language used by the deaf;
- promote the exchange of educational, research and cultural programs both within the community of the deaf and between the community of the deaf and the hearing communities.

Thanks to new information technologies and the multitude of video-data, our societies are creating a new culture on our planet.

The world of the deaf, who communicate with the help of national sign languages as well as graphics and pictography, may find themselves in the vanguard of this new culture.

However, this may only happen if the wealth of new information technologies become available to the deaf and also if the world community realise that human communication is more than mere information exchange.

IVL PROGRAM FOR 1996-97

1. VIDEO-CONFERENCES WITHIN THE INTERNATIONAL COMMUNITY OF THE DEAF

Using special devices already tested by the IVL at previous video-conferences, deaf people of different nationalities (of Moscow, Kiev, Paris, Washington, Jerusalem, Tbilisi, Prague, etc.) analyse and compare in the sign language, without the assistance of a translator, the policies toward education and training pursued in different countries. The video-conferences will work out new lines for the research in the field of education and training.

2. INTERNATIONAL COMMUNICATION OF THE DEAF VIA INTERNET

Within Internet, the Program provides for the establishment of 14 IVL sites; latest news groups between deaf and hearing, Internet access ports for the deaf; training for the deaf experts capable of assisting other deaf people in obtaining access to Internet facilities; an international association intended for research for and design of the optimum communication and education facilities within Internet for the entire world community of the deaf (including overcoming the barriers in approaching the texts, the use of pictorial vocabulary, switch-over to the application of video and operation in the4 direct information exchange mode, etc.).

3. TEACHER-TRAINING OF THE DEAF USING NIT

The IVL Program suggests that the countries wishing to ensure availability of NIT for the deaf people should organise teacher-training for the deaf.

4. A VIDEOTEQUE FOR THE WORLD COMMUNITY OF THE DEAF

The videoteque should contain the entire wealth of the video or other filmed documents created by the deaf or with the participation of the deaf, as well as the main television programs.

It is proposed to film a documentary for both the deaf and the hearing viewers on the specific features of international communication of the deaf. It can be shown in different countries to get the audience acquainted with the subject.

5. TEACHING THE APPLICATION OF NIT TO OF DEAF PRESSMEN

The progress of new information technologies dictates an urgent need to teach the use of new information and communication facilities to the deaf journalists.

IVL offers expert assistance to the countries wishing to start the program of training deaf journalists to use new information technologies.

It is clear that the first stage, that of adaptation to fast-changing novel technologies, particularly as concerns Internet and digital television, should be followed by the second stage, ending in the year 2000.

A deaf person's voice is his/her body.

A deaf person's communication mode is communication via eyesight.

Excluding the deaf from any type of communication is tantamount to infringement upon the right to live.

The NIT's spring into existence in the hearing world dictates the need to revise in full and without any delay the entire range of policies applied in the area of communication and education of the deaf.

The IVL Project is designed to assist in the implementation of these profound transformations. Besides, it is supposed that IVL should promote penetration of the culture of the hearing by the culture of the deaf, and will also facilitate an access for the hearing to the humanitarian values underlying the culture of the deaf.

Annex

Demonstration at the Moscow Congress of communication between two deaf persons of different nationalities without the assistance of an interpreter.

At a video-conference, two deaf persons of different nationalities who had never seen each other before communicated for three minutes from two different geographic sites with the help of video communication facilities.

The original is presented in French

Discussion

EDUCATION, INFORMATICS AND INTELLECTUAL RIGHTS IN AFRICA

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SUMMARY

This presentation is to show that while providing the protection and development of intellectual lights connected with information creative work, one can enable the active participation of Africa in realization of the project introducing new information technologies into educational system, fostering deep creative work in provision of training software. This pioneer role can play the local and regional non-governmental institutions under a UNESCO support.

Similar to fire or gunpowder, a computer ranks among the inventions which left a deep sign in history of human civilizations.

The president F.H.Boigny had declared - and echo of his words were spread anywhere by tom-toms of our state villages - that Africa, being late for industrial revolution train, can ill afford to miss the revolution in informatics. "Because the informatics is a historical possibility for us to respond for all challenges of backwardness." (F.H.Boigny, in Jeune-Afrique Bis, n 10, September 1985, p. VI.)

However none revolution, even technological, and, in particular, informative, lack of organic "magic" ability to cause the new breakthroughs in development, unless it can meet the conditions, promoting its acceptance and mastering in area, where it passes inspection and finds application. The preliminary term concerns about culture and education.

To get rid of "intricacies" and shorten the gap between industrial and developing countries, it is necessary, among other things, to "africanize "software creative work for purposes of training. Specifically, to do this it would require to encourage the developers of such products, promoting their works and protecting their rights [1].

I. INTELLECTUAL RIGHTS IN AFRICA

Most of national legislations, concerning to intellectual and especially author rights are intimated by Western influence and are not marked as efficient in African environment. This can be explained by various reasons. First of all, from political standpoint, the political regimes of last decades did not encourage a creative work, but, on the contrary, they had been establishing the ideological frames in the form of censoring [2].

For this reason the official decisions, by no means, were not incentive for information development and, in particularly, for so-called policy of "equipment purchasing" [3].

From the economical point of view the scientific works did not gain acceptance, since we were not able to provide the due prestigious to authors.

In particular, the originator of software were disappointed by informatics facing to hard competition with imported products and to revelry of piracy.

Finally, from jurisdiction point of view the legislation could not be able to secure the actual protection of authors, supported by administrative and court Bodies.

The violation of intellectual rights are not punished. Moreover, the African jurisdiction is not elaborated in this area at all.

The future of African software creative work, in common, and educational software, in particular, can appear to look uncertain in scope of factors, mentioned above. However, this is a general situation. And still, how to encourage the creative work, which would meet the educational demands of Africa?

II. THE DEVELOPMENT OF EDUCATIONAL INFORMATICS ON THE BASIS OF INTELLECTUAL RIGHTS PROTECTION

The development and protection of intellectual tights in the area of informatics may prove to be the solution of a problem of elimination of a break between the industrial and developing countries while mastering the new information technologies in educational systems. Naturally, the development of rights and the creative work itself may prove to be very useful in many respects:

- owing to financial rewards of authors and upgrading of their scientific authority;
- owing to establishing of a new profession and encouraging the creative work and economical and cultural progress;
- owing to export of African software products and overcoming of their barriers in regard to authors from industrial countries;
- owing to Africa transformation into complete partner in area of information and data exchange at inter-regional level.

Practical terms of realization of such project of development may represent several types of this subject. Apart from establishing governmental and nongovernmental structures, intended to enable the record, acceptance and application of such products; the measures like fairs, national and interregional competitions, the selection from time to time the best products compiling the requirements of special orbs, the awarding of incentive prizes, the granting of scholarships for training or upgrading, may be incorporated over there.

The non-governmental organizations and local Associations can promote advance of educational software products and their authors, attracting an attention to them, advertising their creative work, conducting the educational work. Specifically, they would select the useful products and recommend them to school authorities in due order.

The educational activity of those organizations could, for example, consist of explanation to African people of the fact that human rights are concerned about not only political rights. Really, the violation of intellectual rights are also the violation of human rights. Their activity in this specific area could coincide with the activity of traditional unions of human rights defenders, being expressed as acts of unmasking, protection and education.

The issue of informatics and ethic must also be in focus of attention of those organization. Naturally, the introducing a computer to school must be followed by definite educational efforts from a child's side and, therefore, from a teacher's side.

All these actions constitute an integral art of activity, that African Association promotes for the development of informatics in Zaire, realizing several projects, one of which is called "Informatics for everyone", lies in the fact that women and children must be teached for mastering a computer.

UNESCO, being involved in author's rights, could play a useful role in supporting the activity of those Associations through offering the necessary strategies and mechanisms of international cooperation. Advocating for education in the interests of peace and for elimination of crying inequality among people, provisions should be made today for the idea of educations, going beyond the scope of structural cooperation - education with human face.

CONCLUSION

The development and protection of intellectual rights, connected with educational and informative creative work is an effective way to shorten, if only a bit, the gaps between industrial and developing countries.

The intellectual rights - the source of progress. The progress, being generated by introducing the new information technologies in African educational systems, is capable to provide for the continent a beneficial export of its richest information potential, to release its talents from a intricacy of "marginality".

Thank you for your attention, I am going to deliver some recommendations to the speaker of our Commission.

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The appeal of Mr. NSAMBI BOLALU at Moscow Congress, 03.07.1996.

Mr. President,
Dear colleagues,
I asked for a floor to express the apologies of my compatriot Mr. Paulin Mbalanda Kisoka from Zaïre, who could not come to Moscow because of family problems, arised unexpectedly. Mr. Paulin Mbalanda entrusted me to deliver his address to Congress, which I am trying to bring to all of you. This address from distant Africa is devoted to education, informatics and intellectual rights in Africa. Here it is.

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1. For this theme see MBALANDA KISOKA, Le défi de la datacratie à la dévolution des droits sur le logiciel, CEDIT. Université de Kinshasa, 1993, 27 p.

2. The principle of liberty of thought and research, as will as information spread, was accepted by Sovereing National Conference as a preliminary term for determining of national policy in science area (See "Education, recherche scientifique et technologique au Zaïre", Textes d'analyses et décisions de la Conférence Nationale Souveraine, rasemblés et presentés par SABAKINU KIVtLU et MPEYE NYANGO, Bibliothéque Nationale du Zaïre, Kinshasa, 1995).

3. See J. BEER GABEL, "Le tiers-monde et l'informatique aujourd'hui", in Le Courrier. n 113, 1989, pp 56-62. In Zaire the Article 4^th^ of «Ordonnance №87-243» dated July 22, 1987 states: "Any purchasing of foreign means of informatics must be approved by President Service on Research Problems..."

The original is presented in French

Part VI

Theme 5

EDUCATIONAL POLICIES

Plenary

THE ROLE OF COMPUTERS IN EDUCATION: ACHIEVEMENT AND COMPREHENSION

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INTRODUCTION

In most cases education processes are restricted to asking students to do various activities, which they can, or cannot, do successfully. However, the fact that they may be able to accomplish these activities does not mean that these students necessarily comprehend what they have done.

The distinction between achievement with success (savoir faire) and the comprehension of what is achieved is presented by Piaget (1974). He says that a child is able to do complex actions with success without necessarily comprehending all the concepts involved in the activity. The passage from the level of achievement to the level of comprehension is done thanks to the grasp of consciousness. This passage requires the transformation of action schemes into notions and operations (Piaget, 1976).

The uses of computers in education can fall into the same path. With the computer, the student can do lots of activities and achieve them successfully. However, depending on the type of software used. and the teacher's involvement in the computer activity, the student may, or may not, understand what he has accomplished. This is the case when the student uses a tutorial or many multimedia software. The student's action can be reduced to turning the next page of the lesson or choosing among several options presented by the software.

However, when the student programs the computer to solve a particular task, he engages in an activity that demands different actions which can create the conditions for comprehending what he is doing. The process of programming can be seen as a cycle consisting of description-execution-reflection-debugging-description (Valente, 1994; Valente, 1995a).

In the cycle "description-execution-reflection-debugging-description", debugging constitutes a unique opportunity for the student to construct hers/his knowledge and to understand what s/he is doing. With the help of the teacher, the cycle can be used by the teacher and the student to understand about how, when and what makes the construction of knowledge possible; it makes possible a discussion about "learning about learning" since the student in the process of looking for information is exercising hers/his learning skills; and it raises questions about "thinking about thinking" since the student can analyze hers/his program in terms of effectiveness of hers/his ideas, strategies and problem solving style.

In this paper I discuss the different types of software used in education and I argue that the programming activity is an opportunity to engage in the passage from achievement to comprehension. Programming involves certain actions which are essential for the development of important skills which are often not present in the educational process today nor in many types of educational software. This discussion allows us to understand the role of the computer in education, and the role of the teacher and students in the computer based learning environment. Also, there are several outcomes from this discussion that can help us to set up more effective teacher training programs and educational policies involving computers.

PIAGET'S VIEW OF SAVOIR FAIRE AND COMPREHENSION

In 1974 Piaget published two books, *"La Prise de Conscience"* - translated into English as *"The Grasp of Consciousness"* (Piaget, 1976) - and *"Réussir et Comprendre"* (Piaget, 1974), reporting the process by which children and adolescents come to develop what he called "conceptualized comprehension" of concepts involved in a series of tasks he asked his subjects to perform.

In his studies Piaget observed that children can use complex actions to reach premature success which represents all the characteristics of a *savoir faire*. The child can do a particular task but does not comprehend how it was done nor is aware of the concepts used to achieve the task. Piaget observed also that the passage from this practical form of knowledge to thinking is done through the grasp of consciousness which does not constitute a kind of enlightenment but a level of conceptualization. This level of thinking is reached thanks to a process of transformation of action schemes in notions and in operations.

Thus, through a series of more and more complex concept coordinations the child can move from the level of premature success to a level of conceptualized comprehension.

Piaget showed that the passage from premature success to conceptualization is done in three stages: in the first stage the child neglects all the elements involved in the task; in the second stage the child coordinates some elements; and in the third the child coordinates all the elements involved in the task. He showed this using several tasks such as constructions of objects with a deck of cards, tipping over dominos arranged in a line, playing with scales, etc. The tipping over dominos is a good example to help us to understand these three different stages.

The child is asked to arrange dominos in a line such as if we tip over the first domino, this will tip the following and successively will tip the next until all the dominos in the line fall over. The task is divided into two parts. In the first part the child plays with two dominos trying to predict the interval between the dominos that will make the first domino knock down the second one. Then the child is asked to arrange all the dominos in a line, connecting two points A and B. After the child has constructed the line, the child is asked to predict which dominos will fall and which will not, and why. Then, he is asked to tip the first domino and observe what happens to the line of dominos. In the second part of the task the child is asked to connect the points A and B using different trajectories. The first is a simple diagonal and for the second trajectory, an obstacle, a lake or a mountain, is placed between points A and B.

Children about 5 years of age can arrange the dominos in a line and accomplish the first part of the task with success. However, when playing with the two dominos these children cannot understand that the distance between the dominos is an important element in the construction of the sequence of dominos. They think that what makes the subsequent dominos fall is how hard they push the first domino or that the dominos need to be closer to each other, but they cannot make explicit how much the distance between dominos must be. In this sense, these children can reach the objective of the task but they are not aware of the role of the distance between dominos or other concepts involved in the task. Thus. these children's performance indicated that they are considered to be in the first stage.

The next stage is reached when the child is around 6 years old. This stage is characterized by the fact that the child starts to understand and can articulate the idea that the distance between dominos must be less that the height of the dominos. However, they cannot organize the dominos so they can avoid the obstacle or to arrange the dominos in a diagonal line. Their argument is that it is impossible for the dominos to be arranged according to a circular or diagonal line.

Thus, these children can coordinate the distance element present in the sequence of dominos but cannot coordinate the direction of the dominos. The passage from stage one to stage two happens because the child, in the process of constructing the sequence of dominos, observes that if the dominos are too far apart, one cannot lean on the other or the first domino cannot "touch" the other one. In this situation the child corrects the distance between the dominos, and becomes aware that the distance between dominos has to be such that one has to be able to lean on the other. However, for these children the dominos have to be parallel to each other and, consequently, the sequence of dominos can only be in a straight line. The dominos cannot be arranged one a little to the side of the other so that the sequence can be in the form of a diagonal or a circular line.

Children from the third stage can coordinate all the elements involved in the task: distance, direction and weight of the domino. They understand that as long as each domino falls on the subsequent one the sequence of dominos will fall. They can arrange the dominos so they will fall in a circular or diagonal line. Also they understand that the closer the distance between the dominos, the faster the sequence will fall; and if the dominos are very light (made of plastic) the closer they have to be so a domino will "lean" on the next instead of just touching the next domino.

Besides the sequence of stages, Piaget observed that, first, it is not the object that leads the child to the comprehension stage. It is not the case that a child who comprehends how the dominos works will comprehend how to make a castle using a deck of cards. For each situation the child has to transform the action schemes into notions and operations that are involved in a particular task. Second, Piaget noticed that comprehension is the fruit of the quality of the interaction between the learner and the object. If the child has a chance to play with the objects, to reflect upon the results obtained and to be challenged with new situations, the greater are hers/his chances to be aware of the concepts involved and, thus, to reach the level of conceptualized comprehension.

These last two observations are fundamental to understanding the relationship between the learner and the computer in a computer based-learning environment. It is not the software that determines whether the learner will be able to reach the stage of comprehension of the concepts involved in the task but the quality of the interaction between the learner and the software. The analysis of the interactions which take place between the learner and various educational software will help us to understand the role of the computer.

ANALYSIS OF THE DIFFERENT EDUCATIONAL SOFTWARE

Any attempt to classify the different uses of computers in education is problematic and can result in a very simplistic view of what has been produced in this area. However, it can be an interesting exercise and can help us to understand the role of the computer and how it can be effective in the process of knowledge construction.

Computers have been used to teach about computers — computer literacy, and to teach practically any subject — teaching through the computer. In computer literacy the students use the computer to learn about programming, about computer principles and about the implications of computer usage in society. Although the majority of computers in education projects are about computer literacy, certainly this is not the kind of applications we want to discuss here.

Teaching through the computer means that the student uses the computer to gain knowledge in a particular area. However, the pedagogical approach used can fall in one of two groups: software that have the characteristics necessary for the child !o comprehend the task being developed and software that helps the child to do things but have very few characteristics to help the process of comprehending what is being done. Among the software that help the comprehending process is computer programming languages and multimedia authoring systems. In the other group we have the tutorials, drill-and-practice, word processing and the use of multimedia.

Tutorials

A tutorial is a software in which the information is organized according to a particular pedagogical sequence and this information is presented to the learner following this sequence or the learner can choose the information s/he wants to see. In the first situation, the software has the control over the teaching situation and what can be presented to the learner: the learner can change items by simply pushing the ENTER key or the software alters the sequence according to the answers given by the learner. In the other situation, the learner has the control and can choose what s/he wants. In general, these user controlled software are organized in a hypermedia fashion and the learner can "navigate" between items of information.

In both cases, the information available to the learner was previously defined and organized. The learner is restricted to this information and the computer assumes the role of a teaching machine. The interaction between the learner and the computer consists of reading the screen or listening to the information give, advancing through the material by pressing ENTER key, choosing information with the mouse, and/or answering questions by typing on the keyboard. By observing this behavior we see that the learner is doing things but we do not have any clue that s/he is understanding what s/he is doing. S/he may be processing all the information given but we do not have the means to certify that this is the case. One way of having access to this knowledge processing is by presenting problem situations in which the learner has to use the information given. Some software try to do this but, in general, the problem presented verifies that the learner memorized the information given, or requires a direct application of the information given in a very restricted domain. An open ended problem, that would allow for more that one type of solution would show the level of concept comprehension, is very difficult for the computer to correct. This type of evaluation is left to the teacher. Most tutorials are not developed with that intention. Unfortunately the teacher is often unavailable to follow what the student is thinking while using a tutorial.

Thus, I classify the tutorials as software that allow the student to achieve a certain task such as go through a lesson or acquire a piece of information but these software have very few features that can contribute to the comprehension process.

Programming

When the student programs the computer, the computer can be seen as a tool with which the student can solve problems. I argue that the program produced has several features that allow the learner to accomplish a particular task and to comprehend what s/he has done. Although I am going to analyze the programming activity through the use of the Logo language and I concentrate this analysis on the graphics aspect of Logo, as was mentioned in another study (Valente, 1994) this analysis transcends Logo and can be used to explain other ways of using the computer in education.

In the Logo graphics environment, as the student is solving a problem, hers/his interaction with the computer is mediated by the Logo computer language or, more precisely, by Logo procedures This interaction is an activity that begins with an initial idea the student develops about how to solve the problem. This idea is passed to the computer (or the Turtle) in terms of Logo commands. Thus, the student is acting upon the object "computer", however, this action is a description of the problem solution through the Logo computer language (Logo procedures). The computer, then, **executes** these procedures. The Turtle "walks through" the procedure commands and presents a result in terms of a picture on the screen. The student looks at this picture being constructed and to the final goal and s/he can **reflect** upon them. This reflective activity can produce several levels of abstraction, which according to Piaget (1977) will affect the student's intellectual structure. The student's reflective activity can lead to one of two alternative actions: doing nothing, when the student's original ideas correspond to the result presented by the computer, then the problem is solved; or **debugging**, when the result is different from what the student intended. And the debugging can be either in terms of concepts in the subject area (the student does not know about angles, for example) or about some convention in the Logo language, or about strategies (the student does not know how to apply a particular concept).

The debugging activity is facilitated by the existence of the computer program. This program is the student's description of hers/his ideas in terms of a formal, precise and simple language. The Logo graphics language is easy to assimilate and the commands are similar to the terms we use in everyday life. This minimizes the arbitrariness of the conventions and the difficulty in translating ideas into code.

These characteristics are not found in any other type of activity we do. That is, as the student acts on the world he receives, as a subproduct, the description of the ideas that support hers/his actions. Also there is a direct correspondence between each command and the computer's action. All these aspects available in the programming process facilitate the analyzes of the computer program so the student can find hers/his bug. The process of finding and correcting the bug constitutes a unique opportunity for the student to learn about particular concepts involved in the problem solution or about problem solving strategies. Also the student can use hers/his program to relate to hers/his thinking at the meta-level. S/he can analyze hers/his program in terms of effectiveness of hers/his ideas, strategies and problems solving style. This way the student begins to think about hers/his own thinking (reflexive abstraction).

The program the student produces is a description of the hers/his thinking process. This program contains important information about the child's knowledge and strategies and, thus, the student's comprehension of the concepts involved in the task. The execution of this program can be seen as the execution of the learner's thinking. The computer execution gives us two important ingredients for the comprehension process. First, the computer feedback is faithful. Since the computer does not add any new information or knowledge to the student's program, any mistake found in the result of running the program is the product of the student's own thinking. This faithful feedback is extremely important in order for the learner to become aware of what s/he knows, and the kind of information s/he needs to get in order to debug hers/his ideas. Second, the computer feedback is immediate. After the student pushes the ENTER key s/he has the results being constructed step by step. The student can confront hers/his original ideas and when the result obtained on the screen. This comparison constitutes the first step in the reflective and in the grasp of consciousness processes. These processes can be enhanced by the program which is a formal description of the student's thought. If we save all the different versions of the program produced by the student we can follow the process by which the student developed the concepts involved in the program.

Thus, if we ask the question "why do we want computers in education?" the answer is that we want to explore the computer features which contribute to the conceptualization process. These features include the expression of the student's thinking in a formal and precise language, the execution of the student's thinking, and results which are faithful and immediate. These characteristics present in the programming activities help the student to reach the conceptualized comprehension stage because the student can reflect on hers/his actions and ideas. This reflection is the mechanism by which the student becomes conscious of hers/his knowledge and, thus, can transform hers/his mental schemes into more complex notions and operations.

However, this process does not happen by just placing a student in front of a computer. The interaction student-computer needs to be mediated by a professional who knows about the Logo ideas, from the computational, pedagogical and psychological points of view. This is the role of the Logo teacher. Also, the student, as a social being, is inserted in social environment that is constituted, more locally, by hers/his pears, and more globally by hers/his parents, friends or even hers/his community. S/he can use all these social elements as sources of ideas, knowledge or problems to be solved through the use of the computer.

Word processing

When a student is writing a text using a word processor hers/his interaction with the computer is mediated by the natural language (mother language) and the commands of the word processor to format the text. Many word processors are simple to use and facilitate the written expression of our thoughts. However, the execution part is very handicapped. The word processor only can execute the format aspect of the text or some aspects of writing style, but they can not yet execute the content of the text and to present feedback in terms of whether the content represents what we mean. Since the computer can only present the result of the format execution, the student can only reflect upon the original ideas about the format in comparison to the result presented. The student can read the text but since the computer cannot execute the text content there is no content result to be compared with the original content idea. Thus, the reflective and debugging activities are possible only in terms of the text format. In order to debug the content, the text needs to be read by another person who can interpret it and provide the student with appropriate feedback in terms of the text content.

When using word processor, reflection on and debugging of the text content is not facilitated by the computer. The computer does not provide the necessary information for the student to be aware of hers/his knowledge level and, thus, to reach more complex level of conceptualized comprehension. In this sense, I classify word processors as software that help the student to accomplish tasks but not to comprehend them. The comprehension only can be accomplished by having someone read the text and provide the feedback with which the student can become aware of hers/his performance.

Certainly, by having the text in the computer it is much easier to debug it. The text does not need to be rewritten all the time and this facility can establish a different relationship between the student and the text. However, the fact that the computer cannot execute the text content is a major handicap. We do not have the faithful feedback as we get with programming. The feedback provided by another reader may or may not correspond to the real quality of the text. Without faithful information it is much harder to reach more complex levels of conceptualized comprehension.

Multimedia

Multimedia can be explored educationally in two different manners: use of ready made multimedia software and development of multimedia, by the student, through multimedia authoring systems.

When using a multimedia the student is selecting options that are available in the software. Thus, s/he is not describing hers/his thinking but is deciding among several possibilities offered by the software. Once a selection is done, the computer presents the information available and the student can reflect upon it. Based upon this analysis, the student can select other options. This series of selections and going from one topic to the other, constitutes the ideas of navigating in the software.

It is true that the multimedia software are becoming very interesting, creative and are exploring an incredible number of possibilities. It is possible for the users to navigate in a broad spectrum of topics as well as to go in depth in these topics. However, the student is always restricted to what the software has available. If a particular software does not have what we want, we have to purchase another software. Also this idea of navigating can keep the student very busy for a long period of time. However, very little may be accomplished in terms of comprehension and transformation of the information visited into knowledge that can be applied in a meaningful way. In this sense I classify the use of multimedia in the category of software that helps the student to acquire information, but not to comprehend what s/he has acquired. In the process of navigating the student can come in contact with an incredible number of different ideas. But if this information is not put into use, there is no way we can be sure that this information will transform or enhance new ways of thinking about a particular subject.

When the student is developing a multimedia software through the use of an authoring multimedia system s/he is constructing a sequence of information presented through different media. The student has to select information from the literature or from other software, and may have to program specific items to be included in the multimedia being developed. Once these items are included in the multimedia the student can reflect upon and debug them in terms of the quality, depth and meaning of the information made available in hers/his software. Constructing multimedia provides a chance to pull together information in a coherent project, making sense of information and critiquing it.

In this sense, the cycle description-execution-reflection-debugging established has particular features. The level of description and execution are not the same as the in the programming activity. Authoring systems do not require the student to describe everything s/he is thinking while selecting a particular piece of information or even which media to present this information. Also the multimedia authoring system does not register the process the student uses to set up the multimedia software. Thus, the computer executes the sequence of information and does not execute the information itself. In this sense, multimedia execution is very similar to the execution in the word processor.

The cycle is in terms of getting the multimedia to work. In terms of the content, it can be rich or poor depending on how much the student comprehend about the information present in hers/his software. She/he may know and comprehend a lot if the subject was worked out. May know very little if the subject was just copied from one source to the software being developed.

Since the multimedia authoring systems do not register the thinking process that goes along with the construction of the multimedia, it is necessary to complement the product being construct with some kind of report that describe part of this process. For example, a diary describing what was done, what was discussed in terms of items selected, or what was thought about the items or the strategies in organizing the information as shown in the multimedia constructed. This report is produced separate from the multimedia and constitutes into a task that adds very little to the real construction of the multimedia. However, it is not impossible to implement in the authoring system a facility to help the student describe the construction process.

The analysis of these different ways of using the computer shows that in order to be able to construct knowledge and to comprehend what we are doing, computer software needs to have certain characteristics to facilitate the description, reflection and debugging activities. Programming languages seem to have most of these characteristics. The other educational software such as tutorials, use and construction of multimedia, and word processor the computer does not execute the student's thinking process and therefore the computer feedback is not helpful for the student to comprehend what she/he has done. These findings have several implication in terms of setting up policies for implementing computers in education.

TRANSFORMING EDUCATION

The use of computers to help students to accomplish tasks without comprehending what they are doing is a mere informatization of the teaching process we have in our schools today. The possibility that the computer offers as a tool to help the students to learn, to construct knowledge and to comprehend what they do constitutes a true revolution of the learning process and a chance to transform schools.

Traditional teaching and the informatization of traditional teaching practice are based upon the transmission of information. In this case, the teacher, as well as the computer, are owners of knowledge and assume that students are empty vases to be filled. The result of this teaching approach is a passive student, without capacity to critique and with a vision of the world according to what was transmitted to her/him. This student will have very little chance to survive in the knowledge society we are about to enter. In fact, traditional teaching or the informatization of it produces students that are obsolete.

The knowledge society requires creative individuals and with the capability to critique, to think, to learn about learning, to work in group and to know about hers/his own potentials. This individual will need to have a general vision about different ecological and social problems that are the concern of today's society as well as deep knowledge in specific domains. This requires an individual who is attentive and aware about the changes happening in our society and who has the capability to constantly improve and debug hers/his ideas and actions.

Certainly, this new attitude is the fruit of an educational process whose objective is the creation of learning environments in which students can experience and develop these capabilities. This knowledge is not possible to be transmitted but it has to be constructed and developed by the students. This implies that the schools we know today must be transformed. This transformation is much deeper than simply installing computer as a new educational resource.

Computers must be inserted in a learning environment that allows the construction of knowledge, comprehension of what the student has done and the development of capabilities that are necessary to function in the knowledge society. Learning a particular subject must be the product of a knowledge constructing process, done by the student through the development of projects using the computer as a source of information to solve problems that are significative to the student.

Through the process of solving these problems the student can learn about how to get new information necessary to be incorporate in the problems solution (to learn about how to learn); to be critical regarding the results obtained; to develop debugging strategies and to understand that debugging is the engine that drives learning. In this way students can acquire the capabilities and values from the knowledge society because she/he experience these capabilities rather than because they are transmitted by the teacher.

Teachers also need to be trained to assume the role of the facilitator of the student's knowledge construction rather than the transmitter of information to the student. For this, teachers need to be trained in terms of computer technology, educational software, as well as how to integrate this resource into the respective classroom activities. It must be clear to the teacher when and how to use the computer as a tool to stimulate learning. This type of knowledge needs to be constructed by the teachers and it occurs as they use the computer with their students, with the support from experts who can help the teacher to become more effective in their role of using the computer with their classroom. Through this support teachers can improve their capabilities as facilitators of knowledge construction and, gradually, to leave the role of information deliverer to become the facilitator of student's knowledge construction.

The transformation of schools is becoming more and more necessary. The knowledge society we are about to enter will demand that this happens. It is a difficult process. However, if the computer enters the school to become a device to turn pages of a book electronically or a resource to fix curriculum content, we will be running the risk of computerizing a school that is already obsolete, fossilizing it definitively.

The same transformation required in schools today is also require in training process outside the schools, for example in industries. Comprehension is particularly necessary if we want the person completely involved in what s/he is doing: a level of involvement which is required in a modem organization lean factory.

Industries are going to a major transformation, from the traditional mass production approach to a lean production (Womack, Jones & Roos, 1990). The lean approach produces only what the consumers want, the defects are identified during the production process rather than at the end of the assembly line, and production processes are constantly improved in order to eliminate excesses of time, labor, materials and supervisors. However, it demands several changes that have been hard to incorporate into our society. For example, production will need fewer, but more highly skilled workers (Mazzone, 1993).

The same educational transformation that is needed in the schools is also necessary in the job training programs. The companies, like the schools, can benefit from a training program based on the construction of knowledge and comprehension of what ones does. In this sense, here is a need for new and more adequate learning tools to identify problems and absorb technologies. The new production processes demanded profound changes in work habits and in the policies and behavior of the company itself. There is a need for learning methods that could motivate comprehension and real assimilation of know-how by employees on all levels.

CONCLUSION

When we ask educators about why we should have computers in education, always we get the answer that the computer can help or that the computer can facilitate education. The idea that the computer should always facilitate comes from a generalization of the fact that the computer entered our lives to facilitate. The computer made possible cash machines, computers are inside every automated device such as microwaves, video recorders, cars, etc... These are examples in which the existence of the computer made everything much easier or made available a facility that we did not have before the computer. Thus the same thing should happen to education. The computer should facilitate education, making it much easier for the student to learn, for the teacher to teach, or to organize the administrative part of education.

However, when I analyzed the different uses of computers in education, the conclusion was that the uses that are very similar to traditional teaching practices are the least effective ways of using computers as a tool to promote learning or comprehension. I showed that the computer can help the conceptualization process and the development of capabilities that are very important in the knowledge society if it is used as a programming device. In this sense the computer is a complicator. The student has to describe to the computer all the steps in the process of problem solving, has to do this through a computer language and if the results do not correspond to what was desired, the student has to get the information, incorporate that into the program and repeat the cycle of describing, executing, reflecting and debugging hers/his ideas. This is hard work. The computer is not facilitating this task in the sense of making problem solving easier. The computer is not giving the solution of the problem on a silver plate as we would expect if we had a device that would facilitate our life as it does in the cash machines.

Throughout the article I argue in favor of comprehension because it allow the student to be better prepare for the knowledge society. However, there is another reason for comprehension that is related more to the affective aspect. The effort of creating computer-based learning environments for different populations such as students from regular schools (Valente, 1993) and from special education (Valente, 1991), street kids (Valente, 1995b), teachers (Valente, 1996), workers from the lean factory (Valente, forthcoming) has shown that when given the opportunity to comprehend what they do all these individuals experience the feeling of **empowerment.** This is the sensation that they are capable of producing something that they thought was impossible. Moreover, it is a product that they not only have accomplished but they comprehend. They can talk about what they have done and they can show it to other people. It is a product of their minds.

Piaget in the *"Reussir et Comprendre"* book (Piaget, 1974) talks about the same idea in terms of the **direction to the future.** What motivates an individual to comprehend a task is the desire to achieve, in the future, a result that is predicted actually. However, the process to look for the reasons for one assertion or a phenomenon leads to solutions that will create new problems with new solutions and so forth. This direction to the future oscillates between a determination from the past and openings to unpredictable novelties. But the individual knows that through hers/his reasoning s/he will be able to reach a level of conceptualized comprehension. This is reached through reasoning and not through guessing or discovering.

This sense of empowerment and trust on our own mental capabilities gives us the incentive to keep improving our mental capacities and to debug our action and ideas. We know that we can reach higher levels of comprehension if we keep thinking about what we do and the way we think. It seems that this feeling of empowerment is missing in our schools. We should do everything possible to bring back empowerment to the learning environment and to have the direction to the future. If we think about transforming the schools we should aim to have an environment that can provide the learners with the experience of the empowerment. After that, it is just a matter of time and a question of keeping the environment rich, challenging and stimulating so that any individual will learn about practically anything. This should be the main objective of the school that is compatible with the knowledge society.

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NEW APPROACHES NEEDED TO TEACHING, LEARNING AND THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION [1]

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WHAT IS THE DIRECTION FOR THE FUTURE OF LEARNING?

Computers, especially when they are linked in networks, have the potential to change every day classroom practice dramatically. The impact of the use of information and communication technology (ICT) in education will not be limited to the actors involved in the learning process (teachers and students), but will also change the institutional infrastructure, relations and patterns of behavior within the education system, and even the content of education. For a good understanding of these educational changes if is necessary to look at the transformation our society (in the industrialized countries) is undergoing.

In fact, education is reacting to the emergence of the information society. Traditionally, schools provided the settings where individuals were being prepared for the industrial society. In this society the focus was on 'making things', on industrial production. Today's educational system faces the challenge to prepare individuals for the information society in which one of the most important aims is to handle information. Such a shift in focus can be seen as a new stage of our society, characterized by a new predominant paradigm. A simple overview of successive stages of development of our society is depicted in figure 1.

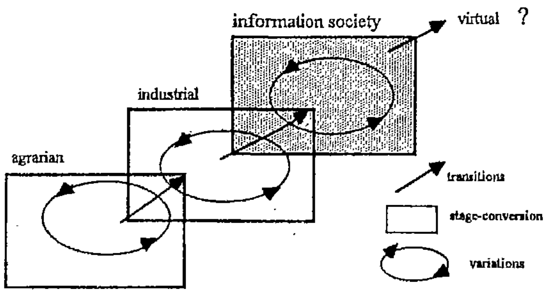

Figure 1. Successive stages in society
(Based on Van Dongen, 1996, unpublished)

The stages are in itself not stable: in each stage, changes and developments are taking place continuously, but these changes tend to stay within the boundaries of the dominant paradigm and the reigning technology. Problems faced are basically variations of common practice, while the order of things is kept in place. After a period of time, successive variations are getting less effect and tension grows until the next stage is apparent and a transition takes place. The conversion to a next stage is influenced by the availability of a catalyst of some kind (money, new energy sources, technological developments such as computers, networks, etc.).

In general terms the mission of the education system is to provide balanced, personal, social, and vocational education, facilitating personal growth and development, citizenship, and preparation for a profession. Quality of education can be defined as the amount to which education is capable to realize these goals. Beside the challenge of preparing individuals for the information era, the education system is also facing other challenges:

- a contribution is expected from education to the solution of social, cultural and economical problems of society. Education can no longer stay aside from all the problems of society: isolation, ethnic integration, juvenile delinquency, non-labor, etc., etc. There is massive evidence that the level of someone's education correlates directly to the opportunities someone has in society (OECD reports 1988 - 1994).
- people want education to be individualized and flexible, suited to their specific needs. Growing individualization in and diversification of society calls for specific approaches in education. Standardized methods and classroom approaches will no longer be sufficient for individual needs.
- life-long learning and new demands for learning. The 1994 report of the SCP (the Dutch national office of social and cultural studies) states that the growing number of people that is participating in education is the main issue to be addressed by the educational community. The guarantee for open and equal access to education for everybody is under the current circumstances becoming almost unaffordable.

[1] *Chapters 1 and 3 of this paper are based on a report of the Committee on Multimedia in Teacher Training (COMMITT); parts of the report have been used with permission. Chapter 2 is based on Pelcfrum (1996).*

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It can be concluded that the near future provides all kinds of challenges and opportunities for the educational system in our society. Managing large amounts of information, developing learning strategies to facilitate effective learning, and assuring that all citizens are skillful in assessing, selecting, and dealing with information are of critical importance. It is assumed that new balance is needed between teacher oriented arrangements of the learning process and student oriented arrangements, within which much more emphasis should be given to. the latter. ICT provides a means to instrument these revolutionary changes called for by the evolutionary transitions in society. ICT as a tool to support the learning process holds a promise to new solutions for the challenges that education is facing.

DIFFERENT SCOPES FOR THE USE OF ICT IN EDUCATION

The use of ICT as part of the learning process can be subdivided in three different forms: as *object*, as *aspect*, or as *medium* (Ministry of Education, 1992). In addition, ICT is often used as a tool for organization and management in schools. In the latter case ICT is not integrated in the actual learning process but provides support to it at classroom level or at school level (an example of an ICT application for organization and management purposes is a student monitoring system).

The use of ICT in education as *object* refers to learning about information technology and is mostly organized in a specific course such as 'computer education' or 'informatics'. As an object, ICT has been implemented broadly in the curricula of schools, especially in secondary education. Following the 'ICT-as-object-courses', students familiarize themselves with the most important ins and outs of information technology as a dominant phenomenon in society. Its educational aim is prevention of computer illiteracy. At present, education is quite good at this. But we have to take Walker's (1986) warning seriously, namely that the easiest way to meet the challenge of technological revolution is to create and implement a new subject, so the existing subjects don't have to change.

ICT as *aspect* refers to specific applications of ICT in education as used in industry and professional practice. Such use in education is found for the most part in vocational education, for example in the training for. computer aided design and manufacturing, and computer mediated accounting. Vocational training in these areas is unthinkable without ICT integrated in it. ICT as an aspect also appears outside the vocational territory, in subjects that are no longer teachable without the technology. For example, in general education carrying out experiments in science education, or accounting as part of economics. For that reason ICT has become an obligatory part of the general exams in science and economics in general secondary education in the Netherlands. The educational aim of ICT as aspect in education is job preparation.

Today, ICT as object and as aspect are firmly embedded in our educational practice.

A third form of use is ICT as *medium* for teaching and learning. This refers to ICT as a tool for teaching and learning itself, the medium through which teachers can teach and learners can learn. ICT as medium appears in many different forms, such as in drill and practice exercises, in simulations, in tutorials, in individual learning systems (ILS), in educational networks, in hypermedia programs, in tests-generating systems, etc. We speak of ICT as medium whenever ICT is used to support the teaching and learning process and not specifically its content (which is the case when ICT is used as object of learning). Current practices of actual use of ICT as medium are few, though there is a growing interest in applications of ICT as a medium.

In this paper we will focus on *the use of ICT as a medium* in learning and teaching.

ICT AS A MEDIUM TO ENHANCE THE LEARNING PROCESS

For a good understanding of the potentials of ICT for teaching and learning, it is important to have a closer look at the learning process. Figure 2 provides a general overview of aspects influencing the learning process. The learning process is represented as a field in which four forces operate. The horizontal dimension represents the relation between the actors in the learning process: the *teacher* and *learner*. The vertical dimension represents the *learning infrastructure*, consisting of *content*, and *teaching & learning materials*. The learning process takes place at the cross section of these four forces. The contribution at the level of school organization and management on the arrangement of the learning process (e.g. by providing a student monitoring system) is represented by the outer circle.

The figure illustrates the view that a learning process is the result of both structural conditions derived from the learning infrastructure and personal characteristics of the actors involved, and their interaction. Changing just one of the driving forces, may lead to tensions, but not necessarily to substantial changes and improvement of the learning process. The introduction of ICT in the learning process, as medium for learning, obviously changes the learning infrastructure in terms of materials and technical infrastructure. But, only in conjunction with changes in the roles of the teacher and the student, and with changes in the organization of the content, it is possible to make use of the potentials ICT holds for enhancing the learning process.

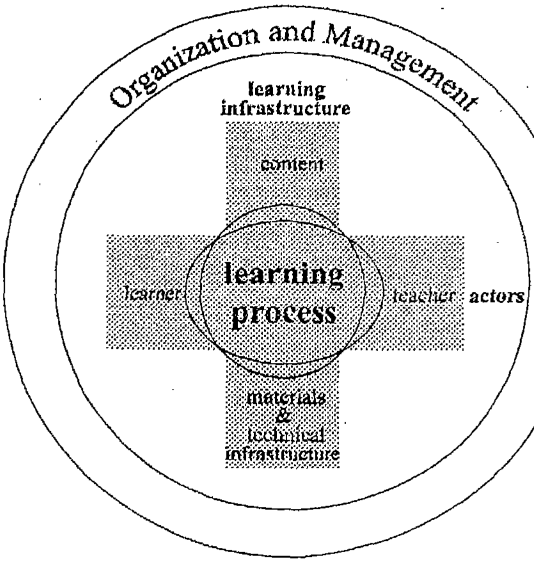

Figure 2. The infrastructure and actors of the learning process

In addition to the dimensions of the learning process at school level mentioned above, changes in the learning process have to be supported from public administration as well. It is hard to imagine how ICT as medium can be implemented in a way that it has impact on the role of the teacher, without proper policy measures at the level of the national government. Installing computers and software for an integrated learning system for instance, is one step and a relatively simple one compared to what has to be done for a structural change in the role of the teacher (needs consent by teachers, teachers unions, management, government), a commitment to more student oriented learning (needs organizational measurements to regulate the use of the schools resources), and a focus on learning which is often labeled by 'constructive learning'. Learning is, in this view, perceived as an active, constructive, goal oriented, and situated process.

THE LEARNING PROCESS IN MORE DETAIL

Adjusting education to societal needs of the future (the information society) means that schools have to enable learners to be continuously active in the sense of lifelong learning. Stimulating and supporting this process of continuous learning implies the elaboration of suitable learning processes in which the learner learns how to become more or less an architect of his/her own learning process. This means that learners have to be more involved in the arrangement of their own learning process. However, learning always refers to a process in which the learner needs support in terms of well-adapted subject matter content, organization of learning activities by a teacher, adequate materials and technical infrastructure. It is assumed that ICT has the potentials to enhance such an approach of learning that prepares for the information society.

The use of ICT as part of the learning infrastructure and its relation to the role of the actors in the learning process (learner and teacher), can be clarified by looking in more detail to the characteristics of the teaching and learning process. Table 1 provides an overview of the activities that can be distinguished in relation to the learning processes (Simons & Zuylen, 1995). The set of activities refers to three main types of activities in the learning process: preparation, executing instruction, and regulation.

In a traditional arrangement of the learning process most of the activities listed in table 1 are under control of the teacher. If a learning process is more student oriented it means in operational terms of the activities listed in table 1 that the student becomes more responsible for (some of the) activities which are completely under control of the teacher in the teacher oriented learning process. It is assumed that a shift from teacher oriented arrangements of the learning process towards more student oriented arrangements can be facilitated by ICT. However, until now these potentials of ICT are hardly implemented. More student oriented arranged learning processes are still rare, and most of the current ICT-applications are used as far as they facilitate the teacher oriented arrangements of the learning process. Applications of ICT are adapted to the existing teaching routines; the beliefs and attitudes of teachers towards their teaching practices did not change, and basically the teaching and learning process itself did not change.

For the development of effective strategies to use ICT to enhance learning and teaching, it is important that we realize that the present use of ICT is just a *substitution* of the current teaching and learning activities. This substitution use can be seen as the first out of three phases through which the implementation of new technologies diffuses in general and therefore also in education (Itzkan, 1994).

Table 1

Activities in the learning process (Simons and Zuylen, 1995)

I. PREPARATORY ACTIVITIES
cognitive
1. orientation towards learning goals and strategies
2. clarification of learning goals
3. choosing and defining subgoals
4. choosing and defining learning strategies
5. mobilizing prerequisite knowledge
affective
6. making students curious
7. challenging yourself
8. generating interest
9. focusing attention
10. clarification relevance
11. getting under way
II. EXECUTING INSTRUCTION
12. absorb knowledge, practicing skills
13. reflecting
14. formulating conclusions
15. relating to what's learned, getting a overview
16. conditions and possibilities for application
III. REGULATORY ACTIVITIES
cognitive
17. testing progress and learning process
18. controlling progress and learning process
19. taking recovery actions
20. reflecting learning process and progress
21. evaluating
affective
22. controlling and regulating concentration
23. keeping motivation
24. generating feedback
25. relating results to strategies used
26. self-assessment

PHASES OF TECHNOLOGICAL DIFFUSION

The three phases of technological diffusion are shown in Figure 3. In the *substitution* phase, the technology replicates or automates the existing instructional practices. The technology is used for activities which people already do in education, e.g. drill and practice exercises on the computer refer to the use computers as electronic paper. This kind of use is not bringing real change in education, and by its character will therefore not meet the real needs of education in an information society as discussed above.

In the *transition* phase, new instructional methods begin to evolve, for example the use of e-mail in foreign language classes to communicate with peers who are native speakers. In this phase the technology is used for activities for which it was not necessarily brought in, and it is challenging old instructional practices.

In the *transformation* phase, the final phase of technology diffusion, the technology provides completely new instructional situations and the old customs may become obsolete. The instructional tasks for which the technology was originally acquired, may no longer be desired.

1. SUBSTITUTION
Automates existing instructional methods

↓

2. TRANSITION
Instructional methods begin to change

↓

3. TRANSFORMATION
Entirely new instructional methods

Figure 3. Phases of Technological Diffusion (Itzkan, 1994)

The underlying rationale of the phases of technological diffusion is that it is a mistake to suppose that new technologies will continue to fit existing or old practices. When we continue to use ICT only for substituting existing practices, ICT will not contribute to solutions for today's problems in education. We might be left with only artificial interventions that by nature provide us no way out for the problems of continuous harsh budget cutting (solution: more money), multicultural students (solution: more teachers), a continuous changing economy (solution: more specialized subjects), and a threatening non-labor market (solution: more study).

It is important to note that in a traditional, mostly teacher oriented educational setting the teacher is completely responsible for the arrangement of most of the learning activities. It is inevitable that the role of the teacher will change more and more if the student is more actively involved in his or her own learning process and ICT is adopted to support an increasing number of learning activities.

Although it is uncertain to what amount this shift will take place and how much time this will require, the direction of future change is clear: the learner will become more responsible for the arrangement of his own learning process. Or in other words, a new balance between student oriented and teacher oriented arrangements are needed to have our education meeting the challenges of the information society.

An important question in this context is to what extent our present education systems are already changing in this direction and whether the use of ICT is reflecting the transition phase.

WHERE ARE WE IN THE EARLY 1990's?

Where the first chapter of this paper is dealing with the question of the future direction of education and the potentials of ICT in instrumenting the future, this chapter discusses where we are in the early 1990's. Knowing where we are is important baseline information for policy makers and those in charge with shaping the future of our education, as it provides the starting point for determining the route to the future.

The IEA Computers in Education study

The Computers in Education study of IEA (International Association for the Evaluation of Educational Achievement) provides information about the status of information technology in education in a number of countries in 1989 and 1992. The major aim of the study was to build a knowledge base from which answers about the *what and* the *how* of the use of computers in education could be obtained.

It is important to realize that the Computers in Education (CompEd) study took place in a period during which personal computers were the dominant forms of information and communication technology uses in schools. When the preparation of the CompEd study started in 1986, personal computers could almost not be handled without a basic knowledge of» programming, while by the early 1990's computer users had access to many easy-to-use tools. During the 1980's, due to many initiatives of schools and teachers and stimulation policies of governments, computers also became available to schools. They were mainly used for computer literacy type of courses (in secondary education) and electronic drill-and-practice exercises (in primary education).

The CompEd study focused on primary and secondary education. Data were collected in 1989 and 1992. In 1989 20 countries participated in the study with national samples of (both computer using and non-using) schools, and using as well as non-using teachers of computer education, mathematics, mother tongue and science. In 1992 data were collected at school, teacher and student level in 12 countries.

The general broad indicators for which quantitative data were collected in each stage are listed in Table 2. The rationale for selecting these indicators has been extensively described in CompEd publications, for example Pelgrum & Plomp (1993).

Table 2

Overview of main indicators collected in 1989 and 1992 in the CompEd study

Educational level	**Indicators**
Country	*National policies* School system
School	School policies Experience with Hardware availability Software availability Attitudes school principal Organization of computer Type of use Staff development Number of using
Glass/teacher	Teacher use Teacher knowledge Teacher training
Class/student Student attitudes Student school use Student home use	Students knowledge

Altogether data about the use of computers in education have been collected from over 20,000 teachers, 10,000 schools and 150,000 students.

Some exemplary results

The results of the CompEd study have been described in numerous publications (for example. Pelgrum & Plomp, 1991, 1993; Pelgrum, Plomp & Janssen Reinen, 1993). Here we present only a few results based on the data of four industrial countries (Austria, Japan, the Netherlands, USA) to illustrate the use of ICT in education was still in its infancy in the early 1990's, even in industrial countries.

From the results the picture emerges, that during the 1980's and the beginning of the 1990's the number of computers available in schools had rapidly increased. A further growth can be expected. Noteworthy is the 'late start' of Japan.

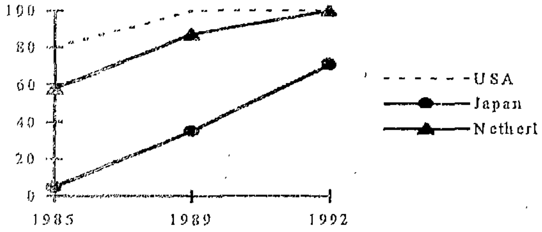

Figure 4. Percentage of lower secondary schools with computers

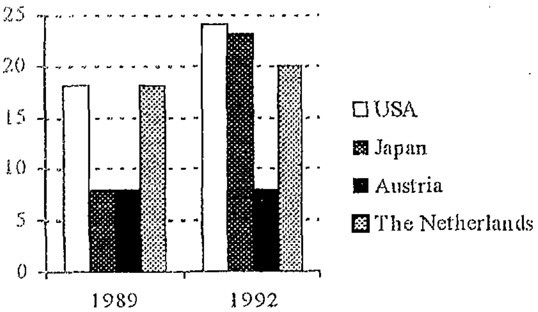

Figure 5. Average number of computers in lower secondary schools

In 1992, however, the number of computers in typical schools was just enough to allow one class at a time to use computers. This means that even in industrialized countries in that year the hardware infrastructure in general is not sufficient to allow a broad and intensive use of information technology within the schools.

Particularly important in the recent past has been the development of electronic networks. The CompEd data show that in 1992 there are hardly any schools which have regular access to external networks, except for the USA where 17 % of lower secondary schools and 12 % of elementary schools were using computers almost weekly for access to external networks (Pelgrum, Plomp, Janssen Reinen, 1993, p. 17).

The lack of sufficient software was a major problem in 1989. This substantially decreased between 1989 and 1992. The most used didactical approach was drill & practice and tutorial programs, which means automating already existing methods (that is, substitution use of technology).

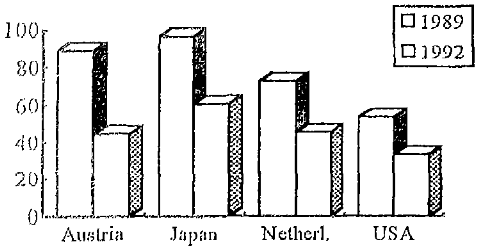

Figure 6. Percentage of lower secondary schools lacking software

The most popular use of computers at schools in 1992 was to learn students how to use this new technology.

Many students were attending computer education classes. The use of computers as tools in existing subjects was still marginal, as the figure shows. The percent of students using computersJn other subjects was even less than the percentages in mathematics.

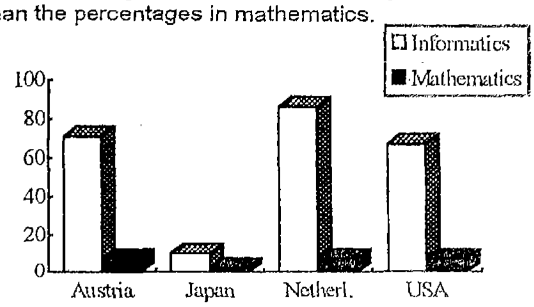

Figure 7. Percentage students in lower secondary schools working with computers in informatics and mathematics classes

Integration of computers in lessons was still seen as requiring considerable additional time-investments. This referring to a major concern. Future use of ICT in education means integration in daily practice of learning and teaching. For such a change in education practice teachers' time need to be made available.

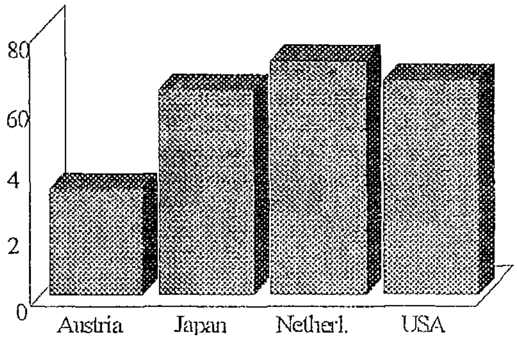

Figure 8. Percentage lower secondary schools reporting insufficient time to integrate computers in lessons

The expectations regarding the added value of computers were quite high, as shown by the opinions of schools principals.

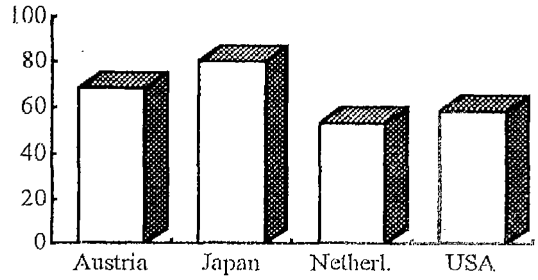

Figure 9. Percentage lower secondary school principals who say that students are more attentive when computers are used

Many analyses were conducted on the data. For instance, Tuijnman & Brummelhuis (1993), Brummelhuis (1995), Janssen Reinen (1996) showed the complex interactions of a number of factors

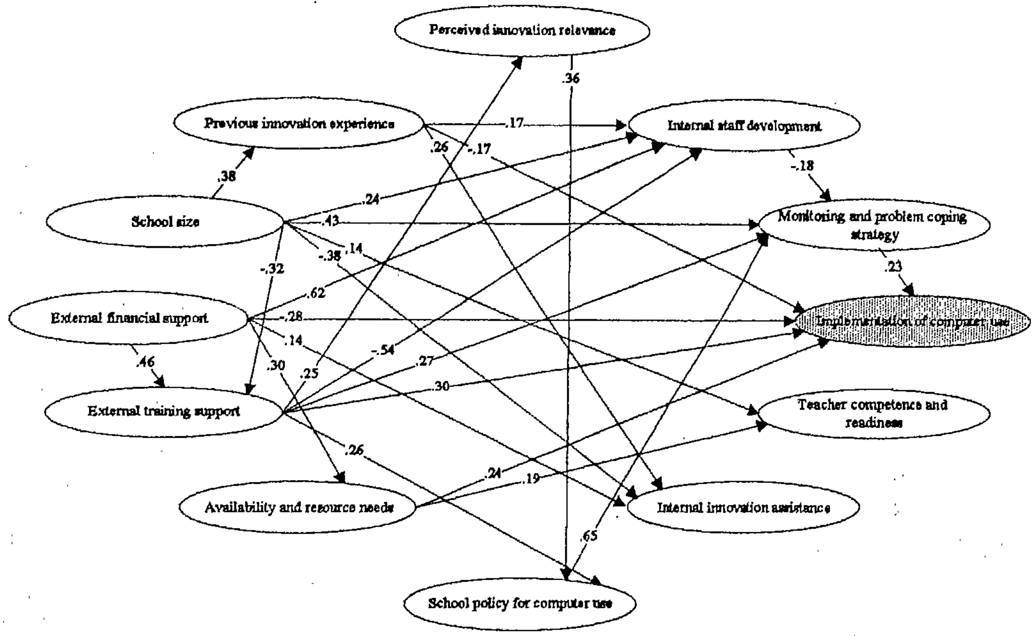

Figure 10. Factors influencing the implementation of computer use in education
(Source: *A.C.A. ten Brummelhuis, 1995)*

influencing the degree of infusion of computers in the school curriculum (see, e.g., fig.10) It is important that policy makers understand that there is not a single factor that determined the integration of technology in education, but a group of interrelated factors, which may differ in different stages of introducing information technology in education. Besides, certain necessary conditions have to be fulfilled, such having a computer co-ordinator in each school.

EN ROUTE TO THE FUTURE

Our analysis so far leads to two conclusions. At first, our society does need increasingly learning situations responding to the need for *flexibility* (adaptability to different needs), *accessibility* (learning when and whenever suits best) and *support* (an adequate learning infrastructure to assist learners). To make this happen, more emphasis should be given to student oriented arrangements, and ICT provides powerful possibilities to realize this. Teachers, being key actors in learning and teaching processes, need to be trained in designing and organizing such innovative teaching and learning environments. Besides, the learning infrastructure of the schools need to change accordingly, both the content of what is being taught as the materials and technical infrastructure (see Figure 2).

A second conclusion, drawn from the CompEd study, is that in the early 1990's ICT use in education is predominantly the use of computers, reflecting a computer use that can be characterized as substituting already existing didactical functions. Besides, the integration of technology in the daily practice of the school is a process influenced by many different factors.

So the question is how to get "en route"! This question will be discussed by applying a system analysis point of view.

A system approach

From the perspective of a system analysis approach, we could regard society as the relevant environment of education. Education is defined here as the set of all educational practices; society as the place where education finds its people and resources, and to which it delivers its results. Schools and teacher training institutes are, among other institutions, subsystems of the education system.

Systems tend to pursue an equilibrium with its environment. They tend to organize their internal processes and exchange with the environment in such a way that they stay stable and viable. For that, they have to cope with the complexity in their surroundings and they do so by controlling variety. The variety of educational needs in society, for example, is balanced to the variety the schools can accommodate. No school can meet all of the individual learning characteristics of its students. In most cases, this is not much of a problem and most people accept the fact that a school offers a limited variety of learning possibilities. However, in order to stay in balance with the (learning) needs of society, schools have to maintain their level of variety above a certain threshold level. When the learning offerings of a school drop below that level, too many student-learning needs cease to be met and the system gets out of balance. This imbalance could subsequently result in a decreasing number of registrants, a rise of drop-outs, less public and/or political support, increase of classroom troubles, etc.

There is a number of subsystems that surround schools such as teacher training institutes, institutions for curriculum development, test development, school support institutes, educational publishers, furniture providers, educational software developers, and others. Each of them does have a specific function for education. Together they act as the safe-keepers of education. Whenever education has a need, expressed by the educators themselves,

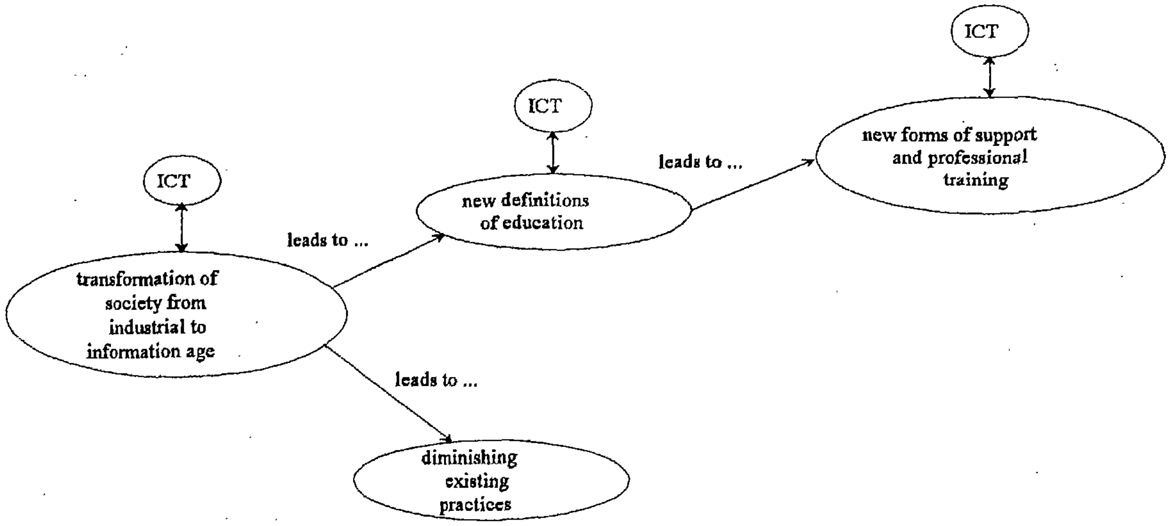

Figure 11. Transformation of society leads to new forms of support and professional training

by the management or by government administration, one of the safe-keepers will react with some sort of service by implementing small but important changes. In doing so, their (support) activities are not only defined by the existing educational system, but in turn, keep the educational system within the margins of *controllable variability*. They are designed to act in this way. But this makes them more the custodians of the present situation, than the change-agents of education. This situation refers to a fundamental problem if one wants to bring about real change in education.

Besides these continuous adaptations, there is another kind of change emerging in education, namely change that goes beyond the boundaries of controlled variety. As long as education succeeds in answering the needs of society, it fulfills its function towards society and it stays stable and viable. But when the demands that society puts to education can no longer be met by more variety, the system itself (i.e. education) needs to change.

It is our belief that this is the case nowadays, where we concluded that our society has moved towards a new paradigm, characterized by 'information society'. This is demanding a new relationship between education and society, or in other words implying a need for transformation of education as well as new definitions of education. These new definitions of education will come from the learning needs and the possibilities in the information society. They should not be regarded as a linearly developing out of today's education. The consequences for education of the transformation from the industrial society into the information society is depicted in figure 11.

In order to facilitate this transformation, it is required that the education system revises its relations with society, takes its needs seriously, and gives its demands the highest priority. These demands, were already mentioned in the first chapter as the challenges the education system is facing.

Developing a future for learning

In order to prepare schools and teachers for education of the future, the current schools and teacher training institutes should shift their focus from serving the current education to serving what emerges as the education of the future. They have to create both room and opportunities in their program for such a transformation. This causes a dilemma, as schools and teacher training institutes cannot refrain completely from providing current education with teachers that can function in the existing situation.

A solution for this dilemma is to create a transition period from the present situation towards a future situation in which education will get its new shape. This implies stimulating and strengthening the development of something 'new', while 'old' is still existing. During such transition process 'old' needs care and attention, but should not prevent 'new' from growing. 'Old', that is our present schools and teacher training institutes, should be challenged to emerge into 'new'. But at the same time, 'new' needs stimulation and incentives, and should not be hampered by 'old' trying to continue its old equilibrium with its environment.

This is asking for a program of action that has to provide bridges from "old" to "new". The program has to be designed in such a way that it creates opportunities for new definitions of education and at the same time challenges educators from existing practices to participate. However, the main focus of the program should be on generating and supporting 'emergent practices' of learner oriented arrangements with ICT as a medium, as well as preparing both teachers and student teachers for the 'emergent practices' in primary and secondary education. This refers to the use of ICT as medium in the schools, but at the same time an aspect of the teacher profession and therefore of teacher (inservice) training. A coherent research and development program, in combination with an adequate monitoring process of first hand experiences is expected to create a clear picture of both tomorrow's teacher training and the educational practices in the field for which teachers are being prepared. The Committee on Multimedia in Teacher Training (COMMITT) will propose such a program in its final report, that will be published in educational practices in November 1996.

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The original is presented in English

Commission I

NEW INFORMATION AND COMMUNICATION TECHNOLOGIES IN FRENCH EDUCATIONAL SYSTEM

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WHAT FOR WE NEED NEW TECHNOLOGY IN THE SCHOOL?

Since seventies France has started to introduce informatics in utterly deferent forms into educational system. Hence, after 20 years and after realization of National programs ("10000 personal computers", "100000 personal computers ", "Informatics for everybody"), all lycees and colleges were equipped by computers of different kinds and configurations and a lot of teachers have passed three - month or more long courses of pedagogical informatics, short term approbation in the permanent educational system became everywhere, though the rules mentained traditional.

Software has introduced into educational media. It's interesting to mention, that the goals, put in the beginning of seventies, concerning application into teaching field, did not change sufficiently, contrary to technical possibilities, which develops very quickly. These goals might be formulated in the following way:

- Modernization of education and school life management with the help of the development and application of multimedia, software for students, school regulations etc.
- Teaching of the base for utilization of new technologies in the information and communication fields; even just now and surely in future we shall touch with necessity of appropriate use of diverse information and communication technique in our everyday life. In order to reach this, the educational system ought to provide all the students by a set of skills, which might allow them to use this technique rationally. This goal is put either on the level of theoretical knowledge or on the level of practical skills and life principles.
- Mastering of the technology, put into new professional tools and their use; really, how one can prepare the students to the tomorrow specialities without concerning mentioned necessity? This factor plays a special significance for mastering of specialists for industry and service field.

- Taking into account of the necessity of developing school subjects in connection with the appearance of new media for information processing and communications. One ought to take into account this concerns all the school subject beginning from musical education, history, geographic up to mathematics.
- Introducing of information media into education.
- Really, informatics is extremely effective educational additional tool. It will allow teachers to meet the challenge, which time throws to school, with confidence.

WHAT MEDIA DO THE SCHOOLS POSSESS?

Currently in France in all kinds (12 000) of secondary, technical and professional education there are approximately 400 000 personal computers. These amount consist mainly of compatible PC.

One ought keep in mind that all these PC might be supplied by necessary set of peripheral equipment: printing devices, scanners, sound plated, reading devices CD ROM, physical interfaces, modems etc.

There are about 15 000 reading CD ROM devices in the lycées and colleges.

It seems that a new informational space is standing out already, which successively will take it peace in few years. It's formed on the base of two evident tendencies:

- significantly increasing spreading of multimedia, allowing CD ROM use;
- communication development, due to introduction of inter school informational networks and linking up to state communication nets. A lot of educational institutions started to develop their own internal networks on the base of their own informational media. In the nearest future these process will extend. Along with it currently the experiments are carried out to link these networks through Internet (400 institutions take part in this process today).

However every kind of practice is based on the existing of software in the educational institutions, which are used in the everyday pedagogical activities.

These are divided into:

- so called "professional" software, which are designed specially for use in the enterprises: operational systems and program languages, general means of institution automation, specialized software;
- so called "pedagogical" software, which are designed and used especially for pedagogical aims. We mean here professional software, intended for teachers (or students).

They are designed by publishers, information service films in the private sector and National center of pedagogical documentation, state institution of Educational ministry.

As for acquisition of software by institutions, the government provides 80 millions Franks (16 millions US dollars) in its annual budget for the secondary school educational system. Ministry has developed special order of acquisition of rights for software use (joint license), that allows to decrease the cost of software, which significance for pedagogical process is confirmed by expert commissions, while the opportunities for spread are large enough. Thus, about 100 000 software products are purchased directly by school institutions.

EDUCATION AND COMMUNICATION SUPERHIGHWAYS

National educational system attempts not *to* lay behind the main directions of informatics development. The activities, concentrated in large united projects on the national level and on the level of educational districts, are concerned mainly the following:

- opening of the institutions for entire world as continuation of means for the aim of assistance to combine their information resources into united network for use of communicational means and providing access to remote sources;
- joint use of information resources by several educational institutions or even on the level of educational district: joint developed data banks, technical and pedagogical assistance for users and institutions;
- joint activities and discussions (in the framework of different forums, institutions, groups of the teachers or students on the international arena or international level;
- distance education and distance teaching: permanent training of the teachers, distance learning of the optional subjects in lycées.

Simultaneously governmental institutions and the Ministry of Education itself develops services, compatible with Internet standards. A special service was opened with the address: *http:\\education.gouv.fr* in network *Edutel* of Ministry of Education. It present an easy and effective access to the block of internation services, concerning all types of the problems in the French educational system. Different types of services were opened also in a lot of educational districts.

The interconnections, established with international educational systems, have also accepted new development. It's possible in particular to mention initiatives, undertaken in co-operation with educational service *Campus World* of British Telecom and Canadian school networks. The most of educational districts and school institutions have also introduced to European co-operation on the base of earlier extended relationships.

THE ORGANIZATIONAL STRUCTURE IN THE FIELD OF NEW TECHNOLOGIES IN THE MINISTRY OF EDUCATION

In order to be able to answer on the questions put by new technologies in the information field, Ministry of Education has created new structure on all levels: national, educational district, educational establishment.

At national level the Department of scientific information, new technologies and libraries has been authorized to define and evaluate the Ministry policy in the educational use of new technology in the information and communication field. In this field the Department acts mainly in the following three directions:

- *watching on the technological situation:* actually, in this rapidly developing field it's necessary to analyze possible short-rate changes, in order to make necessary decisions just in time;
- *pedagogical investigations and experiments;* in every school or university subject it's necessary to confront the potential capabilities of these technologies with everyday reality in teaching;
- *generalization and spreading:* in case the experiments are evaluated positively, it's necessary to start to spread the innovation: information, training novice and continuing oraining of the teachers), purchasing and management of necessary means and software, structure creating for their support and development etc. Finally new technologies in the school become the subject of new administrative rules, whether the idea concerns a new learning subject or it concerns the tool, which all the teachers need: many school curriculum take into account the factor of "informatic technologies".

At the level of every educational district special appointment of the Inspector on "new technologies" was introduced for to watch for establishment of national policy in this region. In the frame of their competition they must take part in defining of teachers training contents, present recommendations to institutions, concerning technical equipment, determine the list of purchasing necessary equipment and adjustment in co-operation with territory communities (municipality), general councils and regional councils to organize the senvice of the technique, experiment control, carried out in their educational district, to inform about national policy and to watch for its use in co-operation with inspectors, to spread the educational materials and documentation.

In each educational establishment the administration and teachers ought to formulate the pedagogical concept of their institution, to define the structures, necessary for its realization and, naturally, to deal with the main subject - to teach the students most effectively.

THE MAIN TASK IS TEACHER'S TRAINING

In conclusion let's underline the specific importance of primary and permanent education and training of the teachers in the process of new technology introducing. Taking into account the role, which new technologies play in school curriculums, teacher's training, preparing of specially adjusted means and software are three directions, necessary for success results of the policy in field results of educational informatics.

No doubt that the primary training and permanent training are the most delicate moments in the problem to be solved. In every educational district in France special structures are engaged in the teacher's training and in the use of informatics in the learning process: IUFM (Institutes universitaires de formation des maitres) for the primary training, MAFPEN - for permanent training. It's necessary to provide the teachers and students/probationers by data, that might allow them in future changes, caused by extending of information and communication technologies extended.

Thus, French educational system wants to use the results of extreme technical revolution of the 20th century. Now, when the informatization of the society already does not depend on us, because it's inevitable, the idea is to transform the technological necessity into educational project.

The original is presented in French

DISTANCE EDUCATION: CURRENT SITUATION AND PROBLEMS

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INTRODUCTION

The author of this paper is working at the Centre for Continuing Education at the Norwegian University of Science and Technology. Our main task is to deliver continuing education for teachers on university level. Most of our courses are traditional on campus courses but we are gradually shifting to Distance Education to reduce costs and improve availability. The services we have used so far in Distance Education are radio, video, videophone and datacommunication. Our main source of income are governmental and university funding. The students normally don't have to pay for the courses.

Let me quote Tony Bates (Tony Bates: Technology, Open Learning and Distance Education, 1995, ROUTLEDGE, London and New York) as an introduction to this paper:

Technology developments will mean the end of distance education as a discreet educational activity

and

Recent technological advances are making the distinction between conventional and distance education more and more meaningless. Technology will dramatically impact on all educational institutions, and change their nature.

My paper will be based on this statement which I find very much in accordance with technological and educational developments in the last years.

My presentation will cover the following main items:

- *A short history of IT in education*
- *IT in education today: The Norwegian plan for 1996-99*
- *Technology*
- *Distance education*
- *Some experiences in technology-based Distance Education*
- *Visions and problems*

HISTORY: IT IN EDUCATION

The use of IT in education is roughly 25 years long. In this section, I will try to identify some trends.

Nearly from the beginning, we can identify three different trends of development:

a. Computer science as a subject.

b. Computer assisted learning.

The use of the computer in learning school subjects.

c. The use of standard software packages like word processors, spreadsheets, databases etc.

This development is well documented by Proceedings from IFIPworld conferences on the general theme:

WCCE: World conference on computers in education.

Up to now, the following conferences has been arranged:

•1972: Amsterdam
•1976: Marseille
•1981: Lausanne
•1985: Norfolk
•1990: Sydney
•1995: Birmingham.

These conferences has covered education from the kindergarten level up to the university level and in my opinion gives the best documented coverage of what has happened during these 25 years.

One significant trend has been what I will call the «religious movements». Some issues:

• The discussion between computer scientist and teachers about programming languages: Basic or Pascal.
• The use of LOGO.
• The electronic teacher - the idea of substituting the teacher by a computer.
• The text, spreadsheet and database syndrome.

These issues raised very strong opinions and feelings bordering on religious feelings.

What is the religious movement of today? Certainly Internet and WWW is such a one. But it is quite different from the former ones because of the widespread use in all educational levels. The former movements were restricted to fairly small members and educators generally were sceptical. For perhaps the first time in the short history of IT in education, we can see a real mass-spreading and a fantastic variety in the use of the technology.

Some characteristic examples:

Educational institutions and individuals presenting themselves with Web-pages;

International school-projects;

On-line courses on Web

etc.

Has IT been a success in education up to now? In an IFIP working conference in Santa Barbara in 1991, this issue was raised and the answer was negative in relation to general education. On the same time, it was a success in vocational education and the reason may be that it is much easier to introduce computers in vocational education. It is simply to base the education and training upon what is done in industry. Whereas in general education you have to invent to a certain degree what you shall use the computer for. Again I must say that very much has happened in the later years since 1991. We feel that educators generally have changed opinion from sceptical to positive. Perhaps this shift has come by the general use of IT in society. Everybody can see how dependent we are of computers in daily life and the consequences for education in general is that we must prepare the students for the society.

An interesting aspect has been the shift from the small software packages with a narrow use to more general and open packages. Let me give mathematics as an example. In my institution we have given courses for teachers on the use of IT in mathematics teaching. After some discussion we have ended up with five standard packages:

• graph plotters
• spreadsheets
• symbolic manipulation (Derive)
• geometric packages (Cabri)
• word processors with mathematical editor.

These packages covers most of what we need in mathematics in upper secondary education. I must say that in lower levels, we often need more subject oriented packages. This is especially true in special education for handicapped students.

All along the way in these 25 years, three main obstacles for a wide-spread use in education has been:

• Lack of equipment
• Teacher education
• Curriculum adjusted to the use of computer.

As to these three factors, I am fairly optimistic for the future:

• The equipment gets cheaper and cheaper.
• We can see a strong development in most countries in upgrading the curriculum.

Perhaps the most difficult case is the teacher education side. Without upgrading the teachers knowledge of how to use computers, very little is achieved in the classroom. Lack of funding for teacher courses is the serious problem. In industry, it is common knowledge that to develop and make new products based on IT, the workforce must be well educated. The same way of reasoning is done for education but in most cases it is not followed up by relevant funding. The situation may differ from country to country, but I would say that too little has been done in teacher education up to now.

IT IN EDUCATION TODAY: THE NORWEGIAN PLAN FOR 1996–1999

As an example of the use of IT in education today, I will shortly describe the plan from the Norwegian Ministry of Education, Research and Church Affairs for the period 1995 to 1999. It may be somewhat special because it covers all levels in education:

• Primary and lower secondary school
• Upper secondary education
• Higher education
• Adult education and continuing education.

The benefit of this is for example that the Higher education level is seen upon as a resource for research and development for the lower levels in teacher education and didactic work with the use of IT in different school subjects. An important aspect of this may be that distance education is looked upon as an important means of educating the teachers.

The plan has 28 different Actions in separate areas. In the following, I will give examples of this work areas with relevance to this presentation:

Development of teaching methods:

Action 2 - Didactic use of IT - research and development

Action 4 - IT-based teaching methods in adult and distance education

Action 8 - Girls use of IT

Action 9 - Students as a resource.

Information wells:

Action 12 - International co-operation

Action 13 - The Norwegian bookcase - creating information wells.

Teacher education:

Action 22 - Continuing education (lifelong learning)

Action 23 - The teachers of the teachers.

Technological infrastructure:

Action 24 - Connecting schools to Internet

Action 28 - National licenses for software.

In this year, the government are funding projects for about 5 million US Dollars in these areas.

To illustrate the actions, I will give some examples of projects in the distance education area:

Action 24 - Connecting schools to Internet

Through Norwegian Telecom, the schools are offered ISDN-connection to Internet. In this way we will have made a national infrastructure which enable the schools both to receive and give distance education courses. Especially important is this in educating the teachers in the use of IT in education.

Action 13 - The Norwegian bookcase - creating information wells.

Norwegian Telecom has invested much money in creating so-called information wells. They contain for example detailed information about school subjects and the use of IT with links to information resources in the whole Internet.

In my department at the Norwegian University of Science and Technology, we have a project for the government which involves many of this actions.

The core of the project is to develop didactic models for the use of IT in mathematics, physics and languages.

A didactic model for use of software packages must contain:

a) at least one example on the use of a specific software package in education related to the curriculum;

b) how to plan and carry out the instruction in the classroom (didactic discussion).

Example: The use of software packages for graph-plotting.

Structure of model which will be presented on WWW:

1. An exercise
2. Solution of the exercise:

• a graphical picture (preferably as a process - not static)

• short text related to the solution.

3. Didactic discussion of a more general nature related to the example.

This text will not be shown on the screen but will be available for downloading by FTP

When the project is finished by the end of this year, we will have a basis for educating teachers by distance education. Most of the course material will be on the Web-page and in addition we must develop supplementary material and exercises.

In addition to this governmental initiative, I will also mention two important aspects for why Distance Education is developing very fast in Norway.

• The role of Norwegian Telecom:

Funding a wide variety of Distance Education projects.

• Norwegian Executive Board for Distance Education at University and College Level:

Funding projects with Distance Education on higher education level. The target group of the courses are very often teachers on lower levels.

TECHNOLOGY

In this section, I will shortly describe the technology used in Distance Education. A lot of book and papers have been written on this subject and I see no need to duplicate these.

In all kinds of education we are basically using three kind of senses:

1. to see
2. to hear and speak
3. to read and write.

In ordinary classrooms, we use all these senses in a natural way.

Distance Education originally was based upon correspondence courses where the student read texts and wrote exercises.

Next step in the development was radio and much later TV. But it was still not interaction between teacher and students like in a classroom.

Real communication came with the telephone. TV combined with telephone, is now often used.

Computerbased communication with email came around 1985. Basically this is also of the «read-write» type, but it reduced drastically the reply-time in comparison to ordinary mail. Of course it also had some other benefits.

The great leap forward, came with the introduction of new technology-based communication like videoconferences and PC to PC communication.

And the last step is on-line courses on WWW. Try a search with key-word «on-line courses» using Alta Vista and you will see how much is offered already.

What we are now waiting for is the communication superhighway on broad-band which will enable us to communicate nearly as good as in the classroom. The words are already invented for this with expressions like:

• The virtual school,
• Global education,
• Classrooms without walls,
•The electronic university etc.

In the following table, I will try to sum up what I have written in this section so far. Beware that I am using one-way and two-way communication in a little unusual way. You may say that email is a two-way communication but I am looking into the interaction between sender and receiver. By one-way I mean that there is not simultaneous communication between the two parts. By two-way communication there is a simultaneous communication like for example by using phone.

Table

Media of communication
in relation to telecommunication technologies

Basic senses:	One-way:	Two-way:
Read and write	E-mail E-conferences News-groups	PC to PC communication
Hear and speak		Phone
See	Television	Videoconferences
Multimedia:	**One-way:**	**Two-way:**
Internet	E-mail E-conferences News-groups WWW FTP Telnet	Phone Videoconferences

Let me sum up this section, by saying that the technology is already here (or nearly so). What we still not have, as so often before in the history of IT in education, is the didactic use of the technology in Distance Education and in the classroom. This is the real great challenge for the time ahead.

DISTANCE EDUCATION

Three characteristic elements of Distance Education is that it allows the student to study in a flexible manner with respect to:

• Distance
• Place
• Time.

The old correspondence schools fits very well into this thinking, but the emergence of new communication technologies often narrows the students freedom in choosing place and time. We may say that the Distance Education situation more and more is like traditional education in classrooms.

A short discussion of these three factors in relation to technology. The discussion will not be complete but rather illustrated with examples.

Distance

By tradition, we imagine a very long distance between teacher and student in Distance Education. After all this was the very reason why we used Distance Education. If the distance was not there, the student would sign up for regular courses.

One example to illustrate the new situation.

Traditional lectures at universities are given in lecture-halls. We have lately seen examples of lectures with cable connections to other lecture halls at campus or at students dormitories. Or for that matter to any place on the earth.

New two-ways communication technologies enables us to follow lectures from distance or near. But opportunity to follow a course from long distance is the main factor and will be so.

Place

Another important factor in Distance Education is the opportunity for the student to study at any place. The correspondence courses gave total freedom for choosing place for study. The introduction of two-ways communication technologies have limited this freedom. You must be in a place where the necessary equipment is available. For the moment we have not built up a national infrastructure with such places. In the not so far future with super highways for communication on broad-band, I expect that every home will have the opportunity to communicate freely and cheaply. As for the old correspondence schools, we will again have total freedom of place to study.

Time

The least important factor in Distance Education is that the student can study at his or hers own time of choosing. Normally after work and when no tutors were available. If you want to have on-line communication with tutors and other students, you will not have this freedom any more. And this should be the final proof of the quote from Tony Bates:

Technology developments will mean the end of distance education as a discreet educational activity.

In the end of this section, I will present a table which give some examples of user areas in relation to «Rooms at the virtual School». All areas are based upon on-line courses I have found on the Web with concrete examples from real courses. My intention with this table is not to give a complete list of «Rooms» but rather to show .the variety of activities in the virtual school.

Rooms at the Virtual School	User area
Information about and registration for courses	Marketing of courses Registration Course inf. Course Description Other inf. from school
Administration and information for students at courses	Information about the on-line classroom and technical assistance Grading Guidelines Course Information Course Syllabus Course Credits Tutorial Support Assignments Order Products Newsflashes Archief, E-mail addresses The Kiosk
Course material:	Lectures Course notes Exercises Tests Exam Sample Solutions Problem Sets Quizzes ELECTRONIC TEXTS Week-by-week, all needs for students of the course, sorted out by week. Project, information about the Online project.
Library:	The HEL (History of the English Language) Home Page The American Dialect Society Home Page Anthony Aristar's History of the English Language Course Page Britspeak Home Page (Differences between British and American English) Edwin Duncan's Home Page Victor (On-Line Card Catalog for TSU &the U. Of Md. System) Hypertext Webster's Dictionary (Useful for consulting)
Other inf.:	Visit the Auditorium-Fred will speak at your school live or over the Internet Workshop Room-Visit Fred's workshop in Spotsylvania, Virginia
Links:	Visit Bernie in the Cellar-A fabulous collection of links. Electronic Resources and References ON-LINE RESEARCH AIDS
Students discussions:	HEEL-L. AN ELECTRONIC FORUM Cafe
Please sign our Guestbook	

VISIONS AND PROBLEMS

In the first section of this paper, I wrote that «The use of IT in education is roughly 25 years long». Thinking about what has been achieved in these 25 years on the technological side, we can only guess what will happen in the next 25 years. It is not difficult to imagine a virtual school with nearly as much opportunity for communication as in the real classroom. And the costs for communication will be so low that we can afford to study at home rather than go to a school for regular classes.

So far the bright new technological world, but as all of you know, we have problems here and now.

One problem which is often mentioned is the difference between countries which can afford to build up the necessary technological infrastructure and nations who can not. We can already see this today by looking on the blank spots for Internet with great parts of Africa as an example.

Another problem is that systems doesn't function as they should. Communication breaks down, printers doesn't function etc. A regular staff meeting here in Trondheim very often contain sections with complaints about malfunctioning of systems. I suppose it is the same in other places. This is a temporary problem but it creates much discontent here and now.

A serious problem when we look upon the use of IT in education and not only Distance Education, is that the teacher educators are so badly prepared both technologically and didactically for using new tools. We are educating a generation of teachers with too little understanding of using the new technology in the different subjects. This will make in-service training of teachers much more important. This fit's very well into that 1996 is the year of «life-long learning».

Another problem and also for the future is that tutoring is costly. We may have excellent conditions for all kinds of contact between students and teachers in Distance Education, but we can't afford it. This is a general problem in education. Look upon a classroom with 30 students and one teacher. How much personal tutoring gets each student?

We think and act in old paradigms when new ones are emerging. Teaching and learning in a virtual school is different from class-room-based education. Educators need to learn the necessary technologies first of all and also how to use them in education. From my experience in Norway and other countries, this is a critical factor.

When we can identify problems, we can also do something with them!

If I had been asked 15 years ago about the available technology for IT in education and Distance Education in 1996, I would not have guessed the situation today. I suppose it is the same situation 15 years ahead to 2011. We may have some visions for the future, and I think they are more soundly based than in 1981, but the technological development usually surpasses our imagination. Educational use of technology is another matter with different scenarios for the future. The worst scenario with only virtual schools, will not happen in my opinion. Man is essentially social and want to get together. Even the best videoconferencing systems can never substitute face to face contact. After all the human factor is the essential one, not technology in itself.

The original is presented in English

Discussion

UNIVERSITY TELETEACHING CENTRES: A CENTRAL AND EASTERN EUROPE PERSPECTIVE

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1. GENERAL ISSUES AND TRAINING NEEDS

Like all other Central and Eastern European (CEE) countries Bulgaria is experiencing a dramatic change in all areas of its society and it is seeking to create democratic institutions and market economy. As the political and economic reforms are not at a satisfactory state, the Bulgarian economy is still in a deep crisis. There is a lack of modern economic and management practice in the Bulgarian companies and the lack of enough public support and understanding of the political and economic changes. In the long run, economics and management understanding is critical to a successful transition and economic growth. In addition, the urgent need to turn around the existing companies and at the same time to create favourable conditions for emerging private enterprises require better knowledge in economics, business, and company management. This makes economics, business and management education at university level of utmost importance to the development of the country. This fact is politically recognised by the Bulgarian government, which would support any valuable initiative. However a mass education could hardly be achieved without applying the methods of the new educational technologies based on Communication and Information Technologies(CIT). As the Bulgarian society and economy is getting more open, a mass foreign language education is also needed, along with training in application of CIT.

The education used to be the main instrument for ideological influence before 1989 and the advanced educational technology methods had not been widely applied. Only few teacher and lecturers are well prepared in this field now both at a secondary school and university level. Most of the teachers and lecturers have to be trained in applying modern curriculum and instructional design methods, instructional technology, educational instrumentation, etc.

Some new ways for opening the Bulgarian education towards the European standards are needed. The traditional forms of achieving it - by student and staff mobility, has its disadvantages, especially for the long term visits. The main problems are economical, political, geographical, social, etc. When a student goes for a study abroad the knowledge he/she acquires can not be easily disseminated in Bulgaria because the students usually leave and study in an isolated environment and in some cases - the students do not come back to the country. The teleteaching option, combined (when possible) with a short term student/staff mobility scheme, gives quite more opportunities and solves some of the problems which appeared. From the other side the teleteaching provides opportunities for developing a school and university presence on the Internet and thus making this institutions transparent for the outside world. In such a way the exchange of ideas, materials, multimedia educational software, curricula, and people would be extended, and the Bulgarian education would be drawn closer to the European standards.

There exists a belief that the traditional departmental structure of universities is reaching great obstacles in fulfilling its usefulness and that new organisational structures are needed if universities are to provide education for the masses with the diminishing resources which are available to them. At the same time, universities are facing increasing pressures from the outside. Tuition fees are rising far beyond the ability of middle class family in the CEE countries to pay, and government grants for research and education are drying up as governments face budgetary pressures. The telematics based Distance Education (DE) is considered as an answer of the new challenges in the field of education. It opens new dimensions for the educational systems of Bulgaria and the other CEE countries.

2. BACKGROUND

2.1. An EU Copernicus Project on Distance Education through Telematics Networks

In January 1995, the EU Copernicus Project COP1445: «Flexible and Distance Learning through Telematics Networks: A Case of Teaching English and Communication and Information Technologies» began. The partners were: Sofia University, Faculty of Mathematics and Informatics and Faculty of Economics and Business Administration, Sofia, BG; University of Twente, Faculty of Educational Sciences and Technologies, Enschede, NL; University of Exeter, Exeter, UK; The Technological University of Kaunas, Kaunas, Lithuania; and Glushkov Institute of Cybernetics, Kiev, Ukraina. The project aimed at:

- establishing Internet communication between the project participants:
- developing Project Data Base suitable for establishing a Telematic Research Network;
- developing pedagogical framework for teleteaching in individual and group mode and a conceptual model for flexible and distance learning system using Telematics networks.
- developing and delivering two sets of distance education courses: English (English for CIT and Business English) and CIT (CIT for Teacher Training and Business CIT);
- developing software tools supporting course development and delivery.

The Copernicus Project outcomes offer a good basis for developing the Sofia University Teleteaching Centre.

2.2. An EU Phare Project on Distance Education

The first steps in building a distance education network in the CEE (Phare) countries were undertaken in June, 1995, when the Technical Assistance Programme (TAP) for the implementation of the Trans-Regional Component of the Phare Pilot Project for Multi-Country Cooperation in Distance Education started. The TAP includes 70 experts from the European Association of Distance teaching Universities (EADTU) and the European Distance Education Network (EDEN) who will deliver technical assistance to the distance education network now developing in the CEE countries. The pilot project is based on the following main activities [2]:

- creation of a background and expertise for future adaptation of distance education learning materials in the Phare countries;
- creation of a common understanding in the Phare countries on the main European open and distance learning concepts;
- creation of a nucleus of DE trainers/experts serving as a basis in the future for the development of DE in the Phare countries;
- development of regional co-operation in human resource and DE issues in CEE countries;
- testing the feasibility of joint course development and implementation actions in the region leading to core course modules which can be adapted to national requirements and contexts;
- development of the necessary conditions for the co-operation with the distance teaching institutions of the EU;
- creating a common basis for the formulation of adequate policies and priorities in the Phare countries, at national and regional level, towards the development of relevant and efficient distance education methods and structures;
- raising awareness and creating cohesion about the national measures and actions in the field of quality assurance, customer care, accreditation and credit transfer, concerning distance education programmes and institutions;
- introduction of European standards in the CEE distance education.

A network of National Contact Points for DE has been established and in addition forty Regional DE Centres are envisaged to be developed during the second phase of the project. The paper analyses the opportunities of developing a network of teleteaching centres in the CEE countries on the basis of the Phare DE infrastructure and the on-going teleteaching projects.

3. OBJECTIVES

The main objectives of the Network of Teleteaching Centres (NTC) are:

- to provide information on the Internet for the on-line distance education courses offered by the NTC;
- to provide information about on-line courses offered by other universities and accessible via Internet, along with facilities for tree browsing, and keyword searches;
- to setup and support mailing lists and list servers;
- to setup and support: a central web server where instructors may put course materials and texts. The web servers will be configured as to allow people to send messages via e-mail as well as allowing establishment of web-based discussion groups;
- to provide access to the personnel database and statistics database;
- to support of distance collaborative training workshops and projects;
- to maintain databases containing students records;
- to provide software tools helping students and teachers locate information on the Internet:
- maintain a list of hypertext links to sources of distance education and mailing lists for discussion of teaching issues.

4. MAIN TASKS

The main objective might be achieved by developing:

- a common delivery and communication system with an user-friendly environment allowing access to the on-line multimedia learning resources;
- an appropriate pedagogical framework for teleteaching facilitating new learning services;
- and course delivery and stimulating both peer to peer and pear to tutor communication;
- a software based technology for course transformation from a traditional mode of delivery to a distance education through telematics networks mode of delivery;
- an adequate credit transfer system adopted for the needs of the NTC and with respect to the European standards;
- a joint set of modules determined as a common core curricula in the participating universities and a common accreditation scheme;
- a common standard for course and other teaching material and software preparation as to facilitate for an easier transition from a traditional type of education to a teleteaching type of education;
- a strict procedure for resource materials filtering and

their organisation in an appropriate data base;

- a procedure for on-going DE monitoring and evaluation based on case studies and «good» DE practice;
- quality standards for teleteaching products and services, and their production and delivery. On the basis of the on-going projects and new developments the first (experimental) teleteaching school year at Sofia University Teleteaching Centre might be offered in 1999. The teleteaching will not replace the traditional type of education but rather make it more flexible, efficient, and cost effective.

5. ADVANTAGES

The main advantages of the NTC are [3,4,5]:

- it provides education and training along with new types of university services, e.g. performance support, partnership, co-operative work, information access, consultancy, etc. on a national and worldwide scale using telematics facilities;
- it defines new roles for universities in their relations to large and small companies who are evolving toward learning organisations. They might jointly develop and deliver appropriate university services to such organisations, using telematics facilities. The NTC will offer services to broader audience:
- staff and students in higher education;
- professionals in organisations who need on-going
- support in order to keep up-to-date with new developments in their fields;
- training departments of organizations;
- enterprises which incorporate the advantages of telematics services.

The NTC might provide a diversity of courses and services and become a facilitator of educational clearing houses, providing learning materials, educational multimedia software and other educational resources both to the networked institutions and other regional organisations and enterprises. The NTC might also help such enterprises in development of their business presence on the Internet.

The NTC offers an opportunity for the universities to participate in a world-wide education and training which can be more profitable by involving new target groups of learners.

6. CONCLUSIONS

A multi-country network of university based teleteaching centres might be established as to cover some of the Phare regional centres but in some cases, depending on the telecommunication facilities which are available, such centres can be established at separate sites, e.g. institutions, big organisations and enterprises, specialised teleteaching units, etc. For the first five-ten years (until the majority of families in the CEE countries have computers and modems at home) the NTC could also provide access to telematics facilities for some students.

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Commission II

PREPARING THE CHILDREN TO ENTER A SOCIETY BASED ON KNOWLEDGE: LATIN AMERICAN EXPERIENCE IN THE USE OF MEGA-TOOLS FOR DEVELOPING MEGA-ABILITIES

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The GENESIS and QUORUM projects sponsored by IBM under the agreements with the governments of some Latin American states proved an initiative which, in the philosophical sense, was designed to deal with a 21st-century task: creating a society resting on global economics and knowledge. This implies the shaping of a new personality model, a higher level of intellectual capacity and new super-abilities, which, in turn, calls for mega-tools and mega-projects.

International competition, the development of human resources and the geographical location of the Latin American countries were the principal strategic factors that in the last years of our century have turned modernization and reform of basic education into the top social priority.

The GENESIS and QUORUM projects were developed by researchers at the Latin American Education Research Center (LAERC) in collaboration with specialists of the Massachusetts Institute of Technologies (Teaching and Epistemology Group), University of Western Florida (Institute of Human Thinking and Artificial Intelligence), Hardford University (Institute of Technical Education), and the Technical Education Research Center (TERC). In addition, a number of Latin American universities and other leading educational establishments gave the project the benefit of their experience and vision of continuous education and raising the level of skills. Among the participants in the project were also Lego (Denmark), LCSI (Canada), IDEA (Spain), and other organizations in the United States, Brazil and Mexico.

Within the framework of the general philosophical approach an attempt was made to identify the key abilities that will be required in the next century, and to define the use of various technologies in the advancement of these abilities. Four mega-abilities were identified:

1. A powerful creative force, an ability for abstraction and critical assessment.
2. Systemic thinking, dynamic change of interpretation and feedback.
3. Continuous education through research, discoveries, the use of the trial and error method, and constructing/designing.
4. Mutual communications, uniting into teams (including virtual ones).

The role of computers and telecommunications as mega-tools far surpasses the ideas and concepts expounded by secondary school courses. They model flexible rational spaces and open up new opportunities for the required transformations. Mega-projects imply the involvement of governments, businessmen, politicians, educators and the public.

This concept was accepted by most private schools and other educational establishments, especially within the framework of the contracts for technological support and unification of services, specifically, by the National and Regional Governments of Costa-Rica, Uruguay, Mexico, Argentina, Colombia, Brazil, Chile, Ecuador, Guatemala, Panama and Venezuela.

After four years of research work in collaboration with the Institute of Human Thinking and Artificial •Intelligence of the University of Western Florida, the QUORUM project covers over 1,000 schools, 10,000 teachers and 1.5 million children in 10 countries; they have access to computer technologies, teaching tools and telecommunications. Within the project framework, a teaching environment «without boundaries» was created for the children's collaboration. Schools in Mexico, Brazil, Venezuela, Costa Rica, Chile and Florida (USA) are currently united by a telecommunication network using the standard local network on school servers, which are hooked up to the regional servers (Vnet and TCP/IP) and Internet.

The main merit of the QUORUM project is that it creates an environment oriented towards creating instead of the environment for consuming information, which is currently offered by Internet-type systems.

Apart from the use of computers to service the traditional subjects on the school curricula drafted within the framework of the existing educational models. GENESIS and QUORUM also offer other opportunities. Specifically, they promote the formation of a new level of responsibility and help teachers, students and the management to acquire practical skills through «New Windows», which can help train the users for work in the conditions of the third millennium. The learning devices, such as «Conceptual Maps» and «Cognitive Capacities», constitute part of the studies within the framework of the QUORUM project and are currently at the stage of development.

Despite the natural limitations inevitably present in the developing countries, the accumulated experience has proved useful for LAERC. It assisted the project heads in achieving the final goal, «putting the most powerful tools in the service of the most promising minds».

The original is presented in English

TRANSFORMING CURRICULA IN THE TRANSFORMING COUNTRIES: AN EXPERIENCE FROM SLOVAKIA

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ABSTRACT

The process of complex political, economical, and social changes in the countries of Central and Eastern Europe involves far reaching transformations. To transform educational contents, form and organization is one of the urgent needs, having in mind the semi-total isolation that lasted nearly half a century. In the paper, historical background of the ongoing transformations of the system of higher education is briefly outlined, with emphasis on analysis of its consequences for the current situation. The transformations must aim not only at overcoming certain weaknesses of the present system, but also cope with new challenges that any curriculum in a discipline developing so swiftly as Informatics is facing today. Approaches taken to transform the Informatics curriculum in Slovakia are discussed. A role of projects for international collaboration is mentioned.

HISTORICAL BACKGROUND

The isolation of Central and Eastern European countries has been most sensitive in areas of economical relations and human contacts. The isolation in economical relations had consequences mainly for the level of technology used in industry and education. No sophisticated equipments were available for education institutions. Moreover, education esspessially at technical universities had to be oriented to technology used in industry. The isolation in human contacts resulted in practical impossibility of taking part in international scientific events such as conferences, common research projects, standardization efforts. The consequences of the above isolation can be found e.g., in a generally lower numbers of publications in international journals, citations, patents. Research and development was therefore more oriented to theoretical, methodological and special technological problems where we have reached relatively good results. In Informatics, this resulted in production of computer equipments in Slovakia, but also in developing own software tools and applications. An analogous situation was in education. Theoretical level and structure of education were good enough what was recognized already at that time. We wish to mention that our graduates were the ones who designed several models of computers that were produced by the local industry. Informatics was introduced already in seventies to secondary education curricula.

NEW CHALLENGES AS CONSEQUENCES OF THE TRANSFORMATIONS

Transforming Central and Eastern European countries towards a civic society with free market economy is a complex task without a precedence in history. Despite that, there have already been achieved enormous results in transforming Slovakia, especially in the economic terms. The process of transforming contents and form of education must keep pace with these changes. Even more, it should be the forerunner of transformations, learning both young and older (here special emphasis should be put on retraining, distance learning etc.) people to understand ideas and concepts many of which were banned for decades. The ideas and concepts are related to various levels of generality. For example, the idea of a university as an environment for free sharing, communicating, and cultivating knowledge is a very general one. It is also a very important one. Slovakia has since 1990 a very liberal higher education law that grants to universities autonomy and full academic liberties. The experience of today's young generation acquired while being at a university is vital for straightening the democratic fundaments of the civic society in Slovakia. One should bear in mind that practically no one else in the productive age has a similar experience in the transforming countries, the teachers not withstanding.

Other important aspect is that the educational process takes place in conditions of an open, or more precisely progressively opening market. Students experience the competitive environment and recognise the role of an individual responsibility in shaping their own personal carriers. Universities are subject to market competition, too. For example, alone in the city of Bratislava, there are three universities offering a study in disciplines related to Informatics. Moreover, there are several other universities offering similar studies within a radius of 200 kilometres (including Brno, Vienna and Budapest) in the three neighborhooding countries. After the fall of the iron curtain, all these have become real options for students from the region, thus creating potentially one of the most competition conditioned regions in Europe. The fall of the iron curtain, geographical location of Slovakia and of Bratislava in particular, has also negative consequences in a brain drain. The brain drain has two forms. First, the classical, is that better conditions for work, most notably higher salaries lead highly educated personal of universities and research institutes to seek work abroad. The second, open market brings many companies to settle in Slovakia. They, as well as an increasing number of local companies are able and willing to pay salaries which are approaching the "western" levels, but which are multiples of average salaries elsewhere. Universities, who are generally underpaid, suffer extremely from this "escape" of their best people.

CONCEPTUAL FRAMEWORK FOR NEW TRANSFORMED CURRICULA

The centuries long European experience of university education is certainly an important source of inspirations for organizing higher education and for designing its contents as well. The very idea of an university as an environment for free sharing, communicating, and cultivating knowledge, which Slovakia shared with others during the whole history of universities in western civilization except during the period of the totalitarian rule, must be revived. This fundamental standpoint, along with their role in studying, maintaining and developing the national heritage, provides the basic conceptual framework for developing curricula for universities in the transforming countries. Our university was one of the first in the country to take part in TEMPUS joint European projects aimed at exchanging educational experience among European universities from both East and West in order to introduce up-to-date know how and technology into curricula. Since 1990, we actively participated in two projects:

- EPICS (Educational Programme In Computer Science), with universities from Great Britain, Spain, and some Central European countries [1],
- Neumann Network, with universities from France, Great Britain and some Central European countries [2].

Essentially, two outcomes of these projects are to be stressed. First, establishing professional and personal links among the institutions and people has added significantly to reestablishing a relatively standard situation within Europe. Second, the projects supported us in building well equipped laboratories where training of students can take place at a level comparable to any standard European university. Building on these outcomes, we have been able to enter into international research collaborations. The personal links and the level of mutual trust and knowing each other proved invaluable e.g., in formulating and successfully solving the research project "Large parallel databases" within the European

Copernicus programme (COST). Here, teams from different institutions collaborated so closely that common results were achieved [3].

It should be noted that the transformation of Slovakia has many facets. The ongoing growth of private enterprises, which can be partly "blamed" for the above mentioned brain drain from the universities, is on the other hand "responsible" for massive increase of utilisation of information technologies. As a consequence, we are witnessing a growing interest of students in studying Informatics.

Despite all the difficulties, lecturers at the universities realise that they must not only achieve results in scientific research, but also maintain industrial links. As an example, software specialists from the Department of Computer Science and Engineering of Slovak Technical University in Bratislava have been collaborating with Slovak Telecom in designing their integrated information system.

COMPLETING TRANSFORMATION

Achieving a "normal" state is a long term goal. On the other hand, in many aspects Slovakia is already now a standard country with a functioning democratic system, including the self-rule of the universities. In fact, it has achieved a respectable level of quality of higher education in many fields. Slovakia's graduates, especially in disciplines not so heavily afflicted by the indoctrination imposed by the former regime, have ever since been able to build successful carriers in free countries. In other words, in most cases Slovak graduates have been able to achieve at least a de *facto* recognition of their higher education diplomas, which can be interpreted as an implicit recognition of their universities' corresponding curricula. Now, the situation calls for a *de iure* accreditation. At the national level, accreditation of universities and of their curricula is a standard requirement that must be met by all universities awarding the particular degree. For example, Slovak Technical University has been accredited by the Accreditation Board to award full range of baccaularate, master and doctoral degrees in Informatics.

While accreditation at the national level is a necessary legal requirement for a Slovak university according to the current legislation, seeking an international accreditation for its particular curriculum is a matter of its serious consideration. On the one hand, confronting own concepts with those of others is a crucial aspect of the openness that is an assumed property of universities almost by definition. On the other hand, meeting the accreditation criteria may be an effort and resource demanding process, so the benefits of the accreditation should be clearly identified.

We at the Slovak Technical University have decided to make the necessary steps towards accrediting our Informatics (Computer Science and Engineering) curriculum internationally at the IEE first. Our reasons are:

- to achieve a higher degree of compatibility of our study programme with those typical in Europe [4],
- to promote introducing several up-to-date subjects into the curriculum which might not be considered as urgently needed yet in Slovakia due to the current situation of still existing underdeveloped industry in certain areas of high technologies, but which are going to become crucial within next few years.

We have already taken several steps towards achieving the stated goals:

- The complete Informatics curriculum is offered not only in Slovak language, but in English as well.
- After at least a decade of concentrated efforts, we have a very comprehensive library with a wide spectrum of international scientific journals, including all the major titles published by ACM and IEEE.

Slovak Technical University has been the first one in Slovakia to graduate last year its students who finished their studies after five years of studying completely all subjects in English. It is very likely that students from abroad, as was the case of these, will form an increasing portion of enrolment seeking an acknowledged quality of education offered in English. The curriculum in Informatics is an excellent example.

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CANADA'S SCHOOLNET: BRINGING THE CANADIAN VERSION OF THE INTERNET TO ALL SCHOOLS IN THE COUNTRY

Gerald McConaghy

SCHOOLNET, WINNIPEG (CANADA)

This is a brief description of Canada's SchoolNet, a unique experiment committed to developing content and services on the internet for all of Canada's schools. Besides its pedagogical objectives, SchoolNet hopes to strengthen communications and sharing among teachers who are scattered across the country's ten provinces and two northern territories. SchoolNet can be seen also as a professional development movement designed to help teachers become skilled in using technology in their classrooms. As well, it is a repository of classroom lessons, Canadian in focus, and suitable for use with or without the computer. And at its very heart it has the goal of improving student learning.

Canada is a vast geographical territory, stretching from the Atlantic Ocean in the east to the Pacific Ocean in the west and from the American border in the south through to the northern land territories to Siberia. In contrast to its physical size, its population is quite small. Most of its 27,000,000 people live along a thin geographic line close to its southern border. However, there are scattered towns and communities in all areas of the country. Remote outports and isolated villages exist in its eastern, western and northern extremities. In addition to its disproportionate population density, Canada finds itself with ever increasing cultural differences among its traditional and recent peoples. The disparity of wealth and the distribution of its resources are evident as one travels throughout the country. Further, Canada has many layers of government and individual educational jurisdictions, which do not foster a national education focus. Yet, both in spite of and because of the Canadian diversities and complexities, the SchoolNet project has been created.

In 1993, SchoolNet began as an experiment among a few schools, a federal government department (Industry Canada) and a telecommunications consortium. The experiment was so successful that by late fall of that year, 1000 schools, located from coast to coast were using SchoolNet services. By 1995, 5000 schools were regular users of SchoolNet. It is now expected that all schools will be connected by 1998. A second experiment was tried. Computer equipment and access to the Internet were provided to a few rural schools, with the agreement that these schools would be open after regular school hours for the use of the community. Through a local co-ordinator, volunteers were recruited to help community members and businesses use the internet. Here, too, the response was enthusiastic. Last year, through joint funding between the federal government and the local community, 300 communities were connected to the information highway. The budget for such connections has been increased and it is projected that many more communities will become internet and SchoolNet users over the next three years.

Despite success of this rural community and business participation, SchoolNet's main focus is education.

SchoolNet is a partnership between various levels of government, the education community and the business community to provide quality services for schools, libraries, colleges, and universities. This vast project is tied together by an organization that has an advisory board made up of about 50 representatives from national education associations, provincial ministries of education, various federal departments, telecommunication and cable companies, and hardware and software companies.

Since education is a provincial responsibility, and provincial governments are quick to respond to any attempt by the federal government to encroach on their domain, SchoolNet ensures that it has the support of the provinces as it develops material for school use. The result is a grass roots organization which decides the net's content, monitors its progress, and evaluates its success. For instance, it has a number of subcommittees, made up of representatives from various provinces, associations and ministries, One of these is the Content and Services Committee which is responsible for advising as to the types of products that should be developed and does so, based on consultation with clients through focus groups and questionnaires.

Consultation with teachers indicates that they want educational materials which can be of direct help to them in their teaching, using or not using the internet. They also want to be able to communicate with other teachers across the country about lesson plans, teaching methodologies, etc. SchoolNet has set about trying to develop these kinds of services. Teachers who are active users of technology are encouraged to share their ideas and materials they have developed for use in their classrooms. As a way to stimulate the creation of teacher made products, SchoolNet pays $300 to any teacher who has material which can be put on SchoolNet for other teachers to use. It is expected that through this initiative a 1000 quality projects a year will be produced for the next three years.

More significant amounts of funding are also made available to schools and other organizations, profit or non-profit, to develop internet products. Each month SchoolNet receives and reviews proposals for developing products which will have educational value to schools. Four criteria are used to judge each submission:

- originality (is there anything comparable on the Internet?) ;
- sustainability (can the product be sustained by funding other than through Industry Canada after the first year?);
- audience (does the product have potential users across the country?);
- partnership (are there partners who support and will be involved in helping to ensure the success of the product?). The SchoolNet site at Carleton University

(http://www.schoolnet2.carleton.ca) is at present the repository for the products developed. Teachers can browse there and can get information on a range of topics. There are hyper links to web sites in North America and around the world. The menu remains under constant construction in an attempt to make it as user friendly as possible.

Encouraging schools and other interested organizations to develop products for SchoolNet has resulted in a rich stream of new material and services being made available. Each month new products appear on the SchoolNet site which have been developed by Canadians for schools. That does not mean that SchoolNet refuses to have non-Canadian products; there are many from other countries, mainly through hyper links. It does mean that the emphasis is on developing Canadian material for Canadian schools.

Most Canadian schools are not yet well equipped with technology. Many have older computers that browse via the gopher. Products must be developed which can serve these schools, now in the majority. At the same time there is an increasing number of schools who have powerful computers with multi-media capability and access to broader band width. SchoolNet actively seeks products that will be of value to these schools. It is sponsoring a multimedia showcase to be made up of school-generated multimedia projects. When the showcase is completed later this year, it will be put on the internet.

Funding is always an issue in the implementation and evaluation of major innovative projects. Who pays for what? How long will the financial support remain? Is the project fiscally viable? Presently, its funding comes mainly from the federal government through the Department of Industry and has been assured for a four year period from 1995 to 1998. It is mainly seed money as the expectation is that after 1998, SchoolNet will become self sustaining through the sale of some of its products and by corporate sponsorships and participation. Money is leveraged by asking organizations submitting proposals to develop products to contribute a part of the cost and to enter into partnership with others who can help support product development.

SchoolNet's content and services are growing but two important questions have to be addressed. The first is what kind of professional development do teachers need to use on-line resources in the classroom effectively? The second has to with the evaluation which needs to be done to ensure that the products developed are useful as learning tools for teachers and students.

The advisory board recognizes the importance of professional development and is currently exploring ways to deliver this effectively, taking into consideration the regional, linguistic, cultural and geographic differences of Canada. A pilot project is now under way with six urban and suburban school boards in the Ottawa area. With funding from SchoolNet and the school boards they have hired teacher education graduates, who have strong technical skills. They have been given special training to work directly with teachers to help them develop on-line skills and to, adapt their teaching to include resources from the internet. An evaluation of the project is being done. It is hoped that from this experiment a model can be developed which can be used in other urban areas.

Newfoundland, a province at the eastern extremity of the country, large in land mass but sparsely populated, has developed a professional development program suited to teachers in rural and small schools. A "train the trainer" model, one or two teachers from schools with a given area are invited,to a two day initial workshop. There are then a series of on-line units with a final workshop towards the end of the year. These teachers are then asked to work with other teachers in .the school. This model is less expensive than the Ottawa project and allows for greater coverage of teachers. There has been no formal evaluation to date. Informal feedback suggests that it works well in many schools, especially where the teacher who has taken the workshop training is skilled in working with other teachers.

It is recognized that if the internet is going to be used as a tool to improve student learning, teachers will need to know more than how to connect to it, browse and find material. There must be a new conceptualization of teaching and learning (Dede, 1995). The power of the internet will be seriously underused if it is seen only as a way to gather information. Its main benefit comes as a tool which permits teachers and students to create and construct knowledge (Stoddart and Niedhauser, 1992). Technical skills for the teacher are not as important as a thorough knowledge of how students construct their learning. The Internet must be seen and be used as a media allowing maximum interaction between the student and the material selected. Hopefully, the evaluation of the Ottawa project will give some insight as to the content needed in professional development to help teachers adopt a constructivist approach in using the Internet.

The question of effective evaluation is probably the most difficult issue to address. Because of the need to get as many projects on-line as quickly as possible, and the rapidity with which the over 1000 new projects have been coming on stream each month, there has not been careful attention given to evaluation *a priori*. Effective evaluation of both the products and the goals will have to be determined by this same grassroots approach. This is a complicated and long term process.

Teachers teach based on different philosophies and, therefore, will use SchoolNet resources in different ways. Students also have different learning styles. Do all students benefit from interaction with on-line material? Which models of use give students greater learning gains? As well, SchoolNet is not the curriculum but bits and pieces to help enrich it and make it more meaningful to students. What ways are there to evaluate these "value-added" components? Evaluation will likely need to be done through a number of case studies which looks at the context in which the teacher or a number of teachers, using the same philosophy and approach, use SchoolNet resources.

SchoolNet is an emerging organization. It will change in structure as new needs are identified and new ways of meeting them are proposed. It is presently examining how it can develop distributed or regional systems, allowing it to respond to needs identified in a various region or by a specific group such as the native community. It is also interested in collaborating with other countries as it and they try to develop valuable on-line content and services for students and teachers.

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Commission III

THE POLICY OF INFORMATIZATION OF EDUCATION IN AFRICAN COUNTRIES

Mushobekwa Kalimba Wa Katana

MINISTER OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH
(ZAIRE)

Mister President,
Dear Colleagues,

I have the honour and pleasure to speak before the colleagues who are attending the meeting within the framework of Commission Three: the use of NIT in education: policy and co-operation.

At the present time one cannot neglect the connection between new information technologies and education. In 1989 on the initiative of France and the former Soviet Union UNESCO organized the First International Congress in Paris with the support of the interstate Programme on Informatics, the main subject being the trend towards «promotion of international co-operation». At the Congress some recommendations were formulated and some supposed top priority tasks were defined. These recommendations were mainly aimed at getting some advantage from a collective experiment and pooling limited resources in the area of new information technologies in education and consolidation of international co-operation in the field.

The main subject of the Second International Congress which is now taking place in Moscow is «The Educational policies and New Technologies». To prepare for the Congress experts from African countries had a meeting in Dakar in April 1996. Some recommendations were formulated as a result of their work. Special attention should be paid to the three recommendations given below:

«The commission of experts recommends the member-states of Africa to support the efforts on the introduction of new pedagogical technologies including the use of new information technologies in conformity with the approved policy which is presented in specific acts».

«This commission strongly recommends for each member-states to work out and to use the national plan for the development of informatics, particularly what concerns applications which are used as a means of education».

«Teaching informatics of the teaching staff should be in the foreground when introducing new technologies in education».

After considering these recommendations one can come to the following conclusions:

- *almost a total lack of approved policy which is to be presented in specific acts on using NIT in educational systems of the countries' subregion;*
- *almost a total lack of national plans and necessary means which could facilitate the introduction of NIT, as well as an insufficient training of the staff who cannot shoulder these new responsibilities.*

Some countries carried out experiments with national plans. The results were mostly satisfactory. However, there are certain difficulties, which are mainly due to the lack of man-power and financial resources.

The purpose of this report is to share some thoughts about the working-out of the national and regional policy concerning the introduction of NIT in educational systems; in this report these issues are considered in the four directions, started below:

The urgent need of national plan.
Stages in working-out of the national plan.
Mobilization of recourses and co-operation.
Conclusion.

1. THE URGENT NEED OF THE NATIONAL PLAN

It is quite obvious that when working out the national plan on the introduction of NIT in education the profitableness and success cannot be clearly defined. In reality, the introduction of NIT in education in conformity with the national plan could enable:

1. to define national priorities;

2. to avoid non-synchronized and «wild» introduction of NIT, which would result in wasting of man-power, material and financial resources and also time...

3. to ensure the efficient introduction of NIT.

II. STAGES IN WORKING-OUT OF THE NATIONAL PLAN

The working-out of the national plan is done in stages. In accordance with the national plan on introduction of NIT in education the following stages could be suggested:

1. The search for people who may be interested in the subject at all levels

At this stage the work is done to find out people who can set specific tasks and to involve them in the solution of these tasks.

2. The organization of the working group

To organize the working group including those who set tasks, specialists and any other people who are interested in the solution of the problem.

3. The immediate working-out of the national plan on the introduction of NIT in education.

3.1. *School curricula.*

1st step: organization of the working group;

2nd step: working-out of school curricula as a series of consecutive blocks.

3rd step: working out of school text-books in accordance with the approved curricula.

3.2. *Training of teachers and other specialists.* First of all thus training is intended for the main group of high level professionals in the field of education. This main group in its turn is to prepare teachers who must be able to introduce new programmes in education process and use new text-books.

Parallel to the training of the main group high level specialists the training of another group of high level specialists is to be organized to create software for education purposes, to work out concepts, to set up data bases and to install infoware, and also specialists in telecommunication and information networks. These specialists will be able to integrate all new information technologies.

3.3. *Acquisition and use of the equipment*

Short-term tasks

Organization of commission for working out of curricula and school-books.

Working out of curricula.

Working out of school-books.

Medium-term tasks

Acquisition and introduction of the equipment.

Adaptation and working out of software.

Training of teachers and technical personnel.

Gradual introduction of NIT in schools.

Creation of data banks containing school data.

Long-term tasks

Creation of data banks on main fields of national life.

Setting up and reconstruction of schools (school infrastructures).

III. MOBILISATION OF RESOURCES AND CO-OPERATION

The national plan of introducing of informatics into education can be carried out with success only in case of mobilisation of human and financial resources.

Nowadays many African countries have serious social and economical problems. These conditions reduce their ability to solve problems in education.

Mr. Colin Power, the assistant UNESCO director of education, emphasised the fact, that the African countries allocate from 38 to 200 dollars on education of one child, while the developed countries allocate from 2000 to 9000 dollars.

In spite of these conditions our governments understand the importance of the problem and do all they could to allocate enough money to accept the challenge. These efforts should unite formal and informal education and increase technological culture.

We should call upon international community to increase their efforts in this very field to make the gap between developed countries and other countries not so huge.

Two-sided and multi-sided co-operation, regarded as a supplement to the efforts of countries and regions, will be appreciated.

Nevertheless, UNESCO should be a catalyst and a co-ordinator of these resources.

African countries should not forget about their responsibility to unite regional and subregional resources for realisation of their projects.

We think that there are some other methods of promoting of NIT introduction in our educational systems by African countries themselves.

IV. CONCLUSION

Is it proper time now to work out the national plan on introduction of NIT into education?

Can we define the main stages in the process of working out?

Is the mobilization of recourses the main factor in the successful realization of this project?

How can we mobilize these resources?

Such are the questions which I put to you, and which you can consider.

I wish that a result of this consideration the measures could be defined that would enable our countries to solve the problems which still arise when introducing NIT in education.

Thank you.

Further we shall try to describe briefly the problems which arise when NIT are introduced in education.

I. THE MEANS OF INTRODUCTION OF NIT IN EDUCATION

1.If it is necessary then all kinds of education regarded as parts of private education, are tested to determine the profitability of these kinds of educational activities, which are to meet the demands of the users who directly use NIT.

2. NIT were mostly used in the systems of formal education to realize education using computers, for instance, in the field of medicine. It should be noted, that institutions of higher education are increasingly interested in using NIT in teaching and research activities.

More and more teachers working in the field of higher education acquire a lot of experience in using NIT. Pedagogics is also taking interest in NIT, which are *used in research connected with education and in training teachers. Some higher educational institutions are working out programmes for the distant training of teachers despite a low technological level. Special studies on the technology of education are carried out at some higher educational institutions. The increasing number of students regard didactic materials as an obligatory subject.*

3. Besides higher education, tele-education and radio education have also been tested at different levels of education. Taking into account that the number of teachers is not enough, some countries have investigated the possibilities offered by the radio and television to ensure the access to school education for the maximum possible number of children who live in remote areas.

4.The cost of hardware may often have been the impediment in the introduction of informatics in primary and secondary education. However, even in these areas of education private schools offer curricula which include using NIT.

5.Among possible ways of getting education numerous courses on primary education and teacher training according to modem requirements give you a chance to choose. These courses mainly aim at training teachers to use NIT in their professional sphere. In connection with this UNESCO/BREDA organized a great number of demonstration lessons. Even if the positive effect of these courses seems to be rather weak, however this training contributed to the acquisition by the teachers of the fundamentals of informatics. It is important to emphasize the need to exchange teachers from different countries, specializing in the field of informatics.

6.This is the grand total on the place informatics takes in African educational systems. Nowadays it is important that we should advance and work out new strategies taking into consideration the limitations mentioned above.

II. THE MAIN PROBLEMS

7. On the whole, African countries admit and appreciate the importance and the role of NIT in education. However, in our opinion, the use of NIT in education presupposes the necessity to solve some problems.

8. First of all, the initial difficulty is connected with labour resources and equipment, which are the main factors in using NIT. As far as labour recourses are concerned, the main difficulty lies in teacher training. In fact, only a small number of teachers in a small number of institutions were really welt trained to be able to use new technologies in education. Another difficulty is connected with an insufficient number of teachers who specialized in didactic materials in general and in using computers in particular.

9.Concerning the problem of material recourses, it should be mentioned, that the programmes of structural settlement make it possible to economize in difficult situations in some countries, simultaneously creating difficulties in acquisition of the equipment which is necessary, when introduction NIT in educational systems.

10.Apart from that, the problem of software arises. Sometimes the software which is available in the market cannot be adapted to the cultural context of a young African. Didactic materials, which can be used in education, are often imported products and are insufficiently adapted to (he school realities of the continent. Taking into account all these reasons, the governments should work out a reasonable policy that could enable to make NIT contribute to the development of their countries and the continent.

11. Imperfect basic infrastructures constitute another difficulty in introducing NIT in education. For example, electrification and telecommunications are almost completely absent in a great number of countries. This is the weak point and the situation can be improved if the competence of African specialists in the field of technology is increased. In some cases there is an impression that the level of technological competence change in opposite directions: where the adequate and sophisticated equipment is used, the personnel make mistakes, it is not numerous or efficient...

12. These problems result in the need to solve the question of support for software and hardware, .because NIT require specialists who look after software and hardware. In many countries the tack of support can be regarded as one of the major obstacles in the technological development of the continent.

13. Some critical remarks can be addressed to the manufacturers of the equipment. In fact, the equipment that is available in the market is often designed and realized not taking into account the peculiarities of the continent, especially parameters on dust and humidity in African climates.

14.It seems that among all the difficulties the main obstacle is the lack of national policy on the introduction of NIT in African educational systems.

15.Obviously, the solution of these numerous problems when introducing and using NIT in African educational systems, would enable the continent to approach the 21st century.

III. COOPERATION

IV. PARTICIPANTS

Interafrican Cooperation

17. The mechanism of this co-operation is gradually taking form with the help of regional and subregional initiatives.

The original is presented In French

INFORMATION TECHNOLOGY IN NEW ZEALAND SCHOOLS

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SUMMARY

In common with the rest of the developed world, uses of information technology in education in New Zealand have focussed in three broad areas:
educational administration;
the "ordinary" classroom;
facilitation of distance/open learning opportunities.

The most recent survey undertaken by New Zealand Telecom in late 1995 reported that there was one computer per 18 students in primary school and one computer per 10 students in secondary schools. Half of the computers in the schools were more than three years old. Statistics from a Ministry of Education survey show that there is a ratio of one computer per 15 students and that a high proportion of schools have one or more CD-Rom drives.

EDUCATIONAL ADMINISTRATION

The most up-to-date information available suggests that all tertiary institutions and secondary schools, and almost all primary schools, are using computer technology to facilitate elements of their administrative or office procedures.

Observers in the field report that all schools routinely use word processing software and spreadsheets for administrative purposes. More than 97 % make extensive use of facsimile and an increasing number make use of e-mail. Many use sophisticated software publishing programmes to develop news sheets for communication with their communities.

Primary schools are using a variety of data file-handling computer programmes to record and process roll, class, and pupil details. Various programmes are used to record and process financial and asset records.

Secondary schools use a variety of software applications (from fully integrated relational data bases to suites of separate packages) to record and process for example: timetable; roll; class; and pupil details; achievement profiles and records; and Financial and asset management information.

The Schools Electronic Network was originally established to improve information flows between schools and the Ministry of Education.

THE «ORDINARY» CLASSROOM CURRICULUM

Computers have been used in New Zealand schools for a variety of teaching and learning purposes since the 1970's. In primary schools most computers are located in individual classrooms while in secondary schools traditionally computers have been located together in computer labs. However, today there is. an increasing tendency to locate some of the computers in classrooms dedicated to particular subject areas, i.e. in the science area for data logging exercises; in the graphics area for computer-aided drawing. Information technology is considered important in the classroom for three fundamental (not necessarily exclusive) reasons:

• information technology as a tool for learning;

• as an aspect of modem life information technology needs to be learned about in its own right;

• information technology to enhance the delivery" or the learning of the traditional curriculum.

A TOOL FOR LEARNING

The most widespread applications in classroom learning are productivity tools. Word processing and publication programmes are very commonly used in the learning and practising of written composition, especially in primary schools; spreadsheets, and data analysis and presentation programmes are often used in numerically rich curriculum areas such as science and maths; data file programmes are often used in situations where students are developing classification skills such as in social sciences. Various kinds of computer aided drawing programmes are used in art, music and technical subjects.

Since the mid 1980s an increasing number of schools have been using e-mail to communicate with other schools and educational institutions. Some schools are also linked to the National Library and the New Zealand Bibliographic network. Today approximately 61 % of secondary schools and 39 % of primary schools report using on-line services. A small number of schools have full access to Internet and World Wide Web but costs of access are preventing other schools from making use of this service.

A number of educational computing applications that might be called "virtual learning environments" have proved useful in New Zealand classrooms and overseas. This genre of software includes simulations such as virtual laboratories and problem solving/decision making "games" which require students to apply thinking, communication, decision making, or mathematical skills relevant to their current area of learning.

LEARNING ABOUT INFORMATION TECHNOLOGIES

The need for students to become confident and competent users of information technology has been a motivation in most schools' decisions to introduce computers into classroom programmes. While in the 1980s computer awareness was an explicit rationale for computing courses today most schools have seen the development of computer awareness as an implicit rationale, that is a goal which will be achieved as a byproduct of achieving more directly curriculum related benefits.

While in earlier computing courses the teaching and learning of computer programming was an important aspect today most courses now concentrate on the use of application software for problem solving.

Some schools have also introduced students to the idea of computer control by interfacing computers to electromechanical (robotics) devices. Given a particular problem students design and then build appropriate devices and write computer programmes to control the devices in solving the specified problem.

COMPUTER AIDED LEARNING/COMPUTER MANAGED LEARNING

A number of educational institutions have used computer aided instruction and computer managed learning programmes. Some programmes are particularly engaging and students enjoy using them (particularly relative to "ordinary" classroom experiences). However, there is little evidence that the use of this kind of software produces better learning gains than "ordinary" classroom experience. The programmes have been most successful with students of lower ability or with students who have specific skills in need of redemption and which can be improved by repeated practice.

DISTANCE EDUCATION/OPEN LEARNING

New Zealand has a long history of successful provision of distance learning. Correspondence education was initially stimulated by difficulties of conventional school access for children in geographically remote locations. The clientele for distance education now spans primary, secondary and adult students with diverse reasons for not attending conventional institutions. Additionally many secondary school students who are enrolled in "ordinary" schools use distance education programmes delivered by The Correspondence School to study subjects which are not available at their schools.

At the tertiary level two universities offer distance education courses and the polytechnics have been active in providing a wide range of distance education courses.

In 1985 more than 70,000 students were enrolled in distance education courses.

Distance education in New Zealand has embraced the use of broadcast radio, telephone services and the use of 0800 numbers, broadcast television and recently satellite television, desk top video, delivery of audio and videotape materials, and computer disk based materials, including CD Roms.

The use of electronic mail and bulletin boards and audiographic networks is now an important aspect of distance education, particularly in rural areas in New Zealand. This has resulted in an increasing number of telephone lines coming into schools. Most primary schools, except small primary schools, have two or more lines and secondary schools have three or more lines.

TEACHER DEVELOPMENT IN THE USE OF INFORMATION TECHNOLOGIES

A major emphasis in New Zealand over the last six years has been the training of teachers to use new information and communication technologies effectively in the classroom. Over that period the Government has committed over $5.0 million to teacher training in the use of IT and more than 8000 teachers have received school-based training. These teacher development courses have been evaluated by independent researchers who have provided feedback to the Ministry of Education on how successful the programmes were in providing effective training for teachers. These teachers are now confident and competent users of technology in their classrooms and are often involved with assisting other teachers to be more effective users of technology. In The Correspondence School is the sole provider of distance education for primary and secondary school students in New Zealand.

Addition most trainee teachers in Colleges of Education undertake training in the use of information and communication technologies.

The snowball effect of this group of teachers growing ever larger as they share their skills with others is leading to a leaching force who are, more and more, making effective use of technologies in the classroom. However technology is changing at a rapid rate and teachers are having difficulty in keeping up with the advances, e.g., use of Internet. A further problem is that teachers skilled in the use of information technologies are actively recruited by industry.

FUNDING OF INFORMATION TECHNOLOGY IN SCHOOLS

Up until the end of 1989 almost all computer equipment in schools had been financed by parent contributions or community fundraising schemes to the value of about $60 million. Although there is no conclusive evidence available it is reckoned that most of the further $55 million worth of computing equipment placed in schools since the review of educational administration in 1989 has also been financed directly by parents or local communities. Since 1989 schools have been bulk funded for operations and schools have been able to use funding from their Operations Grant to purchase information technology equipment. Rural schools have also been able to obtain funding through a proposals pool for innovative curriculum delivery.

As a rule of thumb it is generally held that a sum equivalent to about 40 % of initial capital cost should be budgeted annually for: costs of software and consumables such as paper or floppy disks, line usage, maintenance costs, and for provision for replacement. On this basis schools should be budgeting about $46 million annually to cover the ongoing costs generated by the currently installed equipment. No Figures are available about what schools actually budget for these costs. However over the last two years many schools have realised the need to budget in this area and an increasing number have information technology plans. Recently the Ministry of Education put out a planning kit to help individual schools develop an information technology plan for their school.

Government initiatives in the information technology area have been focussed mainly on teacher development and on providing seeding funding for pilot projects such as the use of audiographics, development of CD-Roms, use of satellite television, desk top video conferencing, schools electronic network, and exploratory studies in educational computing.

CURRENT AND RECENT INFORMATION AND TELE-COMMUNICATION TECHNOLOGY PROJECTS

Development of interactive CD-ROMS

The Ministry of Education contracted The Correspondence School in 1993 to produce interactive CD-ROM's - one in beginning Japanese and one in translation geometry. (This was at a time before there were any commercial developers of CD-Roms in New Zealand.) These were trailed in schools and are being used in distance education courses. A more extensive CD-Rom in Japanese is currently being developed.

Electronic Network Linking Schools

The Ministry of Education has a text-based network the *Schools Electronic Network* linking approximately 500 schools and with approximately 4000 active users. Over the next few years this network will be expanded to eventually link all primary and secondary schools. The network includes bulletin boards and electronic conferencing facilities. New Zealand Telecom also has an educational network. *New Zealand On Line.* to which about 500 schools are linked, and Massey University has a smaller educational network linking about 200 schools. In all nearly one half of New Zealand schools are connected to electronic networks.

Audiographics for Rural Schools

Over 60 schools are connected in various clusters via audiographic networks. This enables teachers in schools to have classes spanning several schools. Over 20 subjects are delivered in this way. Funding ha:, recently been made available to further rural schools to implement this technology and so be able to offer students a wider range of courses.

Desk Top Video

Two remote schools and one city school were linked to The Correspondence School for this project. Courses in languages and social sciences were delivered to students. Both teachers and students were enthusiastic about the potential of *desk* top video for delivery of teaching and learning to small groups. At the time of the trial it was considered that until costs of hardware and software became more reasonable this technology was beyond most schools budgets. Since this trial some schools have been using the See You See Me product (slow scan video) and report favourably on its use.

Satellite TV Delivery of Educational Programmes

In 1995 the Ministry of Education contracted The Correspondence School to undertake a pilot study in the delivery of languages and technology education via satellite. There are 90 official trial schools and 30 other schools who receive the broadcasts. Programmes in three languages and technology are broadcast daily. This is the first use of satellite delivered TV in New Zealand by any institution or commercial organisation. To date the trial is going very well.

Use of World Wide Web (Internet) for the Delivery of Educational Materials and Programmes

The Ministry of Education has home pages on World Wide Web (http://www.govt. nz/ps/mi.n/edu/) where information about curriculum and administration is available. A trial is being undertaken with ten schools to determine the viability of using World Wide Web as a replacement for the text-based schools electronic network mentioned earlier. It is estimated that currently approximately 100 schools access World Wide Web through a commercial provider.

FUTURE DIRECTIONS

TECHNOLOGICAL ADVANCES

The rate of increase in the number of possible applications of computers has been as rapid as the change in computing technology itself. Developments in multimedia which enable users, in an interactive way, to access text. sound, still and video pictures, potentially provide a number of rich learning opportunities. The rapid growth of the Internet and the resulting access to vast amounts of information, to international discussion groups, and access to up-to-the minute research provides exciting learning opportunities for students. As "broad band" technologies become available these technologies have great potential for facilitating educational interactions between students and learning materials, and between students at physically remote locations. Technologies such as video conferencing and Internet provide an infrastructure for more open learning opportunities.

Educational outcomes

A great deal of the literature on the use of information technology in education reports on: the enthusiasm and engagement of students; the changed but important role of the' teacher; the apparently enhanced role of the teacher; greater productivity; and enhanced co-operation between students. These findings are important because the changes in learning behaviours which students exhibit when using computers appropriately, are strong indicators that enhanced achievement will result. Papert in *The Children's Machine,* explains that the extension to human capability conferred by modem information technology changes the nature of knowledge itself. The fundamental questions of learning are no longer "what?" but "how?" "why?" and "how do I know?" Access to information has the potential to change the role of the learner from just seeker of answers to asked of more questions. Recently schools have been set up whose curriculum is supported by an information technology-rich learning environment. While it is too soon to say what the long term effects of such schooling are interim conclusions are positive. It is important to observe such experiments.

A further issue is whether in fact developments in information technology will make schooling less relevant and students of the future may learn from home, or other community institutions such as the library, using information technologies. This perspective ignores some of the important outcomes of schooling including socialisation. While some students may prefer to learn in this way it is still considered in New Zealand that in the foreseeable future most students will still attend schools. However, advances in technology will change the role of the teacher and of the school. In some curriculum areas students will learn mainly through information technology and in other areas through more traditional teaching methods. Information technologies will generally support and enhance the work of teachers.

Funding

Two particular thrusts are being considered by Government in New Zealand: provision of one computer per five students in schools and secondly to ensure all schools have Internet access. The costs of providing a ratio of one computer per five students together with on going maintenance software and replacement cost have been provided to Government and are Still being considered by Government. With regard to Internet access some clusters of schools are organising joint purchasing arrangements with providers, but this is moving slowly because of the high costs of Internet access in New Zealand.

Principles

Whatever possible roles are considered for government, whether that be intervention strategies, or support for research or development projects, it is proposed that the following principles be adapted as a basis for future decision making.

Information technologies should he considered for use in education only if there is good reason to believe that they will:

- increase student choice; and/or
- increase access to learning opportunities; and/or
- provide enhanced learning opportunity, and/or
- increase the productivity of students: and/or
- provide unique opportunities to learn IT skills.

CONCLUSION

The past six years has been a time of great change in New Zealand education. A new administrative structure has been put in place and major curriculum reforms, involving the total curriculum, are now more than half completed.

The importance of including technology as an essential area in the curriculum has been recognised as has the need for students to be able to access and use information and communications technologies for a range of purposes. Government has accorded in-service professional development programmes for teachers a priority. A range of initiatives are underway for ensuring that teachers are confident and competent users of technology; in encouraging the use of new information technologies in the classroom, and for distance education and open learning. Some of the initiatives, it is hoped, will be a catalyst to encourage schools to undertake further initiatives. As evaluations of these initiatives are undertaken these will give an indication of where future funding is best directed in terms of the use of new technologies for enhancing teaching and learning.

Exciting developments are occurring in information and telecommunications technologies. The potential of these technologies to support and enhance teaching and to provide new and exciting approaches to learning for students is being recognised by Governments' world-wide, particularly as part of wider social and economic reforms designed to increase productivity and competitiveness.

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Part VII

Theme 6

INTERNATIONAL CO-OPERATION

PLENARY

UNESCO INTERGOVERNMENTAL PROGRAMMES IN THE FIELD OF COMMUNICATION INFORMATION AND INFORMATICS

Henrikas Yushkiavitshus

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Mr President,

Distinguished Delegates, Ladies and Gentlement!

I am grateful for the opportunity to address this Congress which has brought together such an impressive number of decision-makers, educators, informatics specialists and representatives of governmental and non-governmental organizations from all over the world.

My colleagues and I have been following with great interest the deliberations that have taken place here since Monday and are impressed with the scope and depth of the debate. Now that the different specific aspects of the main theme have been analysed, the topic of international cooperation gives me an opportunity to present it, as seen by UNESCO, in more general terms and in the broader context of the emerging Information Society, of which both informatics and education are major building blocks.

There is no doubt that economic and commercial interests are the main driving force for the building of information highways. However, it is also obvious that the development of education, culture and science, as distinct and integral parts of our civilization, cannot be left totally to market forces. Information highways must not simply provide new and more powerful channels for electronic consumption. They must have large spaces for knowledge and value sharing, artistic creation and public debate.

From the outset, it is important to understand the nature of the relationship between education and training on the one hand, and the information revolution on the other. While education and training are certainly essential for accessing and mastering new information and communication technologies, these techologies must in turn be used to solve today's critical problems of education, particularly in developing countries.

The sad reality of today is that information-wise, just like with regard to economic wealth, the world is divided into "haves" and "have-nots". The industrialized countries have an overwheiming lead in technological advances, while for a great number of developing nations even "old" technologies, like television, telephone or even electricity, are still only a dream. However, a closer look reveals that the new information and communication technologies offer immense opportunities to all societies and individuals for alternative, truly universal and often cheaper ways of accessing and disseminating information.

The concerns of developing countries regarding their participation in the Information Society bear less on whether it should be accorded high priority, than on how to effectively apply information technologies to development so as to reduce, rather than widen and deepen the gap between "haves" and "have-nots" and worsen inequality across the technological divide.

Whether humanity as a whole is to benefit from these opportunities will depend not only on the transfer of technology, but first and foremost on enhancing human capability to make the best possible use of information technology In this context, the importance of education and learning cannot be overestimated. The emerging Information Society, based on the rapid development of information and communication technologies, is changing radically the learning needs of humanity and the traditional perception of education The key word in describing and understanding tins phenomenon is "acceleration". It took humanity over two million years to invent printing, another five hundred to offer itself the first computers, and only 3 to 4 decades to come up with lap-tops, cellular telephones and direct satellite communication. Nowadays, practically every year brings a new technological breakthrough.

In this context, learning is, more than ever, the mechanism through which human beings cope with and in turn contribute to change. The very pace of change and consequently the volume of ever more diverse knowledge and skills required make it impossible to "squeeze" them into several years of traditional schooling. Learning is increasingly becoming *a lifelong* requirement, rather than a mere preparation at the early stages of one's life. The possibility to engage in learning throughout one's life is thus essential for survival as well as a condition for continual quality of life. Without such a possibility, and the will to use it. individuals and whole communities risk to be excluded from the Information Society of tomorrow.

Regretfully, these new learning needs remain, to a varying extent, unmet throughout the world. That is not new: humanity has known unmet learning needs as long as education has been a conscious concern of societies. What is new now is that such unmet learning needs can no longer be seen as isolated phenomena within the boundaries of particular countries or distinct parts of the world, because the emerging Information Society will inevitably be a global society.

But what is the global reality? As we approach the end of the second millennium, there are still some 900 million illiterate people in the world. New illiterates are created every day as the result of inadequate school systems and insufficient conditions to prevent relapse into illiteracy once people have become literate. About 130 million school-age children world-wide do not go to school. Millions of those who do go to school often end up with learning achievements that do not correspond to their immediate needs, nor guarantee the sustainability of learning throughout their lives.

There are many literacies - and consequently illiteracy's. The inability to read and write is but one form of illiteracy. Technological illiteracy, political illiteracy, intercultural illiteracy, and so many other ways in which people are hindered in their ability to act and reflect upon their environment are just as dangerous. More than ever, there is an acute need to address these problems which in a global society are no longer exclusive problems of specific countries and ministries of education, but rather challenges to humanity as a whole. There is simply no way that one can ignore a billion people.

With regard to the world of work, learning is no longer simply a prerequisite for entry into the labour market. In the past, one used to learn in order to get a job and earn a living. Nowadays it is often insufficient merely to have learned. To be a productive part of society, one needs to be able to continue to learn and to respond to the availability of different job opportunities. Linear career paths are being replaced by career networks in which people might explore totally different environments and move in entirely different directions at various stages of their lives.

Furthermore, since labour is no longer a scarce resource, human beings spend on average less time on job-related activities and more time doing other things. Quality of life is thus less a function of self-realization in the formal work environment. It is increasingly related to how people are prepared for the world of non-work. Learning is thus a pervasive aspect of life itself. Both as a condition of survival and as a determinant of quality of life, learning is a basic human right.

The technological development which has posed so many challenges to society is also providing humankind with the means to adjust to the new conditions it has itself created.

In the field of education, information technologies can complement traditional educational techniques and enable education systems to adapt to the different learning and training needs of societies. Computer simulation, telematics and teleconferencing, alongside educational TV or radio, have great potential to reach larger audiences than the traditional classroom process, and to make learning more effective, attractive and stimulating. The increasing variety of interactive media (e.g. compact disks and interactive TV) enlarges the scope and possibilities of self-directed learning. These tools provide an unparalleled opportunity for "reaching the unrelated" and for making lifelong education for all feasible, particularly for learners for whom access is limited by time and space, age, socio-cultural environment, work schedules and physical or mental handicaps. This does not mean, however, that people will spontaneously seize the emerging opportunities to learn, nor does it mean that for those who do, learning will automatically become a less demanding activity. The traditional educational environment will be increasingly transformed into open learning environments characterized by: accessibility, flexibility and interactivity. In these new environments, the roles of both learners and teachers will change significantly. Learners will have to take greater responsibility for their learning, while the role of teachers will be increasingly that of mentor and guide, rather than a mere information dispenser. Most importantly, the new learning environments must ensure dialogue - the main factor in effective learning - both among learners and between learners and sources of learning.

While the traditional school will no doubt continue to exist, the processes taking place within its walls will gradually change. In conjunction with the family environment, society at large, and the media, schools will play a crucial role in preparing new generations for lifelong learning, which itself will take place largely outside the school. Beyond school, people will learn at home, in the work place, in different community settings, using their acquired capacity for self-directed learning as well as the organizational facilities and resources provided by the learning society, a concept which overlays that of the information society.

The use of new technologies raises a number of social, economic, cultural and ethical issues. For example, information technologies and products originate primarily in the developed world. The content of the messages they carry typically reflects the values and interests of that world and the linguistic options are limited to several major languages. This is seen by many developing countries as a threat to local customs, values and beliefs. It is, therefore, important, while promoting the use of information technologies in education, to ensure the preservation of linguistic and cultural diversity.

No country or even group of countries can hope to solve, single-handed, problems related to education and the Information Society. International cooperation in this area is thus a necessity and UNESCO is aspiring to contribute to this cooperation.

Under its very Constitution, UNESCO is required to contribute to "advancing the mutual knowledge and understanding of peoples, thorough all means of mass communication", "promote the free flow of ideas by word and image", to "maintain, increase and diffuse knowledge", and to "give fresh impulse to popular education and to the spread of culture".

With the advent of the information age, these tasks have not only retained their relevance but have taken on a new urgency and UNESCO must seek appropriate responses adapted to the new technological environment. As the distinction between different forms of information and the way in which they are transmitted begin to blur, the principle of the "free flow *of* information" - which until recently had been considered only in terms of mass media - must be extended to include all types of information needed for the advancement of education, science, culture, peace and democracy.

These tendencies and challenges are at the heart of debate within UNESCO and its governing bodies. Thus at the twenty-eighth session of the General Conference of UNESCO last November, a special joint meeting of all the programme commissions analysed "Educational, scientific and cultural challenges of the new communication and information technologies". The General Conference stressed the societal problems of information technologies and the need to:

a) ensure that the rapid development of the new communication technologies is properly and comprehensively assessed through interdisciplinary and intersectional reflection to determine their role as a factor of development;

b) initiate a wide-ranging discussion of the consequences of the development of such technologies for UNESCO's programmes in order to ensure that the Organization is able to anticipate and adapt to these changes;

c) reaffirm UNESCO's ethical mission and contribute to harmonious development of these technologies while ensuring respect for linguistic and cultural pluralism and for the right to privacy;

d) prepare, together with the various partners concerned, specific projects, in particular in the fields of distance education and virtual libraries.

Taking account of the results of the consultative process and the directives of UNESCO's governing bodies, a policy paper, entitled "UNESCO and Information Society for All" has been prepared and some of you have already read it.

UNESCO's recent activities in this area have aimed at widening and deepening international dialogue and at testing various initiatives through pilot projects and activities. Let me briefly mention some of these activities and cooperation modalities.

An important factor in UNESCO's work in this area is collaboration with the International Telecommunication Union based on the cooperation agreement between the two Organizations signed in October 1992. A study carried out jointly by UNESCO and ITU entitled "The Right to Communicate At What Price?" presented a number of strategies and recommendations which together constitute a promising approach to ensuring access to telematics facilities at affordable cost to users in development-oriented sectors.

UNESCO is also cooperating with the study groups set up by the ITU Development Sector to formulate recommendations to strengthen the role of telecommunications in development. It is also participating actively in the work of the United Nations Commission on Science and Technology for Development to prepare a policy report on "Information Technology and Development" for consideration by Member States and UN agencies and programmes.

UNESCO's INFORMATIC programme, launched in 1990, aims at helping African countries to introduce informatics in educational systems. The activities consist of training in informatics of teaching staff, management and administrative personnel in education, training of maintenance personnel, and training in the production of educational software with the participation of teachers and computer specialists.

Within the framework of INFORMATIC, UNESCO organized the first international conference and exhibition on "Computer-based automation in developing countries (AUTO-DC '95)" held in May 1995 at Enugu, Nigeria with the participation of 198 experts from various fields such as educators, researchers, computer consultants, computer companies, planners and users.

The Regional Informatics Network for Africa (RINAF) project of UNESCO's Intergovernmental Informatics Programme (IIP) has mobilized more than $ 1 million from several bilateral donors, notably the Government of Italy. Several training courses for African network managers and technicians have been organized and four African countries helped to connect to the Internet. A Strategy meeting and training course were organized in Libreville in April 1996 to plan activities to extend network connectivity to the Central African sub-region. A model information highway project has been initiated in Ghana under the sponsorship of the International Development Research Centre (Canada), the ITU, the UN Economic Commission for Africa and UNESCO. It is designed to improve access to and use of telematics facilities by promoting coordination and capacity-building in the sectors of public concern. A feasibility study has been completed and extra-budgetary support is being sought, including a request to the World Bank's Info Dev programme.

The African Regional Symposium on Telematics for Development was organized in Addis Ababa in April 1995 by the ITU, UNECA, UNESCO and IDRC. The Symposium brought together more than a hundred specialists from actual and potential telematics user organizations, service providers, telecommunication operators, and concerned government agencies as well as representatives of about 20 regional, international and bilateral agencies active in cooperation in this field in Africa. It formulated a number of national and regional strategies which were endorsed in May 1995 by the ECA Conference of Ministers responsible for Economic and Social Development and Planning. The Symposium will serve as a model for similar symposia planned for the Arab States and Latin America and the Caribbean in 1996 and 1997 respectively.

Following the Ministers' recommendations, UNECA, with the collaboration and support of the other sponsors of the Symposium, established a High-Level Working Group on Information and Communication Technologies in Africa which prepared a regional action framework called the African Information Society Initiative (AISI) which was approved by the ECA Conference of Ministers meeting in May 1996. At. the international level, planning and fund-raising are underway for a $ 11.5 million programme entitled "Harnessing Information Technology for Development" - led by UNECA, the World Bank, UNESCO, the ITU and UNCTAD - to help "kickstart" the AISI as part of the UN System-wide Special Initiative on Africa.

A series of UNESCO-ITU pilot projects on Educational Application of Interactive Television is being implemented in India, Mexico and Morocco. These joint projects are designed to test whether this technology can be affordable and appropriate for educational applications in developing countries, and to provide feedback to the ITU standardization process in this area.

The needs of the international scientific community concerning information highways were discussed at the first meeting of the International Advisory Council on Global Scientific Communications - ACOSC (September 1995) and the ICSU-UNESCO Conference of Experts on Electronic Publishing in Science (February 1996) which recommended that UNESCO contribute to the elaboration of a code of conduct for electronic, scholarly scientific publishing and to pilot projects for the establishment of electronic journals in developing countries. The. Physics Action Council (PAC) organized with UNESCO support network training programmes in Ukraine and the Russian Federation, as well as several regional if network strategy consultations for scientists. Networking cooperation is also underway in the area of environment, particularly within the Intergovernmental Oceanographic Commission and the Man and the Biosphere Programme.

A training course on use of the Internet by journalists was organized with UNESCO support at the Symposium on Information Superhighways: What Strategy for Africa? (Dakar, December 1995). Collaboration is underway with the Panafrican News Agency (PANA) in the development of its African Network for Integration and Development (RAPIDE) which will build on cooperation among public and private media and information services in the region to provide news, market data and legal, administrative and cultural information through the Internet in order to promote investment, commerce and development.

In March 1996, an International UNESCO symposium on communication and copyright in the Information Society was organized in cooperation with the Spanish government in Madrid. The creation, dissemination and use of electronic works, with particular attention to the challenges of ensuring access by the public to such works while protecting the moral and economic rights of their creators and producers were discussed. Dialogue and cooperation between legal specialists and information technologists, and also between users and right holders, were seen as important in meeting these challenges. As a follow-up, a series of regional expert meetings will develop practical recommendations on intellectual property rights and on the organization of cultural industries at the national level.

In May 1996, South Africa hosted the Information Society and Development Conference (ISAD) designed as the continuation of the consultation process within the G-7 group with a view to including in this process the developing world. It was recognized that technological infrastructure was the starting point for the building of the Information Society but, in the long run, content and appropriate use of IT were more important. While the private sector should be the main driving force in the construction of the global information infrastructure, end users and the civil society should not be passive recipients of technology but play a central role in the design of applications and infrastructures, so that the development of the information infrastructure is demand-driven and meets the real needs of society at large. In this context, all societal aspects of IT, including ethical and legal questions and the preservation of cultural diversity, were stressed. The participants also emphasised the role of international organizations in harmonizing various approaches at the regional and international levels. UNESCO actively participated in the conference and will be closely involved in its follow-up.

A project proposed for DANIDA and ITU financing envisages the establishment of pilot programmes in four African countries on mobilization and upgrading of information professionals and community library and information centres to provide multiple development-oriented services, making use of appropriate electronic technologies. In Asia and the Pacific, UNESCO's work on rural Community Learning and Resource Centres (CLARCs) will be extended to make appropriate use of information and communication technologies through pilot projects in several countries of the region. The basis for these activities was discussed at a seminar on the role of communities in the information society (South Africa, May 1996) organized with UNESCO support to coincide with the ISAD Conference.

UNESCO is organizing an International Symposium on Ethical, Legal and Societal Aspects of Access to Digital Information in Poitiers, France, in March 1997, in order to lay the basis for enhanced participation in the information revolution of libraries, archives and information centres, as well as of their users.

A world Forum on the Protection of Folklore, to be held in Phuket, Thailand, in April 1997 in conjunction with the World Intellectual Property Organization (WIPO), will consider the role of information and communication technologies in protecting and promoting intangible heritage for cultural development and intercultural exchange.

UNESCO is actively participating in the preparatory work for the diplomatic conference convened by WIPO in December 1996 to adapt intellectual property rights to the information age by adopting a new Protocol to the Berne Convention and possibly a new instrument to upgrade the protection of performers and phonogramme producers. Efforts have centred on preparing consensus on a balance between the interests of authors and producers, copyright owners and public interest, and copyright exporters and importers through participation in major specialized consultations such as that of the European Commission on Copyright and Related Rights on the Threshold of the 21th Century (June 1995) and the Intellectual Property Conference of the Americas (July 1996).

Regional coordination of training is being promoted in the Arab States and in Africa where UNESCO is working to promote the development of common curricula and international cooperative action for the training of planners and technical specialists in networking and application development, taking account of the roles of communication, information and informatics. Close operational links are being established in this context with other concerned international organizations. A Sub-Regional Arab Workshop organized in Cairo in March 1996 on "Designing and Building an Information Highway" is being followed up in training courses planned in Accra and Tunis in 1996 and in Bamako in early 1997.

Since we are in Russia, I am especially pleased to inform you of the launching this month of the STACCIS project (Support for Telematics Applications Cooperation with the Commonwealth of Independent States) in which our Russian counterparts are playing a central role. With more than $ 500,000 received from the Commission of the European Communities, STACCIS will promote, over a period of three years, regional development and East-West cooperation on telematics applications in the key areas of research, education and environment. Each European CIS country involved in the project will develop its own coordinating mechanism consisting of a principal focal body with responsibility for the overall development and promotion of telematics, and a coordinating committee ensuring the participation of specialized institutions in telematics applications.

Furthermore, an agreement has been reached to establish a UNESCO Chair in Informatics at the Moscow Institute of Electronic Engineering.

These regional and thematic international consultations and piloting are part of a worldwide cooperation framework which UNESCO is proposing to consolidate through a world conference on Information, Communication and Development to be held in 1998. This conference will focus particularly on the critical social, cultural, legal and ethical issues concerning development in the Information Society and will provide a forum for all concerned organizations in the search for international consensus. It will naturally involve consolidation and follow-up of the different initiatives which are addressing these issues, including the Second International Congress on Education and Informatics. More specifically, it will provide an opportunity to evaluate the pilot projects being implemented in various parts of the world under the auspices of international instances such as the United Nations system and the G7, and thus to further develop a framework and methodology for concerted international action.

To summarize, a broad framework for international cooperation in the area of information and communication technologies is already in place. UNESCO, like many other international organizations both within and outside the UN system, is very much aware of the challenges posed by the new information and communication technologies. It sees its mission essentially as an ethical one. It strives to make sure, through the widest possible dialogue, consensus-building and promotion of appropriate policies, that account is taken of the educational, scientific and cultural needs of all nations and individuals, thus promoting a genuine symbiosis of cultures based on mutual respect and enrichment.

However, and I would like to say this very clearly, all international efforts in this area can only hope to succeed if they are matched with commitment at the national level. This commitment must not be limited to simple declarations and expression of interest. It implies a serious and responsible re-examination and adjustment of national priorities and policies. Let me give you just one illustration. We often hear from some poorest countries that they have no financial resources to provide even basic education to their population, let alone access to information highways. That is true. But it is also true (and paradoxical !) that these same countries are often the most active arms buyers and, percentage-wise, spend more on arms than the most industrialized nations. That is why I would like to conclude with one very simple message: if we as a global community want to succeed in building a harmonious Information Society, let us, first of all, revise our priorities.

Thank you.

The original is presented in English

INTERNATIONAL COOPERATION IN OPEN AND DISTANCE LEARNING

Armando Rocha Trindade

INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION

One of the more interesting characteristics of modern societies relates to the increasing role played by information and communication technologies in everyday life; the pervasiveness of the media and the way common citizens can keep abreast of events, news and ideas produced elsewhere and everywhere in the world is an example of the previous statement.

This does not mean that we are involved in a process wherein all man - made physical reality will become immaterial or virtual; but just that most human activities require more and more incorporation of information, of essentially massless nature. Transporting people and material goods, farming, mining, manufacturing, building and food processing still require spending significant amount of energy to transport mass and to reshape or transform matter; individual services demand interpersonal, face-to-face contact, requiring displacement of individuals from one place to another.

Nevertheless, almost no human productive activity can survive without storing, processing and retrieving information. Consequently, there are many products and services which qualify under the general designation of "massless" (weightless) goods. This means they can be conceived, produced and delivered without neither physically or irreversibly transforming raw materials in any visible way nor actually transferring mass from one point to another.

Producing and broadcasting news; auditing or managing businesses; writing books, articles and theses; developing software; playing the stock exchange; doing banking operations; teaching and learning; developing theoretical research; producing many different forms of entertainment; discussing issues and taking decisions — are just so many examples of human activity that can mostly be done just by transferring data digitally between different places.

This is why the expression "Information Society" is becoming more and more frequently used to characterize either the present corpus of tendencies of social organisation or some unknown (and probably still unforseeable) steady-state of the developed societies of the future.

We shall concentrate, in this paper, on just one such recognized tendency: the absolute need to provide lifelong education and training for all citizens of the world, irrespective of the level of technological and economic development of the country they belong to. Professionals need to refresh, to refine or even to reconvert their qualifications in order to match the ever-changing needs of the employment markets; common citizens need to update their basic skills at exactly the same pace as technology keeps invading their day-to-day life. The fabric of society itself will be changing continuously in keeping with the onset of new societal organizations, new daily schedules, new relations between the individual and the community, new ways of using information and communications. Hence, citizens need to keep abreast of all these changes, so as not to drift away from the decision-making process and to maintain their full capacity of intervention in their own societies and in the world at large.

In this context, it is obvious that conventional education and training can not provide adequate responses to the growing needs of literally millions of users; nor traditional ways of learning will be compatible with current jobs, family obligations and distance between residence and school or training centre. Flexibility needs to be an intrinsic part of any type of continuing education, and this includes flexibility of time, of place and of learning contents, so as to fit the diversity of individual situations, needs and degrees of freedom.

Open and distance learning methods have been used for decades to face this problem. From the beginning of the 70's, many educational systems began operating all over the world using this methodology; their basic principle of operation deriving from the postulate that all individuals are able to learn by themselves (if properly motivated), provided the appropriate learning materials are made available to them and a minimum amount of interaction exists between the teaching systems and its users.

All forms of communications are, of course, relevant for the success of this learning regime: mail, telephone, fax, radio, television, audio and video recordings; e-mail, videoconferencing, computer conferencing; multimedia and all kinds of interactive materials. However, the conventional printed word on paper continues to be an essential element for efficient learning.

It is obvious that some kinds of skills and a number of subject matters can not be taught just to an isolated user, studying at home, even if linked to the teaching system by the most sophisticated telecommunications network. In same cases, experimental work can be computer-simulated (as virtual or "dry" laboratories). However, many other kinds of skills can not, or should not, drift away from the actual handling, touching or manipulating reality itself; the same applies to learning abilities of intrinsic interpersonal nature, like the ones required in medicine, psychology and some social sciences. The way out of the dilemma is to mix the distance-learning mode with the necessary amount of presencial activities, even if the pragmatic nature of distance education recommends these activities to be concentrated within a limited period of time, so as to reduce this amount of rigidity within an essentially flexible regime.

Distance teaching systems can be planned and installed as dedicated institutions, wherein the main regime of operation is based on the distance learning rationale. The more complete ones display all the functionalities necessary for this regime: developing curricula and designing learning strategies; authoring books and other subject documents; producing and distributing or broadcasting learning materials (from written, audio and video ones, to multimedia); selecting and enrolling students; providing them with appropriate mechanisms of scientific, pedagogic and administrative support: assessing knowledge acquisition and performance of students; providing academic or professional accreditation; monitoring and evaluating the operation, quality and productivity of the whole system.

A pragmatic approach to the same kind of *single-mode institutions* may mean the sacrifice of some of the above functionalities: using learning materials designed and produced elsewhere; giving the power of assessment and accreditation to another institution; in the extreme, just being the provider of learning materials produced by someone else, to the marketplace. Excluding this last case (whereby the organization can no longer be considered as an educational institution), the corresponding savings may have some disadvantages. In most cases, learning materials include cultural references (or culture-determined styles of approach) specific to the origin of their design and contents, which may clash if transferred to another cultural context, thus making it necessary a sometimes very expensive reconfiguration or adaptation. The same reasoning applies to giving the power of assessment to an external entity, which may have criteria of proficiency divergent from the teaching institution.

A different kind of approach to the organization of a distance learning cooperation has been followed, with increasing frequency, by formerly conventional educational institutions which recognize the need to provide learning to extra-mural students prevented, for some personal reason, to attend classes. By introducing a distance learning opportunity just for these students, the institution becomes a *dual-mode system*.

This option have been adopted by a growing number of conventional universities in different parts of the world, as a way to solve the dilemma created by the conflicting tendencies of the increase of demand by large contingents of prospective students and the one of shrinking operation budgets in higher education.

A more comprehensive approach to solve the same difficulties, while probably increasing the quality of teaching, would be to adopt a *mixed-mode* model of operation. Within a given institution, some subjects would be taught in the conventional, classroom way, while other ones, not requiring experimental and laboratory work, nor a significant amount of face-to-face interaction, would be dealt with in a pure distance learning mode, this solution applying to all the students within the organization. Some experiments in this particular field, involving a network of higher education institutions within the same country, are under way.

Even if a mixed-mode model of operation is not formally adopted, institutional cooperation between distance teaching systems and conventional ones, belonging to the same linguistic and cultural area, is always extremely fruitful. This cooperation is a must for single-mode institutions, so that experimental work can be made accessible to their students within conventional universities; these ones can benefit from high-quality learning materials produced by a distance learning system, to be used by their own students; cooperation in scientific and methodological research benefit both parties; interchange of academic staff will be both motivating for the individuals and profitable for all the institutions involved.

The Distance Learning approach has been used successfully in vocational training, either at the initial stage or as continuing, lifelong training. When applied to the workforce of a given enterprise it frequently takes the shape of in service training, learning activities being supported by an Open Learning Resource Centre located within the physical environment of the company. This kind of training facility usually includes a multimedia library, workstations for accessing learning materials and a number of rooms where face to face sessions can take place, led by qualified trainers. Learning activities may be formally organized at fixed times or be left to the initiative of the trainees, according to internal rules; the mixed mode strategy, combining presencial sessions with the self-learning approach, is most frequently used.

Training agencies, both public and private, provide this some kind of services to enterprises which small or medium dimension and their lack of qualified trainers prevent them to install and to sustain a permanent training facility.

Even taking into account the diversity of organizations and institutions providing open and distance learning services and products, both for education and training, in many countries, we are still . far from having a strucutured market in this field. The offer of these services and products is mostly spontaneous, rather then oriented and determined by the demand; from the latter side of the market, experience has shown that. users seldom know how to characterize their exact needs and objectives. Finally, quality of products offered and of services to be rendered is difficult to evaluate for lack of clear and complete specifications; consumer protection is, in most environments, virtually inexistent.

The significant price of ODL education and training services, when provided by private operators, make them too expensive for the current individual end-user. The fact that continuing education has not yet been recognized as an individual and social right prevents the underprivileged categories of users to access its benefits on a permanent basis.

Given the ongoing expansion of ODL systems everywhere in the world, as well as the effect of local and regional alliances currently taking place in order to share the cost of development of new products and to multiply the number of their prospective users, there is some hope that economies of scale cause the corresponding prices to drop in a significant way. This will stimulate the demand, both from enterprises and from individuals, thus furthering the tendency for decreasing the price of these services.

We can understand the structure of costs of a comprehensive ODL system by analyzing the different functionalities it is supposed to assure. Contrary to conventional teaching systems which can be considered as manpower-intensive, distance learning systems are organized as a capital-intensive organizations, requiring powerful technical infrastructures. The logistic and administrative component must be powerful and efficient enough to deal with tens of thousands of students scattered in many different places, possibly very far from the physical centre of the system, and to be able to cope with their needs using a *just in time* approach. Careful planning is obviously the key for success in this operation.

The concept of self-learning is based on the availability of quality learning products, in written and multimedia format; their production is a lengthy process which needs to be finely tuned to the ever increasing pace of technological innovation, of the evolution of standards and of the trends concerning the private possession of communication facilities, to be used by the current students.

In terms of human resources, apart from those operating these infrastructures, the teaching staff splits into two different functionalities, high level specialists of contents, as well as in educational strategies, are needed for authoring the learning products; the tutoring function has to be assured, so that a minimum of student support, educational dialogue and interactivity complements the self-learning process, either in a face-to-face or in a distance communication mode.

Due to the number and specificity of these functionalities as well as to the number of students benefiting from them, ODL systems are complex structures of significant dimension. It is only reasonable that they are designed to serve different purposes and vocations, providing many different streams of education and training, according to the nature of their users. Besides individuals, who enrol in courses and programmes on their own initiative, institutional users, both in the private and in the public sector, are frequently clients of Open and Distance Learning Systems.

Experience gained in international interchange among these systems has shown that public administrations all over the world have been using extensively this kind of facilities for in-service training of civil servants in priority areas like education, health, armed forces and local administration; teacher training and training of trainers are the most common first sectors to be addressed.

In the private sector, we recognise that institutional clients of large dimension use extensively open learning techniques to provide recurrent training to their workforce, covering a large spectrum of qualifications. This makes good sense, for they may have a large number of operating sites across a territory and ODL provides opportunities for significant reduction of the displacement of qualified trainers from one point to another. The argument is even stronger when the company operates at a transnational basis.

Small and Medium Enterprises can not usually afford the creation of their own training centres; they may even lack the know-how needed for a precise specification of their training needs. On the other hand, they are extremely vulnerable to losing competitivity by technological or methodological obsolescence. Besides needing to re-train their operating staff regularly, it is usual they require updating of qualifications of their top and medium level directors and executives in terms of improving organisation, modernising commercial procedures and marketing, introducing information and communication technologies in their whole operation.

The poor structuration of the ODL market of products and services makes it difficult for offer and demand, not only to match, but even to be accurately known by both sides. This means that, besides good and credible providers of these services, others may exist in the field which do not feet minimum requirements of quality; consumer protection mechanisms are also at an incipient stage. This is the reason why governments have given a high degree of priority to stimulating and supporting continues training activities in SME's, frequently through the intervention of national training agencies.

On the other hand, in what respects individual users of distance education and training many countries have created a national ODL system in the public sector, so that either costs to the user are kept at a mostly symbolic level or appropriate financial support is provided by the State, under the shape of scholarships or student loans. In the industrialised countries, given the usually adequate network of formal education institutions, covering the needs of the classes of age from childhood to the young adults, distance education systems are mostly addressed to providing second-chance studies for the adult population, sometimes as part-time students. Adult and Community Education are other streams of operation for these systems, as well as initial and continuing vocational training; central governments or local authorities frequently take the initiative and provide financial support to these learning activities.

The situation is rather different in the most disfavoured regions of the world, on to accounts. First there may be a serious deficit in technological infrastructures, like communication networks, computer systems, even energy distribution; second, the number and distribution of conventional formal education institutions may be clearly insufficient to cover the basic needs in this field. An appropriate answer to these difficulties is to try to boost teacher training to the highest possible level, using distance education techniques and the very conventional media; another one is to develop teleschool systems, defined as conventional classes supported by radio and/or television, more addressed to support the teacher than to teach the learners.

International co-operation is of paramount importance to pool experiences, to reduce costs, to create synergies and economies of scale. While being careful about the transfer of learning materials from the geographical, social and cultural context where they belong, to a very different one (and this requires a significant effort of conversion and adaptation of these materials, in order to perform their cultural re-contextualisation), exchange between national distance education systems is made easier when they belong to linguistic and cultural regions presenting some degree of affinity, regardless of geographical distances.

The recognition of this fact has led to the creation of many different associations linking distance education systems across their national borders. They may have been driven by the use of a common language, by their geographical or political proximity, their social and economic strategies. We have found that ODL transnational associations frequently follow the common interest strategic alliances between countries.

At the global level, the International Council for Distance Education, ICDE, is the federative organisation of most existing ODL systems, represented in 109 countries in all the continents. It is a non-governmental organisation, recognised by the UNESCO as a category A NGO, governed by an Executive Committee including a President, Vice-Presidents representing the various regions of the world and a permanent Secretariat General set in Oslo, Norway. The very recent explosion of ICDE membership, now including educational and training governmental authorities from many countries, as well as powerful international corporations operating in the field of Information and Communication Technologies, has led to the setting up (still on its way of expanding) of a network of regional branches of the Secretariat General, in different continents.

A change in the ICDE Constitution, aimed at increasing and improving the representation of the different regions of the world, not only in geographical but also in linguistic and cultural terms, is now under way. Other new provisions have been introduced to increase the intervention capacity of the ICDE in the international scene, to improve the support given to regional and national associations and to the institutions themselves.

We believe that a clear change in the educational paradigm is nowadays occurring, whereby the autonomy and the initiative of the individual student is being given more recognition and an increased amount of self-learning materials tends to be mixed, in appropriate amounts, with conventional classroom teaching. In organisational terms, this means that a convergence between presence teaching institutions and their distance learning counterparts is also taking place, leading to a subtle change in the role of teachers: instead of being the source of all knowledge, they will become more and more the catalyst of the learning process, working together with their students in the search for a better understanding of fact, phenomenon, environment, society, science and technology, human creativity and human values and references.

The ICDE is giving its own contribution to the analysis of the paradigm shift, through one of the permanent working groups it has constituted for this purpose. With this and many other initiatives under way, in collaboration with national authorities, transnational organisations and international agencies, we intend, as a global even if ambitious aim, to improve, to democratise and to reinforce education and training opportunities all over the world.

The original is presented in English

Commission I

WHAT IS IFIP AND WHAT DOES IFIP DO?

Peter Bollerslev

CHARMAN OF IFIP TC-3 (DENMARK)

I have been asked to give a presentation explaining what IFIP is and how the organisation operates.
I am very thankful that I have been given this opportunity.
I will in my presentation especially focus on the relations to Education.

WHAT IF IFIP?

IFIP, the International Federation for Information Processing is a multinational federation of professional and technical organisations concerned with information processing.

IFIP came into existence in 1960. It was established to meet a need identified at the first International Conference on Information Processing which was held in Paris in 1959, under the sponsorship of UNESCO.

The official relationship with UNESCO is classified as category B, which means, that we are "able to advise in a particular field". In practice this has been carried out through a number of UNESCO contracts, including one on setting up a curriculum in computer science for developing countries.

IFIP has also established official relations with the World Health Organisation, and we have the status of a Scientific Affiliate of the International Council of Scientific Unions, ICSU.

STRUCTURE AND AIMS

From each country, only one organisation can be admitted as a Full Member of IFIP. A typical member is a national computer or information science society. At this moment nearly 60 countries are represented in IFIP.The aims of IFIP are to promote information science and technology by:

- fostering international co-operation in the field of information processing;
- stimulating research, development and the application of information processing in science and human activity;
- furthering the dissemination and exchange of information about the subject;
- encouraging education in information processing.

To fulfill these aims IFIP has set. up a number of so-called Technical Committees (TC's). Each TC is composed of representatives of IFIP Member organisations.

Each TC supervises a number of Working Groups (WG's), which deal with specialised aspects of the field of their parent TC.

Working Groups consist of specialists who are individually appointed by their peers independent of nationality.

TECHNICAL COMMITTEE 3

The Technical Committee number 3 is the Committee on Education.

The active WG's under TC3 are:

- WG 3.1 Informatics Education at the Secondary Education Level
- WG 3.2 Informatics Education at the University Level
- WG 3.3 Research on Educational Applications of Information Technologies
- WG 3.4 IT - Professional and Vocational Education in Information Technology
- WG 3.5 Informatics in Elementary Education
- WG 3.6 Distance Education.

As it is the case with the TC-members, the members of a working group do the work on a voluntary basis. Very often their participation in IFIP activities is subsidised by their work place or by their national computer society.

TYPES OF ACTIVITIES

The working groups arrange different types of activities as for instance:

they may

- give input to TC3 conferences;
- give input to IFIP Congresses;
- produce booklets;
- give consultancy, often in co-operation with UNESCO;
- organise run workshops and working conferences.

At the working conferences they try to fulfill the purpose of an IFIP working conference, which is:

- to discuss in depth a specific subject;
- to convene people working on this subject so that they can benefit from the personal contact and expand their knowledge of the subject;
- to disseminate the collected information and the results of the discussions to the field by means of the proceedings volume;
- to support the activities of the WG.

THE HISTORY OF TC3 AND ITS WG 3.1

Soon after the invention of the computer, it became apparent that computers could not only be used for mathematical calculations, but that they could also be used for various purposes in information processing, that a wide range of people had to learn how to use them and that there was a need to disseminate information about their use. Therefore, to support and coordinate national and international activities in developing curricula and producing education material, IFIP's Technical Committee on Education, TC-3 was established in 1963.

Computer science/Informatics developed rapidly, with its own theoretical foundations, its principles, methods, techniques, and ever broadening spectrum of applications. Moreover, it offered new tools, new ways of working and new kinds of thinking to other disciplines and thus became a basic science with a fundamental character similar to that of mathematics, physics and chemistry. Anticipating this trend, TC-3 started discussing the question of teaching informatics in schools very early in this process.

WG 3.1 Informatics Education at the Secondary Education Level was the first working group and one of its main concerns was teacher education.

WG 3.1 has arranged several working conferences during its 30 years of existence. I can mention some of them to you:

- Informatics and Mathematics
- Microcomputers in Secondary Education
- Informatics and Elementary Education
- The Computer in the Home
- Informatics and the Teaching of Mathematics
- Educational Software
- Informatics and Changes in Learning
- Integrating Information Technology into Education,

and this summer a working conference will be held in Israel on Information Technology: Supporting Change Through Teacher Education. In 1997 WG 3.1 will arrange two working conferences:

- Secondary School Mathematics in the World of Communication Technology: Learning, Teaching and the Curriculum;
- Capacity Building for Information Technologies in Education in Developing Countries.

BOOKLETS

The main concerns of working group 3.1 have always been the impact of informatics on education. This started already in the late 60'es when members of the WG published a series of booklets on the theme of computer education for teachers in secondary schools.

The titles were:

- An Outline Guide to Computing Concepts
- Aims and Objectives in Teacher Training
- The Use of the Computer in Teaching and Learning
- Elements of Information and Information Processing
- Analysis and Algorithms.

These booklets had wide circulation within IFIP Member Organisations, and the WG joined with OECD, the Organisation for Economic Co-operation and Development to help formulate governmental policies.

The booklets are now 15–20 years old and ought to be outdated, but if you read parts of them today you will find to your surprise that their message is still of current interest.

I will leave it to you to decide what that means!

THE HISTORY OF TC3 AND THE OTHER WGS OF TC3

Soon it became clear that the area of information systems was a key component of this discipline. To satisfy the demand for training in this area WG 3.2 was established under the name "Organization of Educational Seminars". An early project undertaken by WG 3.2 was the development of a model curriculum on information system design education. Because of the relevance of informatics to many other disciplines, the scope of WG 3.2 was enlarged and the title changed to "Advanced Curriculum Projects in Information Processing" and later to its current form "Informatics Education at the University Level". Emphasis was placed on developing curricula for Computer Science/Informatics programs. Care was taken to construct a modular curriculum that could serve countries with a wide range of human and computer resources.

The emerging awareness of the impact informatics had on our lives, and the increasing availability of computers, together with new educational theories stimulated the development of many computer-based tools for teaching. There was even speculation (unwarranted!) that teachers could be replaced by computers. During this period TC-3 chartered WG 3.3 "Instructional Use of Computers". During the following years it became clear that several of the activities of this Working Group fit into the specific framework of the other working groups of TC-3. The WG was therefore re-established with the title "Research on Educational Applications of Information Technologies" which better reflected what was needed internationally.

As the number and the size of computer centres grew rapidly, programming and operating computers was no longer restricted to a small number of educated people. It had become necessary to support computer education at the post-secondary and vocational training level. Thus WG 3.4 on "Post-Secondary Education and Vocational Training" was formed to meet this need. The WG title was changed to "IT - Professional and Vocational Education in Information Technology" in 1995.

The advent of microcomputers posed new educational challenges. Computers became part of daily life and even children began using them. In order to avoid misuse because of lack of guidance, and to give all children the opportunity to learn how to play and work with computers in a sensible way, WG 3.5 on "Informatics in Elementary Education" was founded. This working group focused on developing curricula and organizing workshops to assist elementary school teachers to use computers more effectively in the classroom.

Almost everybody had to become computer literate: Mass education was needed. The new communication technologies on the other hand made mass education possible via teleteaching, distance learning, or remote education. The world-wide interest in this new form of teaching has led to the formation of the newest working group, WG 3.6 on "Distance Education".

CONFERENCES AND PUBLICATIONS

In the past, TC3 has tried to be at the forefront in detecting new trends and new demands and to convert insights into appropriate action. One of the main activities of TC3 and its Working Groups has been organizing seminars, conferences and workshops and publishing the results. TC3 has successfully organized its own series of World Conferences on Computers in Education (WCCE)

- Amsterdam, 1970
- Marseille, 1975
- Lausanne,1981
- Norfolk (Virginia), 1985
- Sydney, 1990
- Birmingham, 1995.

The next WCCE will be held in 2001 in Copenhagen.

Let me here try to give you an impression of what is an IFIP World Conference in Education. I will show some video-shots from the previous conferences which was held in Birmingham, UK in 1995. You will see in glimps how such a conference contains large plenary presentations, small discussion groups as well as interaction with pupils, often organised in untraditional ways. *(Video show to be shown).*

I mentioned earlier the many proceedings from working conferences and the booklets and guidelines produced for OECD.

A number of reports have also been produced in cooperation with UNESCO. According to UNESCO two of their all-time "best-sellers" (actually given away for free!) have been, "A Modular Curriculum in Computer Science" (1984, with an updated version in 1994) and "Informatics for Secondary Education - A Curriculum for Schools". The latter curriculum has been translated into French, Spanish, Chinese, Polish, Russian, Japanese and Indonesian.

At present some of the WG's are producing other publications; some are for sale, others are free. Among the latter is a series of "Guidelines for Good Practice" covering up to five titles: "Informatics Education in Secondary Schools", "Integration of Information Technology into Secondary Education", "Telecommunication in Education" and "Integrating Social and Ethical Issues of Informatics into Secondary Education" (in preparation) and finally also in preparation "Guidelines on Informatics in Teacher Education". The working group on secondary education is the initiator of this series.

The working group on elementary education has produced and published a book with the title "Computers in Education: Pedagogical and Psychological Implications". The book consists of essays on the issue, mostly papers written by working group members. Under preparation is another title:
"Improved Information Technology Environments Through Teacher and School Development".

TC3 has also supported the publication of a book on "Success Stories". This publication was the result of a competition among teachers from all over the world. The prize winners were announced at WCCE '95.

FUTURE

What is the future of IFIP TC-3? And where do we go? The establishment of new Working Groups as described earlier shows that the committee is committed to meeting new challenges. We continually follow new developments in the field. A new WG on "Information Technology in Educational Management" is soon to be established.

We will try to strengthen our links with UNESCO in order to help bridge the gap, and we will try to work more closely with computer educators in less-developed countries. Through the auspices of UNESCO we plan to continue disseminating the results of our work to colleagues in developing countries. In addition, we plan to organize, in collaboration with local colleagues, activities and events in developing countries.

We have just launched a new journal "Education and Information Technologies". This journal should be of interest to both experienced professionals as well as those relatively new to information technology. It will be truly international, and it is intended for teachers and trainers, informatics specialists, policy makers, curriculum designers, vendors, vocational trainers and academics at all levels from elementary and primary to secondary to tertiary and vocational education. TC3 members will form the core of the editorial group.

The general trend in most countries is to integrate informatics into existing traditional subjects which are taught in school. The work in TC-3 reflects this trend, and as a consequence we also expect National Informatics Societies to engage more in matters concerning general public education in the future. Along the same lines we will try to attract more members dealing with computer education and the integration of information technology into education into the WG's of TC3.

We are trying to address the "gender issue". There is an imbalance in the membership of the WGs and also in the TC itself. Finally our goal is to make the Committee and its WG's more truly international by actively seeking members from developing countries in all parts of the World.

In TC3 we are also starting to look at Special Education. A high percentage of the populations all over the world has a special learning need. Whether it is a physical or a mental handicap, Information Technology can often enable these learners to participate in ways that were not possible before.

CONCLUSION

Let me finish by mentioning a major concern.

Technology advances rapidly and curricula are normally very slow to change. We should however remember that the use of information technology in education can be the best and the worst thing in the world. It is not so that education will automatically become better because of technology. That's wrong. A bad teacher using technology is still a bad teacher - indeed his or her lack of qualifications may even be amplified. But the proper use of technology can be of tremendous help in education and training - and this in return implies a tremendous effort in the education and training of teachers for elementary as well as secondary and vocational education. I will therefore stress that the issue of education and training of teachers and trainers ought to be very much in focus in the discussions and considerations as well as in our work with bridging the technology gap.

TC3 will continue to play a critical role in producing and disseminating information concerning the best integration of teaching practice with learning strategies by use of technology. Informatics continues to be a rapidly growing discipline which will produce many innovations important to education - either as knowledge to be learned or as tools to be used. An increasing number of people all over the World, children and adults - need education about informatics and its uses. Challenges for IFIP TC3 are greater than ever!

The original is presented in English

THE IMPACT OF NEW TECHNOLOGIES IN THE SCHOOLS OF EUROPE AND THE G7 NATIONS

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ABSTRACT

The author has been involved with a variety of pan-European research projects seeking to establish the 'state of the art' of educational computing and communications in schools. The findings are rather disturbing. This paper, based on a considerable amount of data collected from over 20 nations, mainly in Europe, seeks to highlight issues concerning the information technology curriculum in schools, national policies towards IT, student access to IT, multimedia, electronic mail and on-line information service provision. The data suggests that many nations are not treating IT in schools as a priority and are very much 'out of step' with IT policy makers in the European Commission. The paper concludes with a suggestion for a much improved partnership in this field between the EU and its constituent nations.

PREAMBLE

In the past few years there have been an increasing number of pan-European programmes that have seemingly focused on Informatics and Learning. The latest of these is the European Commission DG XIII's Telematics Applications Programme which is funding 23 Projects (with 9 on the reserve list) in the Telematics for Education and Training sector. Many of the key actors in the programmes are IT specialists from Universities, non-governmental organisations, research institutes etc. and, no doubt, they all have good intentions towards the various projects with which they are involved. There is real concern that the pan-European approach to improving teaching and learning through the use of informatics, telematics, information technology, computers and communications technology - call it what you will - is supported (or otherwise) by very shaky foundations in the various nations of Europe. The great majority of the member nations of the European Union have tittle in the way of policy towards new technologies in Education and few of them back any kind of strategy with real resources and a realistic teacher training programme. The evidence is that the school Information Technology provision across Europe lacks vision, is certainly under-resourced and is extremely unevenly delivered.

THE REALITIES

Over the last year, a substantial amount of data about IT in schools throughout Europe has been collected, some quantitative and some qualitative [1], [2], [3]. This was in itself a difficult task as a considerable number of Ministries, national and provincial, do not have any meaningful data about IT in their schools. Arguments against collecting data range from *'everything is moving too rapidly* to *'we don't see a need'*. On the one hand we have EU Commissioners and the G7 summit talking about the IT Revolution and on the other, major European nations unable to monitor any changes in teaching and learning that is taking place in their schools.

THE CURRICULUM

If we think of the curriculum as what happens in classrooms in schools ie what is taught and what is learned together with the 'how' - then there are as many variations on the theme as there are members of the EU. In fact more, since a number of nations eg Germany and the United Kingdom, have 14 lander and 4 provinces respectively, each with considerable autonomy on the curriculum. Even with centrally prescribed curricula, local authorities can add regional flavour, schools work with the community and teachers add their own characteristics to classroom practice. Mother tongue apart, a child's curriculum in inner city Athens may be unrecognisable to a child of the same age in a Lapp school in Northern Finland.

INFORMATION TECHNOLOGY IN THE CURRICULUM

Very few nations prescribe any kind of IT in the elementary or primary school phase. Only Belgium, Finland, Denmark, The Netherlands, Sweden and the United Kingdom offer positive IT curriculum support for children below the age of 11. Some parts of Germany are revising curricula to include IT. Britain and Denmark are alone in offering every primary age child an IT curriculum entitlement. If we look at the figures for computers in the elementary schools, we can see from Table 1 that many countries could not offer much in the way of practical IT to primary school children, given the very limited resources available.

The story in the secondary or high school phase is somewhat different, but there are a number of nations, including Austria, parts of Germany, Greece, Italy and Switzerland that have no provision in their curricula for students to gain experience in the use and application of IT. Portugal can only claim to have an average of 4 machines per secondary school - giving, students less than 10 minutes access time per week.

When we search for a commitment to use IT across the curriculum for example in support of the teaching and learning of science or mathematics, we see very little of substance. Denmark and the UK are the only two nations to support initiatives in this area with both written and software resources. It is the case that National Curricula take a long time in the changing. A number of ministries claim to be in the process of revising their Curriculum to include IT but, no doubt, shy away from too much clarity on a student's IT entitlement because of the resource implications.

Table 1

Mean number of micros per school (end of 1994)	Elementary	Secondary
Austria	1.3	15.0
Belgium	5.0	25.0
Denmark	25.0	50.0
England	9.9	85.1
Finland	3.1	10.3
France	1.0	31.0
Germany	2.1	13.0
Greece	0.0	3.6
Italy	3.0	2.9
Northern Ireland	12.0	90.0
Norway	3.2	42.0
Portugal	1.5	4.0
Ireland (Republic)	3.6	12.0
Russia	N/A	*4.8
Scotland	7.0	40.0
Spain	3.2	22.0
Sweden	6.0	55.0
Switzerland	2.0	10.0
The Netherlands	5.3	26.0
Wales	7.0	75.0

* – mean for all schools

NATIONAL POLICIES FOR IT IN SCHOOLS

In any innovative process in education, it is important for the main actors in the process, namely the teachers, the principals, the educational advisers and administrators, to have a clear set of goals over and above the curriculum. It is very rare indeed to find a clear policy on IT in schools. Even in the UK, which has an IT curriculum entitlement for children aged 5 - 16, there is no governmental policy, suggesting for example, that all teachers should aim to have an IT capability demonstrable by the year 2000. The National Association of Advisers for Computers in Education (representative of England, Wales and Northern Ireland) has published a set of Aims for IT in education, namely:

All pupils should develop a capability with IT which enables them to:

make effective use of IT to manage and support the learning process;

choose IT effectively and use IT appropriately to improve learning outcomes;

assess the social effects and implications of IT.

NAACE has also published 10 Objectives for IT in education - one of which is ***"All teachers are capable of using IT resources and applying them effectively".*** The document has yet to become Government policy.

Student's Access to Computers In Schools

There is a very considerable disparity in student's access to IT across Europe, between nations, within nations, between the rich and the poor, between the inner cities and the remote communities and between the genders. Some children have better access to IT in their homes than they do in their schools. Others rely entirely on the school for any access at all. It is impossible to quantify the numbers, but we know many students have no access to IT at all. We are not talking about remote parts of Africa, we are talking about Western Europe.

It is noted, of course, that schools vary in size from 3 pupils in a remote island primary school to over 2000 students in a city high school.

Technological Development

Studies show [2] that many countries in Europe have not kept pace with the technology. Within the G7 nations (Canada, France, Germany, Italy, Japan, United Kingdom and the USA) it is noticed that the nations that pioneered the use of computers in secondary education (and later primary) are more likely to have a greater proportion of obsolete equipment. These are Canada, France, UK and USA. It is very interesting to note that Japan, and to some extent Germany and Italy, have a more up-to-date, and more powerful, installed base.

Moreover we see that there is almost a 'de facto' standard developing in Europe for an educational operating system or environment. Over 85 % of new machines going into schools offer Windows and/or DOS, the remainder being Apple Macintosh or the RISC OS from the British Acorn company. When we look at the installed base, the picture is very different. In France, for example, we find around 40 % of micros in Primary schools being described as pre MS-DOS, with 20 % similarly in Secondary schools. The 1994 Centres de Documentation Pedagogique national catalogue, published in Paris, lists 31 Thomson Nanoréseau packages, 81 MS-DOS, 2 MS-Windows, 1 CD-ROM and 2 Videodisks - demonstrating the lack of investment in software to support the newer technologies. There is not room in this paper to explore the fragmented educational software market in Europe. Suffice it to say that the range and depth of educational software available in any particular country say a lot about how seriously the use of IT is taken by the educational decision makers. It is recognised world-wide that market forces alone will not provide sufficient software to satisfy the needs of the new curricula.

Multimedia in Schools

Data collected at the end of 1995 shows that the penetration of multimedia systems into schools has been slow in a number of countries. The figures in Table 2 show approximate percentages of all schools in a sample of countries, with one or more multimedia systems [3].

Table 2

Country	Primary	Lower Secondary	Upper Secondary
Austria	very few	few	50%
Belgium	100%	*15%	
France	10%	*33%	
Germany	2%	*10%	
Hungary	very few	*few	
Irish Republic	15%	*23%	
Italy	0%	10%	35%
Spain	2%	10%	27%
Switzerland	N/A	-13%	

* - Lower and Upper Secondary combined

We may be witnessing the classical 'chicken and egg' syndrome with multimedia. Schools will not purchase systems until there are more CD-ROMs in the appropriate mother tongue available. Publishers will not invest in software until there are more systems in the schools (and homes?). In the meantime, international publishers like Dorling Kindersley and Microsoft are producing CD-ROMs in the English language and flooding the market places of Europe.

Student's Access to Electronic Mail and on-line Services in Schools

In general, most students, in schools do not have individual access to either electronic mail or other online services such as the World Wide Web. If a school does have a subscription to the Internet, it is very unlikely that all the students will have even limited access without considerable mediation by teachers or school librarians. A very few schools have ISDN connections, thus allowing some simultaneous access, perhaps via a local area network. In practice, the management of schools access to global networks is still on the drawing board and we are witnessing a divisive technology which favours those with access via the home to those with extremely limited or no access at all in the school.

The Professional Development of Teachers and Teacher Confidence with IT

Perhaps the most startling revelation in the G7 research [2] was the lack of support given to teachers' IT development and the low levels of confidence in using IT. The two tables below [2] show comparisons between the European G7 nations and the other three Canada, Japan and the US.

Table3

Teachers' Professional Development (percentages)

	Primary			Secondary		
	Awareness	Short IT Course	Accredited IT Course	Awareness	Short IT Course	Accredited IT Course
Canada	*80	50	30	*80	50	30
France	*80	30	*10	*80	30	20
Germany	*10	*5	0	50	50	*5
Italy	0.	0	0	*25	^5	*10
Japan	24	16	1	43	16	3
UK	91	69	2	83	51	*3
USA	50	50	*5	50	50	*8

* estimate

Table 4

Teacher Confidence (percentages)

	IT Teachers	Subject Teachers	
	Secondary	*Primary*	*Secondary*
Canada	many	50	very few
France	many	few	few
Germany	60	few	50
Italy	few	none	few
Japan	42	8	18
UK	92	56	34
USA	high	low	low

The percentage of secondary school teachers that feel confident about using computers in support of their subject teaching is, in the majority of G7 nations, very low. Only German and British secondary teachers have shown any significant capability in this area. In the Primary sector, it is only in Canada and the UK that a notable proportion of teachers are confident of using IT with their pupils.

Even those teachers with responsibility for teaching computing, are not altogether confident with the subject. The UK is the most successful G7 nation in terms of equipping computing teachers for the job, with Italy and Japan trailing.

Schools without Computers

In the primary sector, 10 % of French, 95 % of German and 57 % of Italian schools are reported to have no computers at all. Of the G7 nations, Italy has around 38 % of its secondary schools yet to install even one computer.

Conclusion. We are witnessing the extraordinary phenomena of significant efforts in concertation from the European Commission in Brussels and a great degree of disorder in the constituent nations. There are some standards emerging in terms of wide area networking, hardware and software environments but none on curriculum, teacher training or policy aims and objectives.

If the European Union is unilaterally to embrace Information Technology in its schools, it needs to consider a number of fundamental issues before investing in too many 'blue skies' initiatives that will disenfranchise even more European citizens of tomorrow. It could be argued that the limited resources of the European Commission should be spent in giving every student a minimum entitlement to IT in school. The constituent nations of the EU would need to be encouraged to commit national resources to attain that entitlement. Only then can Europe begin to involve all of its citizens in the information based society that is rapidly approaching.

References

[1] *The Computers in European Schools Report*, Inteco, Woking, UK, 1995.
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The original is presented in English

Commission II

EDUCATION AND NEW INFORMATION TECHNOLOGIES

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SCHOOL AND SOCIETY

Nowadays governments of all countries are faced with problems concerning the modernization of education systems, their adaptation to changing conditions and their efficiency. Despite of these systems variety, the problems are formulated almost identically - in the same categories and their solution influences learning programmes, contents and methods of education and all the range of means and methods of data transfer - from classical to the newest ones.

In other words, the world of education and professional training, the world of the *School* broadly speaking (from primary to higher school) should satisfy the requirements of the rapidly changing world community. The member countries of this community, their economy and culture exist according to the rules and are managed with the methods, that have nothing in common with the organization of modern educational systems, which, mainly transfer theoretical knowledge, not the knowledge one needs to live in modern social and economic environment. Moreover, now we know, that the knowledge, obtained after leaving school, cannot be regarded as «final».

The problem appears to be even more complicated, when we start to realize, that it is impossible to ensure that everybody learns even the basic skills in reading, writing, counting, social integration, and, quite recently, typing, the skill necessary in keeping up correspondence, getting access to knowledge and self-education.

In such situation it has become clear from the accumulated experience that the so-called information and communication technologies» could play a decisive role in increasing the School's efficiency and in adaptation of education strategies to the real needs of modern society.

All this is indicative of the fact that the world of education is on the verge of deep transformations -with regard for national peculiarities, the role of the family and associations, interests in industry and national interests, the presence and completeness of basic skills, social differences, globalization of economy and the freedom to move.

All this indicates that the transformation of the School, its tasks and the strategies how to solve them is inevitable. If this did not happen, the School in the forming social situation would be like a railway station, from which no trains depart, while passengers are continuously arriving and thronging the platforms.

All this indicates that we are to build the School which would be more flexible, adaptable to. the requirements of the rapidly developing society and to national peculiarities - a new School for a new society in a new millennium. This will be the «information society», many countries have already joined this society and obtained some advantages. This society will be unlike any other society of the past, and it will be based on the system of social and cultural values, methods and mechanisms of production and distribution, communication between people, between man and machines, between machines, that have no analogues in today's life.

NEW TASKS FACING THE SCHOOL IN THE AGE OF NEW INFORMATION TECHNOLOGIES

New tasks

Is there the need to define the School's tasks anew at the end of this millennium and to start a new big project in the sphere of education? The project can only be realized if new educational and communication technologies available and if leaders of countries and heads of international organizations will be far-sighted.

Why it is necessary to define the tasks of the School anew?

Because too many people do not feel how dangerous the present situation is, when the world of education is at the point of unstable balance, and this instability may be threatening for the foundations of society, because it is deeply rooted: first and foremost is insufficient adaptation of education system to the needs of society. This lack of understanding is often due to the pedagogical illiteracy of those who voice their opinion on educational problems through the mass media.

Recent research, numerous experiments and studies of society's main requirements to the specialists show, that the new School, which we are going to create, from the very beginning of a long-term education cycle (today many pupils cannot complete this cycle at all, or do so poorly) should ensure the acquisition of basic knowledge and skills, not only the knowledge of basic rules of social behavior, speaking, reading, writing, counting, reading comprehension and putting one's thoughts in writing - the skills which were necessary at all times and everywhere - but also skills, which have become necessary only recently, such as understanding of basic environmental problems, basic computer literacy, self-education skills and those needed in search for information, etc.

This basis is to be mastered, taking into account the peculiarities of every given country, to claim that a full course of education is completed.

Compulsory general schooling should teach pupils to learn, thus providing them with one of the most important skills which they will continue to use for the whole life (particularly, in one's career) because the School is unable to teach everything, and the knowledge acquired at school can easily become obsolete.

The survey conducted in 1995 by the Economic Society of Cooperation and Development (ESCD) revealed the illiteracy rate in developed countries, to be more exact the percentage of those unable to understand simple texts. First of all the results of the survey show significant and unexpected difference in these figures in different countries. Absolute values of the illiteracy index vary from 7.5% to 42%. They are shocking, puzzling and causing arguments among many specialists, passions run high, which is natural -high rates of near illiteracy can indicate the failure of education system.

But comparing this index of illiteracy/near illiteracy with the budget allocations for education per capita in investigated countries we can see, that *the amount of allocations cannot explain everything: the illiteracy/near illiteracy rates in two countries can be different, while the budget allocations are the same (or almost the same).* In other words, the efficiency of education system (and, therefore, a safe economic and social integration of the educated individual) does not entirely depend on financing: according to the figures in the ESCD study, the well-known formula «rooms, teachers, money» is not a panacea. Everybody knew about it or guessed it long ago, but it is important, that this guess-work was confirmed by statistics.

Therefore, the efficiency of education systems will depend not only on financing, but also on how we will be able to solve such problems as:

• Structures and methods of management which become outdated: these systems are inflexible, the programmes are behind the times, the projects are economically groundless, there is a considerable difference in the stages at which are pupils in one class, the teachers are confronted with great difficulties in their work etc.

• Negative influence of such factors as «diploma hunting» (the rush for the higher education at any cost), low prestige of manual labour, etc.

• Unwarranted centralized management which results in the projects not fit to be realized on the national scale.

• Insufficient information available to families, moreover - the whole society about the purposes and possibilities of education, while the general public has wrong views on the subject.

• Insufficient use (or no use at all) of information and communication technologies and pedagogical methods, connected with them.

• Insufficient competence of the executives and the authors of projects, their lack of knowledge of local situation'. It results in the fact that numerous commissions, that are to analyze, evaluate, carry out opinion polls, develop and discuss projects in the field of education in general, and in the field of information and communication technologies in particular, do not take into account the multitude of factors including the integration and mutual influence of the cultures worldwide.

UNESCO Congresses

The discussion about the problem of interaction of the School and information and telecommunication technologies[2] has been going on for about twenty years in all countries in which they are introduced and given serious attention.

For more than ten years now these countries have been realizing major projects, such as «Intormatics tor Everyone», which are to attain far-reaching plans and where the problems of education take an important part.

Seven years ago the First International Congress «Education and Informatics» organized by UNESCO took place in Paris in April 1989. UNESCO organized regularly and helped to hold other international congresses under the title «Introduction and Contribution of Information and Telecommunication Technologies in Education»[3].

The interest this United Nations organization gives to the subject shows what hopes mankind pins on the development of information and telecommunication technologies and also the difficulties connected with their introduction in education[4] which become obvious, and the problems connected with realization of the recommendations of all these international congresses and conferences.

It should be mentioned that the rate at which these technologies are introduced in schools has probably become lower, in spite some considerable breakthroughs in the area such as:

• transfer to digital codes and the development of data compression technologies;

• rapid growth of the capacity of information processing means;

• development of computer networks connected to global networks of the Internet type, which is going to be a new social phenomenon when the problem connected with the capacity of communication channels will be solved.

WHY DOES EDUCATION NEED INFORMATION AND TELECOMMUNICATION TECHNOLOGIES?

There are main reasons for that:
• obvious pedagogical effect;
• the fact that education falls technologically behind society;
• economic necessity.

Obvious Pedagogical Effect

There is no need to enumerate technical methods and means, to describe numerous pedagogical experiments, but it should be just mentioned that information and communication technologies ensure new incomparable opportunities of access to information, the cultural exchange, individual approach to education and self-education, including distance education, the choice of necessary programme modules, etc. These technologies being not yesterday that they came into existence, but people are unable to use them correctly, although the fact that there is a great park of these means «standing» everywhere, could make us believe in the opposite.

Taking into consideration great positive experience gained in the field of education, there is no need to prove that information and telecommunication technologies greatly contribute to the development of 'teaching strategies. But the development of these very technologies calls upon us to work out a new strategy of education, in which the teacher will inevitably have to play a new role, because a practical application of these constantly renewable technologies leads mass education to a new model: the most popular will be the most comprising partly individual training and the set of personalized configuration modules[5].

Moreover, it should be emphasized, that the role of the teacher in information and telecommunication technologies is to be regarded in the new light; it is noted by everyone that the fact that these technologies will have to make a great contribution in education is mostly unknown to the general public.

It goes without saying that modern systems of education will not be able to remove easily all the «growth» at the bottom of its ships which hinders its advance: the «ballast» of old projects, reforms, plans, technical means, changing fashions[6] and so on - the whole mountain of hopes which so often were frustrated, will lay obstacles on the way of new means. It is worthless stuff, accumulated because of self-sufficiency and the groundless belief that all these means will be introduced into education of their own accord, that there will be no mistakes, that there will be a general support on the part of schoolchildren, students, parents, teachers, industry and trade[7].

Education is technologically behind society

The following factors are indicative:
• constant growth of personal technical means connected with information and telecommunication technologies in developed countries[8];
• open access to computer terminals in state-owned and public establishments (schools, municipalities, libraries, clubs and associations);
• case with which children master these new technologies;
• opportunity to have access to new multicolor visual information - pictures, new publications;
• development of the global network on the worldwide scale and the opportunity to get know each other better;
• sharp increase in capacity and number of applications of these technologies;
• spreading of these technologies all over the planet, constant reduction in prices and maintenance expenses (as a result of ubiquitous applications of such electronic components as printed schemes, chips, etc.)

Economic Necessity

Even if the means offered by information and telecommunication technologies have not work miracles in the field of education, one cannot possibly imagine how the system of education could ignore them, because these means are increasingly used both at home and at work.

It means that besides various pedagogical considerations it is necessary that schoolchildren and students should master these modern means, which are now regarded as the main working tools and a necessary condition of social and professional integration.

Actually, one speaks about
• means used in new jobs;
• means which change the form and context of work, means of production, consumption, communication, transfer of «know-how», renewal of knowledge;
• means which enable to realize the plans of redistribution of industries over territories, to bring to life remote deserted rural regions, to solve the problems connected with environmental pollution, etc., fully in line with the policy of any government.

The statement of these facts enables to realize the problem: pedagogical opportunities of the given technologies are ignored by the sphere of education (it is more obvious in some countries, less obvious in others), it can be seen in the programmes on all the subjects, in pedagogical strategies, in teacher[9] training[10], in the rates at which the programmes[11] are revised and in the projects financed by the state.

WITHIN THE PRECINCTS OF THE SCHOOL

One should remember that in the 80s the means of information and telecommunication technologies were additional to the teacher's tools. At the time the foundation of the education systems was stable but the efficiency of the given systems did not increase considerably.

Today we are aware of the fact that the pedagogical efficiency of information and telecommunication technologies will be fully obvious only .if the basis of education undergoes drastic changes: education must become partly individualized.

These technologies will inevitably lead to the radical reorganization of such fundamental functions of our sphere as *education, professional training, access to knowledge, know-how, methods of information and skills transfer, preparation for «grown-up» life.*

In these conditions the walls of the School seem to have collapsed. But actually they have become less solid first of all because computer networks, new multimedia carriers and new means to transfer data (such as the Internet, CD-ROM, etc.) have come into existence.

Many more groups of population have come to the School now, and it tries to adapt to different rates of learning, thus ensuring an individual approach. Moreover, because you cannot now have a store knowledge which will be enough for the whole life, people have school and then come back, and this is a life-long process.

The School begins to encompass areas and regions which are located far from traditional educational centres. As a result the developing countries get access to knowledge which was accumulated by the developed countries easily and at low costs, tanks to, for instance, such means as encyclopedias on CD-ROM, self-education programmes on CD-ROM, programmes of progress evaluation on CD-ROM, information data-banks, distance education, cultural exchange through the Internet, etc.

Schools get access to culture and know-how of the whole world regardless of their geographical location. They open their doors and welcome other cultures, new groups of pupils, new specialists, other schools, the whole world.

The School begins to involve the whole society (the professional world, cultural centres, various associations, pupils' families, ministries, etc.) to fulfill its main function — education, 'professional training, and society uses its experience, its experts, etc.

The School becomes more open to the community:
in some classes the latter can better control the teaching/learning process, the way it is organized (getting access to information of the school administration, information about pupils' progress) to learn the results of competitions, correct answers to sums, correct answers to exercises, how to enroll in the given educational establishments, etc.

THE CHANCE THAT YOU SHOULD NOT MISS

The age of new media-technologies does not eliminate most difficult problems which the world of education faces now and which must be solved in any case: whether the new technologies are adopted or rejected. This is, for example, reconstruction and reorganization of school space and school time, the control of this space and time, the reorganization of teachers' training, programmes, content of education, etc.

Nevertheless, the requirements of the training process, social and professional requirements, globalization of Communication, Education arid Economy, political projects of building a new society presupposes the introduction of information and telecommunication technologies into Education.

The School now faces the situation when it must choose these technologies and must solve the problems that go with them, otherwise it may run the risk of finding itself in the opposition to the world of industry, which has mastered the methods of digital coding of information and how to work with them, and also multimedia networks long ago.

In this situation society needs:

- the new Teacher who has mastered all these new means;
- the new School (from primary to higher school), which has turned its face to the new life of society;
- which is new because of its purposes, programmes, content of education, new because it opens its doors for greater number of people, greater number of different categories of people.

But working out such policy, providing necessary material and people resources, working out long-term programmes of realization of these decisions require optimal expenditures, realistic approach, and no sharp changes in the adopted course, if we want it to be a success. We have arrived to such a conclusion because of the experience gained when numerous projects in the field of informatics were carried out in the 80s.

Information and telecommunication technologies give all the nations a new chance which they should not miss: for the developed countries it is a means to reconstruct the «skidding car» of education, for other countries it is the chance to get access to knowledge and know-how of all the nations of the world, to the treasure house of knowledge from all over the world.

To solve the problems of the 21st century it is necessary to define the tasks of the School and the Teacher. To do that it is necessary to understand deeply the interaction between two worlds - the world of education and the world of information and telecommunication technologies and to realize that the world of education should reconstruct its basis thoroughly.

Following this way, the School will be able to regain the hope to increase the efficiency of training, to make education meet the real social and economic demands of society, now and in the future, and to ensure young people the chance of successful social integration.

RECOMMENDATIONS TO THE INTERNATIONAL CONGRESS'

The obstacles on the way to the solution of these problems are numerous, but I am speaking about the greatest challenge in the history, which society should take to be able to survive.

But how these obstacles can be overcome?

The International Congress should formulate appropriate recommendations. There are often very many of them. However, the following five recommendations could be given as the main.

1. It is necessary to give those who make decisions all the information that is necessary for them to understand how important it is to work out a new strategy in education based on information and telecommunication technologies[12], such technologies which cannot go together with old technologies (in this case they will not be effective), but in which have to change old technologies, and in some cases to replace them.
2. It is necessary to ensure good and sufficient training of the teaching stuff for them to be able to use these technologies. This recommendation has been inevitably included in resolutions of all international congresses devoted to these problems for the last ten years.
3. It is necessary to make inventory and the description of all resources accumulated by humanity in the field of pedagogical use of information and telecommunication technologies (the experiments that have been carried out, the programmes that have been worked out, the experience that has been gained, etc.) and to set up the World Data Bank, available through the Internet.
4. It is necessary to work out the main strategies in the development of information and telecommunication technologies and the minimum requirements for their use in education, these requirements should be rather general, so that any country could decide on its own approach and take into consideration its peculiarities.
5. It is necesary to adopt the conception of «partly individualized education based on information and telecommunication technologies» as the one that is to be gradually introduced worldwide[13].

[1] This can explain the low quality of some projects, erroneous evaluation of a situation in submitted reports and the hostile attitude of many teachers to them as far as the problems of introduction of information and communication technologies are concerned a good knowledge of a local situation is necessary as well as the constant renewal of this knowledge if we want to increase the efficiency of projects.

[2] The expression «information and telecommunication technologies» have finally replaced the term «informatics» of the 80s. The word «new» in the term «new technologies» has also disappeared, because what is new for some technologies is not necessarily new for others.

[3] In particular, in December 1990 in Lome (Togo) in the framework of the UNESCO programme «The priority is Africa» the congress was held under the title «Informatics at the serve of Africa». In 1992 under the auspices of UNESCO the international conference «Education without bounds» took place. The resolution of 28th session of the General conference of UNESCO also should be mentioned, it was dedicated to these problems («New Technologies, Communication, Information and Informatics»).

[4] One example of such difficulties is the following fact: the question has been debated for ten years now how to introduce information technologies in schools and further education institutions - as a theoretical or as a practical subject (practical professional training).

[5] What is meant here is partly individual education: 'partly' because traditional classroom education is usually understood as the process of training connected with self-education which is adapted to each pupil and which taken place outside the traditional school (at home, in the 'extended' sessions after classes, in the library, etc.) Under existing conditions information and communication technologies are to play a leading rote. This function has been mentioned in the programmes of all the congresses dealing with education, but it has only found a limited application in the field of education.

[6] The fact that the LOGO language has disappeared without any obvious reason can only be explained by changing fashions. It was a successive teacher's means which came into being because of the development of information and telecommunication technologies in pedagogical sphere, the means which gained recognition throughout the world due to its use in primary schools.

[7] Let us remember that we are speaking now about education as it will be in the next few years, when, according to the experience of the past years, some regular drastic technological changes will take place, which will produce a deeper influence on the world of education than anything that has been invented in the 20th century,

[8] Parents often make certain sacrifices to buy their children personal computers, CD-ROM drives; etc.

[9] Some teachers were quick to master the means of information and telecommunication technologies to use them in teaching. There is various reasons for that: besides purely pedagogical or personal considerations teachers would not like lag behind their own pupils who often turn out to be real computer experts.

[10] The teachers training in the use of information and telecommunication technologies is absolutely insufficient - it is not long enough, it does not in the line with the content of the subjects taught. Very often there is no training at all, more often teachers are given the opportunity to engage in self-education. This statement should not overshadow the fact that teachers themselves try to master these technologies, they should be given the chance to do it and to introduce these technologies into the teaching/learning process.

[11] Everyone remembers that the ball-point pens were not allowed in schools in those days when only pens with metal tips were used. The same happened with calculators. Can we really ignore the fact that the important role the book plays is on the distance, and that the work of teacher, irreplaceable as he is, will undergo changes in due course.

[12] Let us remember that the introduction of information and telecommunication technologies results in a radical reorganization of the two elements in the system of education: teaching function and contents, it will take place by all means, if not now then in the future.

[13] Nowadays this approach is becoming more popular all over the world, every country should give it a serious attention and to find out what has to be done in this respect on the national scale.

The original is presented in French

FLEXIBLE AND DISTANCE LEARNING THROUGH TELEMATIC NETWORKS

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1. THE PROJECT

The main mission for the Copernicus Program is: Transfering and developing knowledge to contribute to the rehabilitation of the economy.

In this project we have the following participants:
- University of Twente, The Netherlands;
- University of Exeter, UK;
- Sofia University, Bulgaria;
- Institute of Cybernetics (UNESCO - IIP) Kiev, Ukraine;
- Kaunas University of Technology, Lithuania.

The main project activities are organized around the following two case studies, represented as courses on the Internet:
- Communication and Information Technologies:
- English as a Second Language.

The duration of the project is from 1995 till 1997.

1.1. Project Specifics

1) High communication and information technologies in low-level infrastructure
   - Infrastructure upgrade;
   - Policy making.

2) Transfer of Educational Technology knowledge to Eastern Europe
   - Combined with local subject matter expertize;
   - New approach to education - multiplication opportunities.

3) Open products and architectures

- Extendible with new developments — multimedia, interactivity;
- Updatable content.

4) Mass implementation
- Distance learning centers.

1.2. Project Objectives

• To *establish Internet communication between participants.*

This objective has been met totally. Now the project network is operational and stable, reducing the need of staff mobility and exchange of printed materials. The network includes E-mail discussion groups in six main areas of the project work and an integrated set of WWW sites. Policies and user manuals for use of the Project Network have been developed and distributed between participants.

• *To develop a common project database and the choice of appropriate for the Telematic Research Network (TRN) DataBase Management Software.*

The structure of the database have been developed and approved by all partners. In order to structure also the big amount of Internet and paper references, discovered and used by participants, an electronic catalogue (EC) has been introduced. Now both the database and the catalogue are operational and used by the partners. After evaluation of different alternatives, a combination of WWW and Gopher servers has been chosen as management software (DBMS). The experience from the use of the database leads to the conclusion, that more searching capabilities might be necessary, when the data are growing. Since the database has an open architecture, these capabilities can be added as extensions to the existing WWW server.

• *To develop a pedagogical framework for feleteaching (PF) for teleteaching in individual and group mode and a conceptual model for flexible and distance learning system (FDLS), using telematic networks, creating methods and techniques for courseware development, with respect to different instructional approaches and distance delivery methods.*

The pedagogical framework and the FDLS model have been developed, thus reaching partial objectives for the reporting period. The work is started to be operationalize these theoretical findings into guidelines and instructor manuals. Both CIT and English courses make use of them.

• To *develop and implement CIT and English teaching courses.*

Comprehensive needs analysis have been done for both courses, in cooperation between educationalist and content experts. Special attention have been paid to the needs assessment at the validation sites. The curricula have also been developed, structuring courses into modules to meet different needs. Further, based on the assessed needs, different instructional strategies have been adopted for the courses. The work on CIT course is already at the stage of course micro-planing and technical development. Prototypes of three of the five modules are on the World Wide Web.

• *To develop an appropriate toolbox (software tools and shells) to support course development and distance delivery through telematic networks.*

This objective is planned mainly for the second half of the project, since the toolbox depends on specifications, derived from the actual development work for the courses. The partial objective, achieved during the reporting period, is the analysis and evaluation of the existing software, which could be used for course design, development and implementation. In this scope, comparative study of existing systems for computer conferences and development environments for the Internet has been conducted.

1.3. The cooperation

The coordination and cooperation between project partners is based on the folowing principles:

• Distributed responsibilities, joined effort
Kiev: CIT course, pedagogical framework;
Kaunas: project database;
Sofia: software toolbox;
Exeter: English course;
Twente: research on telematic networks, project management;

• Computer discussion groups on each topic;

• Common standards for exchanging information over Internet - the Net Codex;

• Course prototyping on the World Wide Web;

• Shared electronic catalogue of relevant resources.

2. THE WORKING MODEL

2.1. The work in the project is organized arround 6 Work Packages (WP)

2.2. WP 1 - Communication architecture

The main goals of this WP are to establish Internet communications between the Project participants, installing appropriate hardware and software. Practical results include guide-lines, supporting materials and institutional policies for use of the Internet. These goals have been achieved totally, despite poor communication infrastructure in East Europe and lack of experience in using Internet there. Now the project network is operational and stable, reducing the need of staff mobility and exchange of printed materials. This WP is practically completed.

2.3. WP 2 - Information resources

Creating a Project DataBase and access procedures and creating an Electronic Catalogue (EC) of information resources across the Internet, related to the Project are included in the WP2 as main tasks. A clear structure of the DataBase and the catalogue has been designed and implemented. A lot of useful entities for the electronic catalogue has been selected and annotated at each site, but more coordination effort need to be spend on their integration. The DataBase is operational and used by the participants. The exploitation of the database have shown a need of more enhanced searching capabilities, which can be implemented in the remaining time and effort for this WP, so changes in the Work Plan are not necessary.

2.4. WP 3 - Models and Methods

The main goals of this WP during the reporting period are to develop Pedagogical Framework (PF) for teleteaching in individual and group mode and a conceptual model for Flexible and Distance Learning System, using telematic networks. These two deliverables have been developed at very good quality level, having the potential to be operationalized into guidelines and instructor manuals, which are the future goals in this WP.

2.5. WP 4 - CIT and English Courses

The curricula for both courses have been developed based on thorough needs analysis, in particular for the English course. The content selection and course micro planning have been done in good cooperation between content experts and educationalist from different sites. As a result, a modular structure for both courses have been adopted, in order to meet different needs. The two course are based on different instructional strategies, which, gives opportunities for further research and comparison. Four of the six modules of the CIT course are ready, earlier than the target date.

2.6. WP 5 - Software

An important set of practical results, connected with the theoretical platform of the Project, is reflecting on the development of appropriate software tool - box. Benchmark evaluation of existing software tools and shells, which are supporting the course-development and delivery at a distance has been done, as well as comparative study on the offered computer conferencing software products. Their results have been used successfully for decision making about the tools to be used and as a reference for technological opportunities and limitations in other WP's. The rapid development of such tools in the mean time requires that this evaluation have to continue, with more effort put into developing of benchmarks and specifications for software adaptation. Better communication of the results in this WP among the partners is also necessary. It appeared, that software reviews need to be done prior the main development work on the courses, so they have been started earlier than planned.

2.7. WP 6 - Organisation

An telematic organisational infrastructure have been developed, based on discussion groups, integrated WWW sites and other project management software and policies for their use, thus reducing the need of coordination meetings. All project activities are regularly monitored, so that they are completed in time and in the budget, by shared effort between partners.

3. COURSE BASICS

The courses could be viewed as a case studies for:

- instructional design principles for on-line courses,
- technological framework for course implementation.

These courses are based on the self-study as an instructional design principle, enhanced by following Internet features:

- hyper-text for structured presentation of the material,
- interactivity, allowing experiments,
- communication with the tutor and study follows,
- multimedia (in the future).

The following technological framework is used for these courses:

- World Wide Web (WWW) as delivery platform,
- integration of other Internet services - E-mail, computer conferencing.

3. 1. Curriculum for the CIT Course

CIT course has a modular structure with the following three parts:

- basic part or content environment part (this part includes all main aspects, that are connected with communication and information technologies);
- applied part or implement dependent part (this part includes an educational material "how to use these technologies for implementation of some learner activity");
- examples and assignments for basic and applied parts.

3.1.1. The global objectives of the course are following:

- to learn a different telecommunications media;
- to use telecommunications media as a new form of teaching and learning;
- to work co-operatively to each other in classroom and far away on on-line learning tasks;
- to understand key aspects of technologies that support distance education and new types of educational activities with CMC support.

3.1.2. The expected results of teaching:

- a student "will be has to understand and correctly apply vocabulary and concepts relevant to present-day discussions of distance education and on-line learning";
- a teacher "will be able to use the Internet as a designer of educational resources".

3.1.3. Introductory, Technological and three Applied Modules of the CIT Course

This on-line course will help to learn how to use the Internet: electronic mail, computer conferencing, World Wide Web, on-line databases and global networking for distance learning. This is a four-months on-line course. The course has modular structure:

- Introductory module - about communications between people, computers, etc;
- Technological module introduces existing features in CIT;
- Applied modules deal with using CIT in different areas: education, engineering, business.

The course aims are:

- To give students an opportunity to discuss and test the strengths of the Internet as teaching and learning medium;
- To provide students with new forms of teaching and learning using ideas and techniques of distance learning;
- To familiarise students with telecommunication applications in education, engineering and business.

The course will help:

- To gain first-hand experience of potential uses and limitations of electronic mail;
- computer conferencing, FTP services, TELNET logins, newsgroups, World Wide Web, the Internet informational resources (Gopher, Veronica, WAIS);
- To use the Internet as a teaching and learning medium; design an on-line course;
- environment to suit your own open and distance learning situations and objectives and discuss them on-line with other participants and teachers;
- To develop authoring skills with WWW publishing;
- To work co-operatively from a distance solving different learning tasks.

3.2. Curriculum and Outline for the English Course

The main aims of the course are to:

- build on Copernicus links to establish functioning distance learning networks between participant institutions;
- introduce and develop pedagogical and technical concepts relevant to distance and flexible learning, with particular reference to English Language Teaching;
- help participants to experience the potential and problems of distance education;
- develop IT and course design skills of participants to a level where they can plan and carry out their own courses;

- support participants in the production of a course appropriate to their own teaching environment;

By the end of the course participants should;

- know more about IT and its applications to distance learning in an ELT context;
- be familiar with the basic issues in flexible and distance learning;
- understand some of the practical questions related to distance course design and implementation;
- be able to use up-to-date Telematics methodologies to communicate, particularly e-mail and World Wide Web;
- be able to contribute to the MAPS course Web page;
- have planned a course specific to local student needs.

The overall course outline is only a framework. Much of the detail is flexible and there are a number of areas where negotiation will be required between participants. Participants will also be able to call on other members of Copernicus teams for support, for example in a technical context. Some of the main course elements are described below.

4. MAIN RESULTS AND ACHIEVMENTS SO FAR

4.1. Expectations for Implementation and/or Exploitation

The two courses to be developed (CIT and English) are expected to be included, after the validation phase, in the regular distance education programs at the participating institutions.

The preliminary teacher training course (see Major Achievements, p.5) is already included in the regular Continuing Professional Development programme at Exeter University, School of Education.

The M.Sc. Program "Educational and Training System Design" at University of Twente, Faculty of Educational Science and Technology currently uses the results and expertise from the project for developing Internet based courses. It may use them too for moving all existing core courses to the Internet platform for distance delivery.

The main scientific results wilt be disseminated both through the traditional channels of publication and conferences and by using the Internet in its current and future forms, for the benefit of research community.

The technological, communication and informational infrastructure, especially the electronic catalogue and the database, will be used to create a community of practice which will continue to grow after the project is itself completed.

New information technologies applied within all phases of education have a significant effect on basic literacy of a population, permitting a widespread application of Communication and Information Technology (CIT) in commerce and industry. Making use of English language is a very important advantage for all users of new information technologies.

CIT application to flexible and distance learning directly and through pre- and in-service teachers training will cause to rapid integration CEE countries and NIS into European Community. A prerequisite for this application is a good command of English language, which also can be built.

4.2. Major achievements till now:

- Internet connections and working practices between 2 EC (The Netherlands and UK) and 3 CEE and NIS (Ukraine, Bulgaria, and Lituania) countries have been established for collaborative research and teaching.
- A model for lifelong, Flexible and Distance Learning System (FDLS) in communication and information technologies has been developed, which is appropriate for the CEE and NIS countries, and valuable for EC countries. A pedagogical framework for teachers has been developed as practical application of the model.
- A modular World Wide Web based course in communication and information technologies has been designed and partly developed to support professionals in different areas (teachers, engineers, businessman) in Bulgaria, Lithuania, and Ukraine.
- A method for user involvement (English) teachers) in design and development of a World Wide Web based course in English as second language has been developed and applied. The course itself has been designed in cooperation with the selected user group. This method includes a preliminary course, given to the teachers to help them to collaborate in the design and development process.

4.3. Expected end-products:

- Pedagogical Framework for development and implementation of open and distance courses.
- Internet based training course in Communication and Information Technologies (CIT).
- Internet based teacher training course in FDLS for English Language Teaching.
- Software toolset for development of training courses on the Internet.

4.4. Problems encountered

The poor telecommunication infrastructure in participating countries from Eastern Europe makes difficult the cooperative course development on the Web, especially during the phase of making interactive WWW pages. Even the expensive leased lines are not of sufficient quality.

The purchase of necessary equipment for the East European partners have been obstructed by the custom formalities. Although there is an agreement between EU and participating countries from Eastern Europe for duty- and tax-free import of the equipment, there are long and unclear procedures to make use of this agreement. These formalities delayed the establishment of the Project Network more than one month and were repeated during the next equipment purchases.

5. COURSES DELIVERY AND EVALUATION

One of the main goals of this project is the following distance courses to be delivered: Communication and Information Technology (CIT) course and English Course. At the end of the year all the courses should be on the WWW. This two courses will be developed for three target groups: pre-service teachers, students in engineering and students from a MBA program. So we will have 6 user's groups: pre-service teachers (CIT course), pre-service teachers (English course), students in engineering (CIT course), students in engineering (English course), MBA students (CIT course), MBA students (English course). First two groups will be located in Kiev, next two groups will be located in

Klaipeda (Lituania), and last two groups in Sofia.

The groups in Kleipeda will include nine students each from University of Kteipeda (KU), with visiting lecturer (one time per month for two days) from Kaunas. Students of KU are seeking for master degree, in Computer Science specialisation, fifth year students. Students are full time employees in companies, offices and SME. All of them are interested to use flexible and distance education possibilities as an alternative for face-to-face seminars and lectures. Student in Klaipeda have classes on PCS with Windows and email boxes. They don't have other access in classes, but could have access in free time.

The groups in Kiev will be actually four (two for English Course and two for CIT course), with about fifteen students each, from two different Universities in Kiev. Each group will have technical assistant and responsible lecturer. Students will work 2 times each week for two hours for the whole period - four months. Students are pre-service teachers in their fourth and fifth year and are interested to use flexible and distance education in their future practice. They have classes on PCS with Windows.

The groups in Sofia will include: one about twenty students from University of Sofia having 60 hours (15 weeks X 4 hours each), and other about 16 students having no regular classes but working in their free time, possibly from a distance. Each group will have technical assistant and responsible lecturer. Students are seeking for master degree in MBA in their fourth or fifth year. More of the students are part time employees in companies, offices and SME, which have their own Internet connections. Students have classes on PCs with Windows95, MACs and SUN Workstations. They have full Internet access in classes, but could work also in their free time.

One of the main contributions of users groups should be in the development of conceptual model for flexible and distance learning system (FDLS), using telematic networks and for creating methods and techniques for courseware development, with respect of different instructional approaches and distance delivery methods. Practical results are connected with elaborating guidelines and instructor manuals for courseware development and implementation of the framework in training and courseware development intensive courses with teachers and instructors.

Another contribution will be in the adaptation and the development of the supporting materials as well as in the course delivery (pilot experiments), course evaluation and other necessary follow-up activities for the course refinement and improvement.

The overall contribution of all these groups to the project will be twofold:

- they will help to test, evaluate and improve the courses developed;
- they will contribute to the course content and delivery, having to complete course works directly linked to the overall course objectives.

The two courses to be developed (CIT and English) are expected to be included, after the validation phase, in the regular distance education programs at the participating institutions.

In order to enhance the courses with multimedia capabilities and to strength the implementation opportunities by involving new partners and create new courses, a proposal for a follow-up project has been made under INCO-Copernicus Program - "Multimedia applications for educational telematic networks". The proposal was selected by the EC for financial contribution.

The preliminary teacher training course, delivered to the user representation group, is already included in the regular. Continuing Professional Development programme at Exeter University, School of Education.

The M.Sc. Program "Educational and Training System Design" at University of Twente, Faculty of Educational Science and Technology currently uses the Pedagogical Framework and expertise of the project participants for developing Internet based courses. The program plans to continue this cooperation in moving all existing core courses to the Internet platform for distance delivery. In this case a Bulgarian small enterprise - VIRTECH Ltd. - will be commissioned to do the technical development, making use of the software toolset, developed under the project.

The technological, communication and informational infrastructure, especially around the electronic catalogue and the database, will be used to create a community of practice which will continue to grow after the project is itself completed. This has not been foreseen as a commercial service in the mean time, but as a open forum for instructional designers and course developers across Western and Eastern Europe.

6. END PRODUCTS OF THE PROJECT

6.1. Pedagogical Framework for development and implementation of open and distance courses

The pedagogical framework is based on a theoretical model of Flexible and Distance Learning Systems, developed under the project. Its purpose is to help the teachers and content experts in design, development, and evaluation of distance education and training courses, especially delivered via telematic networks.

The framework consists of a Teachers Guide and a Student Package.

The guide mainly deals with distance education from a methodological point of view. Although many aspects of distance education are quite similar to traditional education, the guide stresses on the specifics of distance education and particularly on the use of new information technologies as instructional media. The guide also describes activities which have to be performed during the development and implementation phase.

The student package describes the tool students need to follow the courses, developed under the framework, the ways these tools will be used and the preliminary knowledge and skills students need to use them.

6.2. Internet based training course on Communication and Information Technologies (CIT)

The course has modular structure.

Introductory module is about communications in general - between people, computers, etc.

Technological module introduces existing features of the Internet literacy and beyond.

Applied modules deal with using CIT in different areas: education, engineering, business.

Each CHAPTER will highlight a different aspect of CIT.

When a student has learned all the chapters of the course, he will gain experience of teacher-mediated discussions, one-to-one and one-to-many communications by e-mail, and group collaborations, and independent work with the Internet resources (FTP, TELNET, GOPHER, WWW, etc.)

By the end of the course a student will be able to apply some useful concepts and techniques you will gain from the course to your own contexts.

Course aims:

- To familiarise students with telecommunication applications in education, engineering and business.
- To give students an opportunity to discuss and test the strengths of the Internet as a teaching and learning medium.
- To provide students with new forms of teaching and learning using ideas and techniques of distance learning.
- To gain first-hand experience of potential uses and limitations of electronic mail, computer conferencing, anonymous FTP services, remote TELNET logins, newsgroups, World Wide Web, the Internet informational resources (Gopher, Veronica, WAIS).
- To use the Internet as a teaching and learning medium; design an on-line course environment to suit your own open and distance learning situations and objectives, and discuss them on-line with other participants and academic staff teachers.
- To develop your skills as an author of your own WWW pages. On completion of the course you will be given a certificate describing the course coverage and recording your participation.
- To work co-operatively with each other in a distance solving different learning tasks.

Benefits:

- Gaining first-hand experience of potential uses and limitations of electronic mail, computer conferencing, anonymous FTP services, remote TELNET logins, newsgroups, World Wide Web, the Internet informational resources (Gopher, Veronica, WAIS).
- Using the Internet as a teaching and learning medium; design an on-line course environment to suit your own open and distance learning situations and objectives, and discuss them on-line with other participants and academic staff teachers.
- Developing authoring skills for WWW publishing. On completion of the course students will be given a certificate describing the course coverage and their performance,
- Co-operative work with other students, possibly from different countries, solving different learning problems at a distance.

6.3. Internet based teacher training course in FDLS for English Language Teaching

6.3.1. Course aims:

- introduce and develop pedagogical and technical concepts relevant to distance and flexible learning, with particular reference to English Language Teaching;
- help participants to experience the potential and problems of distance education;
- develop IT and course design skills of participants to a level where they can plan and carry out their own courses;
- support participants in the production of a course appropriate to their own teaching environment.

6.3.2. *Structure*

Module One:...........Introduction to telematic Communication.

This deals with IT concepts and methods of distance communication.

Module Two:...........FDLS pedagogic.

This looks at the parameters and issues related to FDLS and compares them with traditional learning methodologies.

Module Three:........Examples of teaching and learning materials.

This will provide examples of distant ELT materials and will compare them with classroom-based approaches.

Module Four:.......... Course Design.

This will look at the various stages of designing a distance ELT course.

Module Five:.......... Local case study preparation.

This is a specific location-based module designed to support participants in the preparation and delivery of teaching materials appropriate to their own situation.

6.3.3. Benefits

By the end of the course participants will

- know more about IT applications to distance learning in the context of English Language teaching;
- be familiar with the basic issues in flexible and distance learning;
- understand some of the practical questions related to distance language course design and implementation;
- be able to use up-to-date telematics methodologies to communicate, particularly e-mail and World Wide Web;
- be able to design educational Web pages, in particular pages for language teaching and support;
- be able to plan a course specific to local student needs.

Since the participating academic staff teachers will be able to design and develop distance courses in English language teaching, a cascading effect is expected in developing custom-made courses of this kind in participating institutions, countries and regions.

6.4. Software toolbox, containing software tools and shells to support course development and distance delivery through telematic networks

The purpose of the toolbox is to facilitate and speedup the development of training courses on the Internet and to support the implementation and delivery of these courses.

To fulfil these requirements, the toolbox will include:

- High level integrated authoring tools for WWW pages. Both static information presentation pages and interactive exercise pages will be supported. No technical knowledge on HTML or programming skills will be necessary.
- Tools for automatic publishing of the produced materials, version and project management.
- WWW server extensions and gateways to other software (e.g. databases) to support monitoring of the student activities, provide personal feedback to students and student administration.
- WWW based tools for communication, discussions and cooperative work.
- Design templates for different instructional strategies and course models, based on the Pedagogical framework and teacher guides, developed under the Project.

6.4.1. Benefits

For content experts, academic staff teachers and instructional designers – opportunity to produce effective technology enhanced training and educational materials without a need of technical development staff. This could result in shorter development time, better control over the whole process and cost reduction.

For publishers and software developers - reduced development time and partial overcoming the lack of knowledge on instructional design, as well as improved consistency and user interface of the end product.

7. CONCLUSION

7.1. Contribution to the application domain

The proposed research is expected to build a technology-based bridge between CIT Teacher Training in the CEE & NIS and EC countries. It will offer a model for FDL that allows learners to acquire skills and knowledge at their own pace, to choose the location of study (at home, at a workshop, at school, etc.), to choose the time for the group sessions, to navigate in a modular curriculum by using flexible learning materials based on CIT. We expect a significant contribution to the development of CIT Teacher Education in all participating countries and corresponding impact on the society.

Properly designed educational software, learning materials and activities will allow teachers and students to process and analyse scientific data, to have discussions with distant partners, to collaborate for producing technology-based learning materials.

The modular teacher training course on CIT that utilises the FDL model will allow to overcome a paradox situation in the education when CIT became really open to general use but they couldn't be. effectively applied because teachers can't manage to include them to their didactic repertoire. The creation of a telematics network for teacher educators provides an important infrastructure which will improve the quality of teaching and research across Europe as well as supporting flexible and distance learning. TEFL will also be considered as a first case to inform the development of similar networks for other disciplines and will be the first telematics network of its kind in the world. It is expected that the courseware, protocols and pedagogy will be transferable as will the technical developments and some of the equipment.

The language engineering aspect will provide new forms of computer-aided language learning (CALL), which will not only enhance the teaching and learning but permit teachers to adjust materials to, the wide range of students, including the pressing needs of university staff. This will be a step towards development of language engineering standards.

The case of English as a foreign language has been carefully chosen also to enhance the use of telematic networks and CALL internationally including the CEE and EC. Teachers of English will also support their colleagues within their own countries and they frequently support clients in commerce and government too, as least in the early days of an innovation. In addition universities prepare teachers in the schools and thus the next generation. This project therefore has important multiplier effects throughout the community within and across countries and will influence the development and uptake of systems for business, home and personal use.

7.2. Dissemination activity and plans

The main scientific results will be disseminated both through the traditional channels of publication and conferences and by using the Internet in its current and future forms, for the benefit of research community.

The two courses to be developed (CIT and English) are expected to be included, after the validation phase, in the regular distance education programs at the participating institutions.

The preliminary teacher training course (see Major Achievements, p.5) is already included in the regular Continuing Professional Development programme at Exeter University, School of Education.

The M.Sc. Program "Educational and Training System Design" at University of Twente, Faculty of Educational Science and Technology currently uses the results and expertise from the project for developing Internet based courses. The Program aims to continue this cooperation in moving all existing core courses to the Internet platform for distance delivery. In this case, the actual development work will be done by a small Bulgarian enterprise - VIRTECH Ltd.- making use of the guides, manuals and software toolbox, made under the Project. A preliminary agreement between the Project Coordinator, the M.Sc. Program management and VIRTECH have been reached.

The technological, communication and informational infrastructure, especially the electronic catalogue and the database, will be used to create a community of practice which will continue to grow after the project is itself completed. Members of academic staff at University of Twente and GMD (Germany) already make use of the electronic catalogue.

The educational services, offered at a distance by participating institutions have been enhanced by adding flexibility, openness, interactivity and more communication capabilities, which are included in the courses, developed under the Project.

The internet course development services, offered by Internet publishers or software enterprises can be enhanced by use of the software toolbox, guidelines and manuals, developed under the Project, in terms of reduced development time, proven educational value of the courses and professional user interface.

The combined application of the Pedagogical Framework, teacher and developer guidelines and the software toolbox could develop a new service - direct development of Internet based distance courses by content experts and instructional designers, without need to involve software designers and programmers.

The leading design principles and technology in Web development have been catched-up and applied to the field of instructional design

The expertise and know-how in open and distance learning from leading Western Universities have been transferred to the participating institutions from Eastern Europe, thus putting them in the leading position in Eastern Europe and creating opportunities for further spreading of expertise in this region.

7.3. The main conclusions from the project so far are:

- The adaptation of educational pre-normalisation & standards (including software and hardware) for CEE and NIS countries will facilitate the development of portable- technology-based learning materials appropriate for different educational settings and cultures.
- Properly designed educational telamatic applications, learning materials and activities allows teachers and students to process and analyse scientific data, to have discussions with distant partners, to collaborate for producing technology-based learning materials.
- The modular teacher training course on CIT that utilises

the FDL model helps to overcome a paradox situation in the education when CIT became really open for general use but they could not be effectively applied because teachers cannot manage to include them to their didactic repertoire.

- The language engineering approach to the English course provides new forms of computer-aided language learning, which will not only enhance the teaching and learning but permit teachers to adjust materials to the wide range of students, including the pressing needs of university staff.

7.4. The main future possibilities foreseen now are:

- To analyse and utilise from educational perspective the new technological developments in telematics, in particular multimedia and enhanced interactivity, and to incorporate them into the developing courses.
- To derive clear specifications for the software toolbox, based on the conducted reviews and on the experience earned during the course development, and to develop the toolbox.

The original is presented in English

DISTANCE EDUCATION IN NEW INFORMATION ENVIRONMENT

V.S. Meskov

DEPUTY CHAIRMAN OF THE STATE COMMITTEE
FOR HIGHER EDUCATION OF THE RUSSIAN FEDERATION

Apprehension of the fact that the future of the mankind, its survival, is connected with the future progress of science and education, had led to the considerable enlargement on the share of learning young people of corresponding age groups. By the beginning of 1990s the number of learners in the world had increased threefold in comparison with 1960, and amounted more than 900 million. The entrenched traditional systems of higher education became unable to accept the increased flow of students. Besides that, they turned out to be unable to waive theirs principles of classical university education, and to re-orient the process of learning on the training of specialists in economy, while the demand for them was enlarging constantly, being afraid that excessive professionalization of education might water the universities down and convert them into highly specialized educational institutions.

The way out from that controversial situation was founded in partial professionalization or university education, creation of a network of new type educational institutions in the system of higher education, targeted training of specialists in the sphere of economy, considerable expansion of extra-mural tuition on the basis of new information technologies, and, in addition, general recognition and new impulse for development was received by distance education (DE).

The numerical growth of students was accompanied by the creation of absolutely new (non-traditional) types of institutions of higher education. Since the beginning of the century the number of it increased more than 700 times.

The stable growth of the share of extra-mural students who work and study at the same time is followed by rapid development and broad application of various technical means, that provide higher quality of this education. Among them there are the following technologies:

- computer and information technology;
- satellite systems of communication;
- educational television (including cable television), videotapes;
- mass telephonization, enabling to link up to information systems;
- global and regional networks, Internet, etc.

A number of students prefer DE deliberately, because of the purely financial considerations - the extra-mural education allows students to keep their employment and thus to support themselves.

A demographic factor plays its significant role in the progress of DE.

There is another positive factor for the benefit of further DE development. Through it the number of educated people increase more rapidly than that through other forms. An insignificant number of tutors can teach a great number of learners, including those who were unable to gain higher education at a "normal" student age, and those, who cannot attend traditional educational institutions' because has physical lacks.

The higher educational establishment has faced difficult tasks, connected with the extension of lifelong education programs, in-service training and re-training of specialists.

The philosophy of UNESCO and other international organizations acting in sphere of education, is that reform and innovations in higher education should be aimed at conversion of various theories and conceptions of lifelong education in reality, and rigid, inflexible, and elite systems of higher education should be made accessible to all.

Distance education is called to give an adequate answer to the educational challenges of the future society.

According to the Concept of RF Ministry of Education, the introduction of distance education in the system of personnel training will broaden the number of consumers of educational services, including the inaccessible and sparsely populated areas, in remote regions. Distance education, is considered as one of the forms of the lifelong education system, which is intended for realization of the human right to obtain information.

According to the Concept, *distance education is understood as a complex of educational services. offered to broad strata of population both in the country and abroad with specialized information-educational environment on any distance from an educational institution.*

The information-educational environment of distance education is a system of communication means, information resources, protocols of interaction, hardware and software, methodological provision, aimed at the satisfaction of consumers' educational needs.

The traditional educational system is based on lectures, seminars, laboratory studies, games, independent learning. The book is the educational basis, and the teacher is the interpreter of knowledge.

The distance education Concept is targeted at the introduction of other educational models in the process. These models foresee the teleconferences, information performances (i.e., students' work with databases, student projects, ratings, etc.). The application of new organizational forms of education changes radically the method of learning, together with the interrelation between the student and the teacher. In these models, databases and books are the information source, the teacher is the co-ordinator of the learning process, and the student is the interpreter of knowledge. So, the teacher's role in the educational process is changed. So his/her functions are to co-ordinate the learning process, to correct the course, to advise in connection with the development of individual curriculum, to guide the student's projects, etc. He guides student groups of mutual help, helps students in their professional self-determination. The student's activity changes from the reception of knowledge to independent search for the latter, to creation of independent educational curriculum.

The technology of distance education is an aggregate of methods, forms, and means of cooperation with a student in the process of independent, but guided learning. As the information and education environment is being filled with the necessary content, and provision of universal distant access to the environment is secured, an open information-educational environment will be created. Information to learners may be presented in the form of printed materials (sets of textbooks and methodological literature, and tasks), electronic materials (computerized educational environment, databases, electronic textbooks), audio- and video-materials, and television broadcasts.

The ultimate goal of creation and development of the distance education system is to grant school-students, students, civilian and military specialists, the unemployed, general public in any area of the country and abroad, equal educational opportunities, and to raise quality of education through more active use of scientific and educational potential of leading universities, academies, institutes, leading training and re-training centers under the branches of industry, institutions for re-training, and other educational institutions.

As it was mentioned in the Concept, at present the development of an unified system of DE in Russia is a pressing issue, since it will be able to the most adequate and flexible react to the needs of the society, and provide for realization of the constitutional right to get education by each citizen of the country. The system of distance education corresponds with the logic of development of the educational system and the society as a whole, where the needs of an individual are of paramount importance. Besides the system of distance education may play a role not only of an instrument which satisfies, but also forms educational needs of a human beings, according to the interests of the each human being and of the society.

Connecting the problem of bridging distance between a teacher and a student with technical capabilities of modern electronics, scholars come to the conclusion that the solution of an issue on methods (ways) of bringing distance causes a fundamental change in opinion on the essence of the learning process itself. This is substantial for the countries which do not have national DE systems yet. The introduction of modern technologies makes it possible to surmount substantially conservatism and rigidity of the frameworks of traditional educational systems and "totalitarianism" of tutors, and to create an open educational environment, where a student is not an object, but a subject of education.

The prospects of further DE expansion are connected with the new achievements in the means of communication. An important role is given to the development of communication satellites, which enable to create inexpensive special purpose translation networks for learning.

Information technologies of distance education may be divided into three big categories: *non-interactive* (printed and audio-visual materials), *computer-based instruction* (including the most up-to-dated multimedia), and developed means of telecommunication *videoconferences*.

The means of computer-based instructions and telecommunications provide distance education with radically new opportunities, and they are progressing rapidly in the form of electronic textbooks and hypertext transmission technology via e-mail.

Developed means of telecommunication, satellite communication and transmission of video image via computer networks, have recently entered the practice of distance education only, primarily because of absence of developed communication infrastructure at early stages of DE formation, and high cost of lease of communication channels and transmission and receiving equipment and information.

Looking forward, one can see already now, in what way new technologies come forward to the scene of distance education. Almost all of them are based on digital methods of information processing. They are used both in hipermedia programs, which allow the student to operate the used information, and large-scale data and knowledge bases, accessible via global computer networks, and integrated data systems, allowing the student to have access to video-programs, audio-materials, databases, software, both from home and office.

It is recognized that a information society needs to establish an open educational environment, that is why it is advisible to fulfil under the UNESCO umbrella the following tasks:

- to form a global bank of distance learning sets, distance educational programs;
- to develop multichoice programs and sets for distance learning which take into account national peculiarities of consumers, countries that have insufficient educational services;
- to develop a unified multi-language educational system of educational terms, including the DE terminology;
- to set up conditions for free use by countries of the global community.

The original is presented in English

LOOKING SIDEWAYS

John Middleton

CHIEF, THE WORLD BANK
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NEW PRODUCTS AND OUTREACH DIVISION

In addressing issues of international co-operation, the Commission may wish to consider three key issues. First the technologies will be only as useful as the knowledge they carry. Where will this knowledge come from? Who will it be for? Second, while knowledge alone is a important to the human spirit, knowledge in use is the key to positive social and economic change. What can be done to enable individuals and institutions to use knowledge more effectively? Third, we know that global corporations are at the cutting edge of the use of new technologies for learning. How can this experience be shared? These issues are explored for their implications for international co-operation.

The commission will address issues of international co-operation in the promotion of the new information technologies (NIT) for education. The Main Working Document ably identifies the many issues associated with the technologies and their implications for learners and teachers, social, economic and cultural development, and educational policies. The issues identified for international co-operation are mainly focused on UNESCO and on the technologies, and properly so.

However, I would suggest additional issues that the Commission may wish to consider in addressing the role of UNESCO and the broader international community. First the technologies will be only as useful as the knowledge they carry. Where will this knowledge come from? Who will it be for? Second, white knowledge alone is a important to the human spirit, knowledge in use is the key to positive social and economic change. What can be done to enable individuals and institutions to use knowledge more effectively? Third, we know that global corporations are at the cutting edge of the use of new technologies for learning. How can this experience be shared? I will briefly explore these issues, and conclude with a few tentative thoughts about their implications for international co-operation.

ISSUES

Knowledge From, Where and for Whom?

It is not just information technology that is changing. Many nations are undergoing both economic and political transitions. These transitions bring with them enormous demands for knowledge, not just from students, but also from the public at large; not just from public officials, but also from the private sector. Much of this demand is for knowledge that is built on the experience of other nations and other citizens. The new technologies offer the potential, realized in some nations but far from all, to provide access to this knowledge. But who will provide it? How can we increase the chances for knowledge to flow, not from the rich to the poor, but among nations and citizens as information equals?

Putting Knowledge to Work

At the center of our concerns for equitable access to technologies and the knowledge that they can carry should be the continuing global effort to reduce poverty through sustainable and equitable development. Economic growth is a necessary, although not sufficient, means to this crucially important end. Four decades of economic research has provided us with important lessons about how growth can be achieved. Policies that open economies to international trade, a reduced role for governments in those parts of the economy best managed by a competitive private sector, a stable legal and regulatory environment, and investment in both physical and human capital are widely accepted as essential to growth. Governments play a key role in ensuring equity and in providing those public goods, such as education, that enable citizens to share in the benefits of growth.

Recent research suggests an additional important factor. That is the efficiency and effectiveness with which nations use resources, both physical and human. A recent study by Mancur Olson provides a powerful example for human capital. The incomes of migrants from poor to rich nations rises much more than can be explained by access to the greater resources of the receiving nation. Olson concludes that the difference represents "...human capital, entrepreneurial spirit, and cultural traits..." that were under-used in the country of origin.[1]

We are all aware of the many and complex factors that could lead to less than effective use of knowledge. Indeed, capacity building has been a central concern of global development effort. But we must also recognize that this effort has been only partially successful. Thus both economic analysis and the record of experience suggest that the new technologies will be effective in putting knowledge to work only if they are accompanied by a fresh approach to capacity issues. Good policies and investments will help, but institutional factors will matter as well. What role should the international community play in building the capacity of citizens and nations to use their knowledge to improve individual and social welfare?

Experience of the Private Sector

I recently attended a presentation by a team of course developers working for two global automobile manufacturers who are developing management skills training programs for subsidiary organizations in a dozen countries. Team members were based in the US, Switzerland and Spain. They work together effectively via computer and telephone links despite technical obstacles. Several elements of their experience are worth considering. First, two companies are collaborating. Partnerships are possible. Second, collaboration at a distance required the development of new working methods and relationships. Another global corporation with which I am familiar has replaced most of its residential employee education and training programs with instructional materials on CDROM, notebook computers, and a toll-free international telephone number. Costs of training have been reduced by half.

Of course, the international community is not an integrated corporation, and should not be. However, the practical lessons being learned in the private sector would be invaluable not only to learning at a distance, but collaborating at a distance. How can this knowledge be tapped to the benefit of developing countries?

through new (and old) technologies, still emulates traditional didactic instruction: the teacher (or the computer) teaches; the students learn and are assessed. This can be efficient and effective, but it assumes a knowledge source and a knowledge receiver raising, as the Main Working Document suggests, the possibility of dependency relationships. International distance education is developing along these lines, such as the UK Open University's graduate business program.

Such programs are quite valuable, bringing the knowledge of rich nations to learners in transition societies. But the burden of adaptation and of knowledge use is on the individual learner. Programs of this kind add to individual human capital, but do relatively less to develop the social institutions through which knowledge is used. Could the international community, perhaps with UNESCO leadership, seek to help educators look sideways across national boundaries to develop distance education programs together, with knowledge from all sources? Can collaboration at a distance become a global reality?

Citizens of many nations in transition do not have access to educational institutions during the formative period of their lives, much less as adults. But they are likely to have access to radio and television. The digital revolution, cable distribution, and advances in satellite communication are vastly expanding the capacity of broadcast media to carry knowledge to even the most remote populations. International broadcasting is expanding rapidly and there is a shortage of programming. At the same time that the world contemplates electronic networks, it will be important to think through new partnerships that help broadcasters contribute to the exchange of knowledge between the citizens of developing countries. Important initiatives are under way, such as the Television Trust for the Environment, WETV in Canada, and others. The Economic Development Institute of the World Bank has begun producing documentary television series on development experiences as a contribution to South/South learning. Presently these initiatives are not well linked: helping to do so could be a natural role for UNESCO, given the organizations distinguished history in broadcasting development.

Putting knowledge to work will, I think, require some new thinking about human resource development. We know that the economic returns to investment in education and training come through productive use of knowledge and skills. We have, however, narrowly viewed this as a linear relationship: get educated, get a job. The evidence that knowledge is often wasted

IMPLICATIONS: LOOKING SIDEWAYS

In his exploration of the implications of new technologies for modem organizations, Nobel prize winning physicist Arno Penzias identifies 'looking sideways' as a key characteristic of organizations that use technology well to increase their effectiveness.[2] Lateral relationships in networks, facilitated by technologies, are becoming an essential feature of organizations for which knowledge is the main product. I believe this concept has important implications for each of the issues that I have discussed.

Most distance education, even when made interactive compels us to rethink this relationship. Knowledge and technology are both changing continuously. Lifelong learning, always needed, is now a reality in much of the corporate world. Many modern corporations now think in terms of 'intellectual capital,' which is the sum of human resources, information technology, lateral networks and client relationships. Could this concept help in building the capacity to put knowledge to work in developing countries?

I think it could. One of the practical implications for establishing lateral networks would be to build first on functioning national and regional networks of institutions, adding the technology linkages to facilitate collaboration in developing and expanding teaching and learning activities and materials. The four elements of intellectual capital could provide a framework for assessing the capacity building needs of such networks. The idea alone that relationships with clients form an important element of an organization's effectiveness has implications for all forms of public service delivery, including education.

In an era of declining official development assistance, sustained development of both national and international capacity to collaborate in teaching and learning will require high levels of efficiency. A 'network of networks' that enables all to learn from the experience of others could help avoid duplication of effort and also to avoid costly mistakes. To mention just a few of the present initiatives: the Economic Commission for Africa's program for telecommunications development, USAID's Leland Initiative to build Internet access in Africa, the Soros Foundation's similar work in the Former Soviet Union, and the World Bank's INFODEV program in which the Bank and the private sector are cooperating to improve launching pilot projects to establish international I both telecommunications policies and applications. The Economic Development Institute of the World Bank, is Internet networks in the FSU and with the African Economic Research Consortium for the purpose of developing and sharing knowledge.

In developing such a 'mega-network' we should be careful to look sideways. The international community can use the power of the Internet to regularly share information on their initiatives. At the outset, this is as simple as maintaining comparable windows on agency sites on the World Wide Web that report on networking activity, with hyper-links to other agencies. With an open architecture, this network could very quickly enable both national and international members ,to supply information and seek advice. It is also possible, though certainly not assured, that global corporations would share non-proprietary information through this network. Perhaps the development of this architecture and the identification of the initiatives that it could link would be an appropriate 'catalyst' role for UNESCO.

[1] *Cited in The Economist, May 25. 1996, p. 25.*
[2] *Arno Penzias (1995). Harmony. New York: HarperCollins.*

The original is presented in English

Part VIII

CLOSING CEREMONY

PLENARY

SPEECH

Yu. L. Ershov

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DIRECTOR OF THE RESEARCH INSTITUTE OF MATHEMATICAL AND INFORMATION FUNDAMENTALS OF EDUCATION AT NOVOSIBIRSK STATE UNIVERSITY
(RUSSIA)

Dear Chairman,
Dear Ladies and Gentlemen,
Colleagues!

I am glad that I have an opportunity to participate in this important and interesting Congress, I am glad. that I have an opportunity to speak before you. From numerous conversations with the participants in the Congress 1 know that many of them are rather pragmatic and they expect that some concrete problems will be solved at the Congress or, at least, they will be given advice and recommendations how to solve them. I hope that at least some of their questions have been answered during the plenary meetings, the meetings of the commission and the seminars.

Some of the pragmatically-minded participants do not like speeches on philosophic and general methodological problems. Let me apologise in advance before them, because I am going to speak about very general issues. I believe that the- most general issues can and must be discussed at such a large forum as this Congress. In the materials of the Congress such concepts as the pupil and the teacher, the expert and the person making decisions are used, but actually even particular person can play simultaneously a few if not all of these social roles. Thus. yesterday, for example, the majority of adult population of Russia look part in the Presidential elections and. consequently played the role of the people who make decisions I personally have always preferred the role of the pupil. Both at the Congress and while preparing for it I have been trying to understand the problems which are connected with the influence of new information technologies on education and their role in our lives.

The main working document of the Congress has enabled to focus the discussion on those queslions which are believed to be the most important at the present time. However, at this Congress 'be problems were discussed that were not mentioned in ihe working document and the urgency of which was realised only recently, I mean such brilliant speeches as those by V.G. Kinelev, Vice Chairman of the Government, Russian Federation, and Academician Blagovest Sendov, Chairman of Parliament, Bulgaria. Obviously, these problems are going to be among the main at the next Congress, which, I hope, will soon take place.

To formulate some of the future problems I would like first to consider one important concept. Such terms as «information age», «information society», have become quite common and are used to describe lhe coming 21st century. There have been a number of successful attempts to show what they mean. to describe this concepts using precise scientific terms I shall try to explain my understanding, giving not strictly scientific description of these important concepts.

Thus, let us imagine that a new continent has emerged on this planet. Let us agree to call it Infoland (nowadays such terms as cyberspace, *kiberprostranstvo,* and many others are used). I will refer to this new continent as Infoland. It is both beautiful and ugly. having Wonderfields, Disneylands and Las Vegases, having wells of wisdom comparable to the Lenin Library, the Congress Library, USA, the British Museum. On this continent there is all the beauty of ihe world and the masterpieces of art, the paintings from the Hermitage and immortal arias of the Milan Opera. On this continent there are also places where all information dirt is accumulated and it is spreading. There are certain diseases on the continent. One of them was mentioned in the report by professor M. Larijani from Iran who called it *"infomania".* It is very easy to get to the continent and it takes little time. there is no need to get a visa or the permission of the parents for children. To wander over the continent you need neither teachers nor instructors (by the way, here arises a new pedagogical problem). This continent is created not from material but from information. Academician Sen dov believes that lhe concept of information is fundamental in the same way as the concept of matter and energy. The information age begins, in my opinion, when such a continent emerges, and I believe that this continent has already emerged, that is the information age has begun I also believe that it came into existence not when the first computers were introduced, but when ihe global information networks having powerful information channels were introduced.

The emergence of the new continenti on lhe Earth is undoubtedly influencing and will continue to influence life of the whole planet. That is why it is so important to understand the nature of civilization on this contineni. Fortunately, there are at least «traffic rules and regulations» on the continent. We should be grateful for it to the specialists in network technologies who carry out in time technical protocols which enable to keep order on rapidly spreading highways of Infoland.

And what about law, morals, culture and philosophy on the continent? As the discussions indicate, including those conducted at this Congress, there have only appeared sprouts of these most important components of civilization. I think that alongside with a further development of Infoland the most important problem at the beginning of the information age is the creation of such a civilization on the continent that will help all the old continents on the Earth to use its many fruits to be able to create a just, free and prosperous life. This is the most difficult task. To build such a civilization is the common cause of the whole planet, the cause that will help to develop international cooperation and mutual understanding of all the nations and countries.

At the same time the solution of this problem is a challenge to education: *how to educate the new generation most efficiently for it to be able to live in the information age, to respect it*. In two reports, apparently irrespective of each other, in the report by Konstantin Kolin from Russia and in the report by Jose Valente from Brazil the term «society of knowledge» is used and what is more, both these reports contain a prediction or, I should say, an appeal to create an ideal way of development: the transition from industrial society or consumption society to the society of knowledge and I agree that in the society of knowledge the care of science and education, of acquisition of knowledge is the top priority for the state. I believe that it is in this very society that the above mentioned problems of creation of information civilization and education of the generation that is prepared to lead a successful life in two civilizations - a traditional one which exists on the Earth and handmade information civilization - can be solved most efficiently. Because Infoland is not a material continent, its geographic description is certainly neither full nor precise. Moreover, a rapid growth of the continent, irrespective of its location, would result and in a sense will result in the expansion,of the whole planet.

Let me use one more analogy or one more image. In the report by V.G. Kinelev it was it was emphasised that the most important gift of the 19th century to the 20th century is the understanding by the humanity of the notion of relativity. Speaking only about the theory of relativity by Einstein, it showed that we live not in the three-dimension spatial world but in the four-dimension spatial and temporal world. Now, I daresay, that the 20th century presents the 21st with one more dimension, that is informational. This dimension is not a unity, using a technical but quite common and intelligible term, it can be viewed as a hypertextual dimension. By the way, the 20th *century has not been long enough* to be able to understand rather fully our four-dimension world. I cannot say that everyone knows well, feels and understands what is the gist of it. Will the 21st century be long enough to understand even a greater number of dimensions of our world?

Summarising what has been said, one can arrive at the following conception: at this Congress new information technologies have been considered as new means to solve traditional education problems of adaptation of the coming generations to be able to live a successful life in the information age will come to the foreground. Let us hope that living in the information age, *in the society of knowledge, the humanity will* successfully solve all the problems it faces.

The original is presented in Russian

MANY QUESTIONS, A FEW ANSWERS

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1. INTRODUCTION

Mister Chairman,
Ladies and Gentleman,

The theme of this Congress was: Educational Policies and New Technologies.

I am very grateful that the Russian organizing committee gave me the change to elaborate on this theme during this Closing Session of the Congress.

I have listen with great care to many of the presentations, and I was very impressed with their quality, their scope and their vision. Many questions were raised. In my presentation I will cope with some of these questions and try to give some answers.

To make sure there is no misunderstanding, when I speak about new technologies, I mean new information and communication technologies.

2. FRAMES OF REFERENCE

What I have experienced very strongly during this Congress, is that we need much communication in order to understand each other. Speaking different 'languages' is certainly one part of misunderstandings that can occur, but much stronger in this respect is the fact that we operate from different 'frames of reference'.

It was very strongly emphasised during the opening sessions on the first day (and repeated several times during the following days): the need to. be able to maintain our own cultural, ethical, personal and organizational identity. In other words, to be able to operate in the environment and the context we are familiar with.

This emphasis on individual identity and individual differences is strengthened by the current technology, which makes individual choices much easier. This is happening in education, but even much more strongly in the consumer market and our daily lives. Current societies emphasise the chance and the right to be different, and, more important, the opportunity to be different. This applies to individuals and to schools, as well as to educational systems at large.

As there are many people, many schools and many educational systems there are also many individual differences and therefore many frames of reference. Those frames of reference are the result of our culture and our personal development. It would be wrong to even try to make them equal.

3. CHAOS OR STRUCTURE?

However, when every individual, each school, and each educational system wants to be 'different', chaos will be the regular pattern and conflict will be the result. So, how to deal with this dilemma?

The solution is that we should agree upon the goals of what we want to accomplish with our schools and our educational systems. And from those goals, criteria should be derived in order to evaluate our actions.

This reasoning is basic to my thinking. This is my approach from which I try to answer the fundamental question that should be raised by all of us: why are we using technology in education?

4. WHY USE TECHNOLOGY IN EDUCATION?

'Why are we using technology in education?' is a question we all should deal with sooner or later. There are at least three answers to this question:

a. because the technology is there,
b. because we believe that technology is good for education,
c. because there is empirical evidence that technology makes education better.

It depends on our own frame of reference, which position we will take. Please reflect for a moment and make up your own mind.

If I had asked the participants of this Congress to answer this question, my guess is that 30 % would choose for answer one, 50 % for answer two, and 10 % for answer three. And to keep in pace with the Russian tradition, 10 % would choose for 'none of the above'.

Whatever our answer, we should live up to our choice. This means that we have to make sure that when we support the use of technology in education, we have to be convinced that the criteria, related to our particular choice, are being fulfilled.

Let us overview each of the choices in more detail.

If the answer is 'because the technology is there', the criterion is very simple. Technology is all around us and that can very easily be verified. When you made this choice, however, you have to realise that you will have a difficult time to keep up with the very fast changes of technology. What is there today, will have changed tomorrow. It will not be possible to continually implement the permanent changes of technology in education. After a while, you will have to give up. Therefore the first answer to the question cannot be sustained. Maybe it is acceptable as an answer in the beginning, but gradually, the answer should evolve to one of the other two.

When your choice was: 'because we believe technology is good for education', we have to derive a criterion that operationalises 'good' education.

What is considered 'good' education is very strongly determined by the frame of reference we use. 'Good' education in one setting could be interpreted as 'bad' education elsewhere. Therefore there are no universal criteria to describe what 'good' education is. Consequently there is no absolute way to determine if using technology is indeed 'good' for education. 'Good' can only be operationalised in a particular situation, with reference to a particular frame of reference. The fact that the derived criterion will be a specific one as well, does not dismiss us from the obligation to check if using technology in our particular situation fulfils the promises put forward by the criterion.

In the hypothetical survey to which I referred, my personal answer would be in the third category. My point of view is that we should use technology in education assuming there is empirical evidence that indicates that technology makes education better. And as this empirical evidence is still very rare, I am constantly looking for applications of technology that produce clear indicators of improvement of the educational system I am working in.

There are many perspectives that can be considered when we talk about better education. 'Better' can refer to the learner, to the teacher, to the institution or even the educational system as a whole. There are also many dimensions of 'better' education. We can think about better performance of the learner, better attitude of the learner, better motivation of the learner, improved working conditions for the teacher, lower workload for the teacher, better financial conditions for the institution, better organisational conditions for the institution, and so on. 'Better' is the criterion to evaluate if using technology in education is adequate and appropriate.

5. EDUCATIONAL PRODUCTIVITY

As has been said before, 'better' can be operationalised in many different ways. In order to be able to cope in an easier way with this multidimensional criterion, I suggest using another concept: educational productivity. In this respect I do not mean productivity in the capitalistic sense whereby, based on competition, output is being maximised regardless of the consequences for the input, and in particular the people and the environment. When I talk about educational productivity I mean productivity as an expression of the optimal use of means, taking into account the limited resources of schools and educational systems, taking into account the need for a natural evolution in human change processes, and taking into account the care for the environments in which we operate, including our cultural and historical heritage.

Educational productivity maximises the effectiveness given a fixed amount of input, or minimises the costs given an acceptable amount of output. Optimising educational productivity implies that technology is used where it can provides its strongest effects: (a) to support communication, and (b) to provide access to information.

Taking into account the very different environments that exist all over the world, specific criteria related to educational productivity will be very different as well. This is certainly the case comparing developed countries with developing countries. In developed countries criteria for using technology could be to stabilise the output of the educational system while reducing the costs (the input). In developing countries criteria for using technology could be to expand the educational system (the output) while keeping the costs (the input) stable.

Summary

It is very important to realize that different environments and different frames of reference lead to different criteria, and therefore to different ways of applying technology in education. Being different, however, does not imply, there should be no criteria.

6. EDUCATIONAL POLICY AND NEW TECHNOLOGIES

In the remainder of my talk I will give an analysis of the new technologies in relation to their use in education.

When implementing technology a number of issues have to be taken care of:

a. the hardware infrastructure of a school,
b. the network infrastructure of a school,
c. the provision of educational materials and software,
d. the teacher or professional training,
e. the integration of technologies in the school curriculum.

For each of these issues, I have chosen one topic that I consider as typical and crucial and express it as a bipolar choice. For each topic I will give you my opinion and point towards policy implications.

6.1. Hardware

Computers labs with PCs or Laptops, input/output and communication devices?

It almost has become a kind of tradition to start the introduction of computers in education with the instalment of computer labs. Computer labs however become very fast the 'private' domain of a few (computer science) teachers. In addition, using computer labs create large logistics problems. Therefore the productivity gains created by such provisions remain limited to the few subjects areas that are able to make use of them. A better solution is to have available a transportable set of powerful laptops that can be moved from classroom to classroom. Each teacher should eventually have his own laptop. In time, such laptops should be replaced by (privately owned) palmtop with CD-ROM drive and/or network computers that can be taken home by the learners, or interactive television that makes use of two-way cable systems. The strategy of policy makers should be that the hardware used by teachers and learners should become privately owned by them, as soon as this is financially feasible. School provisions should be focused on input devices (such as scanners, digital cameras, CD-ROM players in order to present multimedia), output devices (such as projection devices in classrooms) and telecommunication facilities (to connect schools to external networks).

6.2. Network

Internet or Local area network?

Given the discussion about the Internet and its possibilities, it is obvious that it should be the goal of each school to become connected. Given the vast amount of information available on the Internet, significant productivity gains can be achieved in terms of reduction of preparation time of teachers and in terms of reducing costs of learning material by learners. Eventually, in addition, schools should be equipped with an Intranet system, which is a local area network server supporting the same features as the Internet. Such an approach could reduce the communication costs to the Internet significantly in that interesting topics from the Internet and in particular from the World Wide Web can be downloaded onto the local server and used as local applications. This approach can be very productive as Internet contact time can be reduced and also the teacher can better structure and adapt the materials.

6.3. Educational Materials

Quality of materials or Quality of teachers?

Much has been said about the 'lack' of quality of electronic learning materials, such as educational software. However, given the great variety of 'frames of reference', in particular curricula and teaching styles, it is very difficult, if not impossible, to produce electronic learning material that fits many frames of reference at the same time. In addition, one should realise that producing educational quality is an activity that results from the combination of the teacher with his learning material. Just as it is a cook who produces a fine meal given he has sufficient ingredients, it is the teacher that has to use materials and produce a fine lesson with them. Productivity gains therefore are not to be expected from 'high quality' educational material, but from quality materials that can be shaped by the teacher in order to fit his own teaching styles and goals.

6.4. Professional Training

Basics of informatics or Educational technology and quality control?

Teacher training about the use of technology in education is a subject of much discussion. Many aspects can be mentioned in this respect. It is the expectation that teachers will use the potential of the Internet to communicate with each other, to exchange information and to collect examples and materials to be used in their own lessons. As been said before such activity can contribute to the productivity of their actions. However, a crucial variable in this respect is the potential lack of quality control. When teachers receive materials from others, such material has being produced in other frames of reference. It is up to the teacher to evaluate those materials, and decide if such materials are useful for his own activities. A major part of professional training should therefore be spent on developing an expert sense of quality control. Training teachers in instructional, curriculum and instrumentation design, as well in evaluation techniques, could provide teachers with the necessary basics.

6.5. Integration into the Curriculum

Computer literacy or Integration of computers into the curricula?

How much computer and telecommunication literacy should be taught in school as a regular subject area? It can be observed that learners have no difficulty with these issues. It are the teachers who feel uncomfortable with them and therefore refuse or delay integration of technology in their curricula. Many productivity gains can be achieved when technology is adequately and appropriately used in curricula (as drill-and-practice, as simulation, as tutorial, as data-collection device, as a drawing tool, and so on). Therefore it is necessary however that teachers are supported to get over the first threshold. The suggestion by Dr. Semenov, whereby he suggested pairing two teachers (an informatics teacher and a subject-area teacher) at the start of a course in order to overcome the technical and psychological difficulties of the subject-area teacher, is worth considering.

There many more topics to be discussed, but due to time limitations I cannot go into more detail.

7. SUBSIDIARITY PRINCIPLE

In the European Union much discussion is going on around what is called the 'Subsidiarity' Principle. This means that everything that can be handled well at the country level within the community, should not be dealt with by the European Commission. The reason for the application of this principle is very simple. Because of the diversity in each of the countries, the countries themselves are best suited to decide what to do when dealing with specific issues.

The same is true in education. Therefore, as a general principle, let the appropriate educational level decide what is most appropriate to that level, also in terms of using technology. In each case, however, all of our decisions should be driven by the same goal and by the same criterion: using technology to improve educational productivity.

In this respect UNESCO should not do what can be done better by others, such as the creation of educational materials. What UNESCO should do is what national authorities cannot do: provide supranational opportunities for co-operation and information dissemination, such as described in the Global Project presented by Dr. Stanchev, and connect people of different nationalities for better mutual understanding.

The major power of technology lies in its capacity to support communication and to give easy access to information. UNESCO should concentrate its efforts in this area by exploiting these two potentials. UNESCO could transforms itself into a focal point of telecommunication facilities between nations. Instead of having physical meetings, creating major organisational difficulties, UNESCO could create, when appropriate, virtual (video and audio) conferences whereby participants in each country could stay at home and meet in a central location in their country. With the vast amount of information of the UNESCO library and resources online, such an approach could significantly rise the effectiveness of a conference and, most probably, result in a serious reduction in costs.

8. CONCLUSION

Ladies and Gentleman, this is the end of my talk. Much more could be said, but I hope I have said enough to give you an impression of my frame of reference. And I do hope that it will make you think and reflect about yours.

Finally, I want to thank professor Yuri Ershov and all of my colleagues in the International Programme Committee for their availability and their perseverance with this committee. It was very nice to work with you all.

Thank you.

The original is presented in English

PROSPECTS OF DEVELOPMENT OF A RUSSIAN INFORMATION INFRASTRUCTURE AND ENTRY IN WORLD INFORMATION COMMUNITY

A.S. Golubkov

THE CHAIRMAN OF COMMITTEE AT THE PRESIDENT OF RUSSIAN FEDERATION ON THE INFORMATION POLITICS

PROSPECTS OF DEVELOPMENT OF A RUSSIAN INFORMATION INFRASTRUCTURE AND ENTRY IN WORLD INFORMATION COMMUNITY

In last decades of the XX century the world community enters the new stage development - information community. Russia nor costs in party from global world tendencies. The changes, which occur in the world, are accompanied in Russia by great changes in economic, social and political spheres. Much vary and information attitudes in society. In the Russian market thousands firms, delivering modern hardware-software means of the conducting world manufacturers now work. A number of Russian firms are engaged by assembly and delivery of computers. The inventory materials for their manufacture act mainly from boundary.

The majority of the large Russian companies is prepared to the customers by the systems network decisions on foreign catalogues and develop separate components of the software, but also deliver system program environment with the using of own development. In Russia are function the decades of large computer networks of general using. Among them it is first of all possible to name «RELCOM», «ROSPAC», «IASNET», «SPRINT», «INFORTEL», «ROSNET», «TECOS», «SOVAM TELEPORT», which function on the base of protocols TCP/IP. Practically all of them are using in their work the import network equipment. Therefore one of the main problems here is to expand manufacture of means of computer science on the basis of international cooperation.

The computer networks, functioning in Russia, have sluices for output on foreign networks, including in Internet. Among other Russian units Internet follows to allocate education network FREENet. It unites the organizations of RSA and educational institutions. The network Internet is accessible also through service of e-mail from such networks, as BINET, DECnet or Sprint, which uses the other systems of the protocols. Thus, in Russia now already there is the number of elements, necessary base for creation of a national information infrastructure.

At the same time the condition of information in Russia is characterized and beside of unsolved problems: by backlog in relation to countries - leaders in manufacture of own element base, means of computer facilities and communication, insufficient level computerization of various spheres of activity of a society and development of the market of information services.

Despite significant expansion in last years of the information market, the opportunity of access to information is still limited. The majority of the population receives the information in traditional kind - printed editions, radio, TV.

The requirements of economy, successful making of reforms require perfection of a national information infrastructure of Russia (NIIR), overcoming of barriers (legal, economic, technical) for free movement of the information and creation on territory of Russia of uniform information space.

The decision of problems of national information infrastructure of Russia assumes outstriping development of its(her) telecommunication environment as bases of open interaction of information systems according to international model OSI.

Obvious and important condition of development of national information infrastructure of Russia is compatibility of soft - technical platforms of computer and telecommunication services. The basis for maintenance of compatibility could be served by development and realization of open interfaces, the specifications of which should be easily accessible to all suppliers and users of services.

Not less important is the decision of a problem «toleration» of software. Toleration as ability of the applied programs and data to be moved without essential updating on more than one type of computer platforms and, accordingly, operating systems, will allow to a society to save intelligent labour of a plenty of the experts, will create a basis for faster development of an infrastructure.

The development of national information infrastructure of Russia requires creation not only technical and technological base of information, but also account political, social and economic aspects of Russia. It results, as a rule, in essential compilations of western decisions.

Overcoming monopoly of state and commercial structures on information resources and services is also necessary. It is for this purpose required in legislation and economic gears to realize a principle of liberalization of the information market.

Proceeding from specified parcels, it is possible to formulate the following purposes of national information infrastructure of Russia as bases of formation of uniform information space of Russia:

1. Maintenance of the constitutional rights of the citizens on information;
2. Creation and maintenance of a society necessary for steady development of a level of information potential;
3. Distribution of new information technologies to all spheres of activity of a society and person, first of all in education, public health services, science, social maintenance;
4. Increase high speed, stability and efficiency of activity of bodies of state authority, local self-management, subjects of managing;
5. Integration with world information space.

The development of national information infrastructure of Russia will be carried out on basis:

- Modernizations of a domestic microelectronic and computer industry, creation of conditions for development of the domestic market of information, progress of Russian competitive means of information on world markets;
- Encouragement of domestic and foreign information technologies;
- Development of a primary network of communication, especially at regional level, construction of information superhighways:
- Perfection of the legislation on use of information and telecommunication systems by the physical and legal persons, protection of the intelligent property, counteraction of computer criminality;
- Maintenance of compatibility and interaction of systems and networks in view of international systems standartization;
- Providing of access of the citizens to open state information resources, information on activity of bodies of state authority and local self-management.

The quality in market of means and systems of information should be provided by creation of system of organizations for licensing and certification of means and systems of information and information production, including on safety.

Federal and local systems and networks of the tax, processing and the distributions of the information should render various information services to the population, enterprises and organizations on the basis of state information resources. With this purpose we are going to accept the legislative and normative sertificates, determining the rights and of a duty of the officials on formation and to use of state information resources, to decide economic problems, connected to their use.

Formation and the development of an information infrastructure requires significant expenses, designed for a number of years. With the purpose of rational distribution of resources it is supposed step's development of national information infrastructure of Russia and creation pilot zones.

1-th stage (till 2000)

Creation of an infrastructure in several regions of Russia, the most advanced on a level of development computerization and of communication, with improvement on them of principles of construction and functioning of national information infrastructure of Russia, organization of «sluices» for access of the Russian users in international networks.

The 2-nd stage (till 2003)

Creation of information superhighways: Copenhagen - St.-Petersburg - Moscow - Far East; Palermo - Istanbul - Novorossiysk - Moscow with connection of regions in accordance with readiness. It is very important to supply wide informing of a public on opportunities and information services, perfection of system of training and increase computer education of the users.

Creation of a modern information infrastructure - very expensive measure. In such countries, as USA, on these purposes are spent many billions of USD per year. Certainly, main part of work on development of national information infrastructure of Russia will be carried out by private sector as the most dynamic and interested user and supplier of information services. Sources of financing of development of national information infrastructure of Russia will be also means of the federal budget, budgets of regions and local budgets for creation of regional structures of national information infrastructure of Russia.

The main problem of state structures - creation of conditions for investing in national information infrastructure of Russia, attraction of consolidated means of major concerns, industrial companies, banks etc. There could be used also the target loans and other forms of attraction of means from population and commercial structures. The certain prospects are available in Russia and for foreign investments and credits.

For decision of problems in the field of information relations in February 1995 the Federal Law «About information, informatics and protection of the information» is accepted. The specific measures have found reflection in number of the state programs. The federal target program «Informatization of Russia», «The Concept of Formation and Development of Uniform Information space of Russia and appropriate information resources» and number of the documents on support of various directions of information were prepared. The projects and programs, directed on development of national information infrastructure of Russia, including such as «A Business network of Russia», «The National Telephone» and other wilt be realized.

International information exchange and cooperation. The leading countries of the world work international information infrastructures out. At various levels the projects of creation of a global international information infrastructure are discussed.

Russia and partners are interested in international information exchange. The integration of Russia as of the equal in rights partner in international information community will allow:

- To receive access to information resources of all countries (members);
- To develop networks of communication and system of information as on federal, and on regional, local levels;
- To ensure progress on world market of domestic high technologies and «know-how». It is a lot of useful it will give to the partners of Russia in development of vast markets and resources.

However, except political will, the high-grade integration of Russia in global information community requires the decision of problems, connected to technological and legislative questions, touching use of computer technologies and networks of telecommunications, protection of the information and information safety. Therefore the entry of Russia in global information community will be evolutionary, in view of experience of other countries.

By virtue of that the rates of development of an international information exchange will be determined, mainly, activity of private sector, including foreign, to state bodies in this period follows to give attention to creation of an international legal mode, ensuring an information exchange and application of the sanctions to the suppliers of off-standard means of telecommunication information products.

Now the legal basis of an international information exchange is developed insufficiently. Acceptance of the acts in this area in Russia and appropriate international agreements is required.

The successful development of an information exchange is possible only that condition of maintenance of protection of the rights of the intelligent property would be provided. In this area the situation is bad even in advanced countries. That concerns to Russia, the state bodies at last 3-4 year have undertaken a number of measures on protection of the rights of the developers of the computer programs, databases and other information resources. Therefore the situation recently begins to be stabilized.

Other aspect of a problem - protection of information resources as of objects of the property. The significant part of information resources according to working rules of law is not referred to objects of protection of the intelligent property, it appear legally unprotected.

The heaviest complexities cause questions of unauthorized access to confidential information of computer networks. These questions closely adjoin to problems of personal data. We have developed system of the legal sertificates and measures on protection of information resources.

It is clear, that the realization in today's conditions of a principle «free input» of information resources for all participants of an international information exchange results in reception of unilateral advantages by advanced countries. Besides the payment acceptable to advanced countries for using by network resources frequently appear inaccessible for Russian users. The factor, rendering adverse influence on Russian economy, can become non-adecvation of an information exchange.

The ability to interaction of information systems, using a plenty of the various equipment, is caused by development of many global standards. The development international standartization in sphere of information will be realized within the framework of work, conducted under aegis of joint Technical committee CTK «Information technologies» and some European bodies on standartization of IT. Russia participates in this process through Technical committee TK22 «Information technologies».

There are the problems, connected to humanitarian questions. New information technologies, the systems multimedia, virtual reality, remote work and training change an image of life of millions of the people. The mass consumption bad of information services of a type porno of videofilms, video conference, games, renders adverse influence on consciousness, especially of youth. The international information exchange aggravates these problems.

Important for us is the cooperation to countries of CIS. Integration processes, occurring in these countries, have caused need for agreed development of national information infrastructures of country of CIS.

According to decision of coordinatory-advisory Committee of CIS creation of Incorporated system of an information exchange between state-participants of CIS, Interstate system of the legal information for countries of CIS is carried out.

In November 1995 the Council of the Heads of Governments of countries of CIS has accepted the decision on formation of uniform information space of Commonwealth of Independent States.

And, in summary - main directions of development of an international information exchange. For development of an international information exchange and the cooperation are necessary for making active work of international organizations on following directions:

- Perfection of legal protection of information resources, including protection of the intelligent property in open telecommunication systems;
- Formation of international arbitration information court on disputed situations in international information exchange:
- System engineering of the international standards, first of all ensuring International interaction and information exchange;
- Formation of system international sertification program and means;
- Creation of favourable economic conditions for international information exchange, first of all in the field of science, education, small business.

The original is presented in Russian

REPORT ON THE WORKSHOPS

Ivan Stanchev

DEPARTMENT OF EDUCATION,
UNIVERSITY OF TWENTE (THE NETHERLANDS)

In his report, Prof. Stanchev pointed out that, in addition to the plenary and commission sessions, *12 educational-and-practical workshops* were conducted within the Congress framework on the following topics:

1. Information Superhighways and Education *(Part I:* Prospects and problems of common global and regional information space for education; *Part II:* From Information Literacy to Information Culture).
2. The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies.
3. The Software Environment – A Perspective for Effective Involvement.
4. Transfer of Knowledge and Skills through Information and Communication technologies.
5. National Policies - Transfer of Technologies.
6. Individual Distance Training.
7. Analysis of UNESCO/IFIP (International Federation for Information Processing) Documents published in 1994-1995 *(Part I:* Informatics for Secondary Education - A Curriculum for Schools: *Part II:* A Modular Curriculum in Computer Science).
8. Logics, Informatics and Education.
9. Information Technologies and Humanities Education.
10. Development of Pre-University Education via Modern Information Technologies and Methods.
11. Medicine: New Approaches to Knowledge Acquisition and Improvement.
12. Forming Integrated World Data Bases and Knowledge about Planets of the Solar System and Their Use in Research and Education.

The workshops were chaired by leading experts, academics and researchers such as: David Walker (UK) - DW Associates consultant; Peter Waker (South Africa) - IFIP TC3 - Computer Olympiad consultant; Alain Meyer (France) - Director of Centre de Tele-Enseignement, Conservatoire National des Arts el Metiers (CNAM); Tom van Weert (The Netherlands) - Director of the Informatics School under the Mathematics and Informatics Department of Ni-megen University, 3.2 IFIP Working Group Chair; Har-ald Schutz (Germany) - Deutsche Welle Internet associate; Konstantin Koline (Russia), First Deputy Director for Research of the Informatics Institute under the Russian Academy of Sciences; Yuri Afanasiev, Rector of the Russian State Humanitarian University; Alexey Semenov (Russia), Deputy Chair of the Moscow Education Department, Rector of the Moscow Institute for Professional Upgrading of Education Workers; Nikolay Yevtikhiyev (Russia), Rector of the Moscow Institute for Radio Engineering, Electronics and Automatics.

Over 200 experts in various fields of education and computer science took part in the worshops.

Prof. Stanchev drew attention to the great number and diversity of the opinions voiced at the sessions and of the proposals to be incorporated in the work on the final documents of the Congress.

The results of the workshops were summarized as the following conclusions:

- Information and communication technologies have brought to life new forms and methods in education and promoted open and distance education.
- Effective implementation of new information and communication technologies in education requires improvements in the system of teacher pre-service and in-service training, including the development of social programs and courses.
- It is necessary to coordinate the efforts of instructors at the higher and secondary educational establishments applying new information technologies in the teaching process with those of the hardware and software developers.
- The information and communication technologies have a significant role to play in reforming the education systems, particularly in the developing countries and those undergoing a period of transition.
- The implementation of information and communication technologies can change the content and assimilation of the knowledge taught, as well as promote the development of individually oriented education.
- Support on the part of the governments, international and regional organizations is essential in order to extend the emerging communication networks 'and superhighways to the institutes of education.
- Conditions should be provided .within the framework of international cooperation in education to promote the exchange between schools and individual instructors of information and of the programs for learning new information technologies. Telecommunication technologies can be a major factor in the achievement of this objective.

The reports on the results of the workshops contain many practical proposals on implementing international research projects which could be of interest to UNESCO and its institutes related to education and the information science..

The original is presented in English

REPORT ON COMMISSION I

Katerina Martcheva

DIRECTOR OF THE HIGHER SCHOOL FOR FOREIGN LANGUAGES (BULGARIA)

Ms Katehna Martcheva, President of Commission I, pointed out in her report that the discussion of the trends, introduction experience and the implementation of new information technologies (NIT) in education covered the main topics of the Congress.

When the topic «Learners» was discussed, the participants analysed the basic stages of applying NIT at various educational levels, examined the instruction in computer science course using the experience compiled by general secondary schools in Russia and Switzerland, and identified the difficulties involved in the development of computer tutorial programs for various disciplines and in providing the learners access to new technologies.

The application of NIT can significantly change the role of the *tutor.* The reports pointed to the need to organise the course that would make it possible for the teachers to effectively apply NIT in the teaching process. There is also a need for educational computer networks available both to the teachers and learners free of charge. Besides, to ensure a better effect from the application of teaching networks, they should incorporate the tutorial programs worked out by the teachers, since they are best suited to be the pioneers, innovators and initiators in a wide-scale application of NIT for educational purposes. Interaction and mutual assistance of the teachers can be greatly enhanced by the use of computer networks. Due to computer networks, the teachers have an access to comprehensive information and resources and can choose the programmes best suited for their specific curricula and tuition subjects.

It was stressed that the implementation of new information technologies should be focused on *pedagogical rather than psychological aspects.* The latest and traditional *technologies* should be mutually complementary if the most suitable interactive educational materials are to be developed.

As was pointed out, there were some great expectations connected with the possibility of applying computer information systems for achieving social and economic objectives. However, since the research so far conducted into the possibilities and implications of applying NIT in various fields is still not adequate to the task, a more profound analysis is required of the ranges and limitations in the implementation of these technologies.

Other subjects discussed within the framework of the Commission's work were the problems encountered by the teaching and learning humanities in the new informational environment. University education places a great importance on informational independence and informational freedom. In fact, informational freedom is the foremost objective of the education inhumanities. The participants pointed to the need for applying a more humanitarian character to the education in natural sciences, and engineering/technical fields.

The use of multimedia, as was stressed, though providing the required knowledge and information resources, cannot adequately substitute for the learners' and teachers' interaction.

Since the institutes of education lack the possibilities for producing tutorial software on their own, it would be desirable for UNESCO to coordinate at the international level the efforts aimed at providing software for schools, that is to say, to promote its legal use by schools and the development of computer programmes specially designed for application at school.

The speakers presented data on the application of new information technologies in a number of countries. The French educational system was described to demonstrate the principal strategies adopted by the French Ministry for Education to achieve the following objectives: modernisation of educational management in schools, introduction of respective NIT into the technical and vocational training, measures necessary to ensure the application of NIT as the teachers' aid in various disciplines, the use of NIT in general secondary schools via Internet, making computers available to the learners.

Other problems involved in the implementation of new information technologies relate to the countries' inequality in respect of availability of required technologies, the system's instability, and the teacher training. As was pointed out, every institute of education should have free access to computereducational resources.

The speakers stressed the need for working out a more clear-cut NIT classification and terminology for educational applications.

Attention was drawn to IFIP contribution to the development of NIT and to their applications in teaching and learning processes attained due to IFIP's close ties with UNESCO and to the convention of conferences, seminars and consultations.

The materials on the pedagogical and psychological impact of NIT on the teaching process, translated into several languages, as well as the modular computer science curricula for the higher and secondary schools, could significantly assist the effort to apply new information technologies at school.

A proposal was put forward on the development of an international programme for legislative support to the system of distance education and for obtaining government licenses and certificates at the national and international levels.

In conclusion, Ms. Martcheva thanked the Russian colleagues for their good organization of the Congress and the rich and interesting cultural program organized for the Congress participants.

The original is presented in English

REPORT ON COMMISSION II

Gerald McConaghy

WINNIPED (CANADA)

Ladies and Gentlemen,

Our Commission deliberations on technology and education can be summarized as having dwelt on the following: culture and language, equity and accessibility, the role of the school in a knowledge-based society, teacher training and the sharing of information. I shall speak briefly to each of these.

Culture and language. It was felt that technology should be an instrument that enhances language and culture. Some concern was expressed about the Internet. While it provides fast and easy communication among users and provides limitless information for young people on any subject, its dominant language is English. This is worrisome for many countries who wish to maintain and enhance their language and culture. Internet usage is expanding rapidly and young people of all languages wish to use it. How can the Internet remain a facilitator of communicating and yet not undermine languages and culture? We did not arrive at any solutions but raise the question as one needing serious study and action.

Equity and accessibility. There are major differences in the funding of education and of technology from one country to another and, indeed, from one region to another within a country. This means that the schools in richer countries will have more computers and greater access to technology than poorer countries. It was pointed out that the problem is further exacerbated by the continuing cost of new information technology. As one speaker reported, costs are not going to diminish over time; in fact, they are likely to go up. Equipment wears out, new equipment is needed, new software, etc. What are the ways to ensure some reasonable level of equitability for new information technology among countries?

The Role of the School in a Knowledge-Based Society. Our Commission kept coming back to the role of the school as we move into a knowledge-based society. How must the school change? What kind of curriculum., particularly for information technology, should it have? What is the role of teachers and other professionals in helping students use new information technology? For our Commission just as important was the question: What is the role of the community in helping the school prepare young people to enter a new era dominated by communications and knowledge? It was felt that the school cannot be isolated from the community. It will be only through partnerships between the school, parents, business, etc. that the school will be able to carry out its mandate and that a society, committed to learning will develop.

Teacher Training. This follows from the role of the school. Our Commission felt that there needs to be new teacher training models which take into account the new information technology. Teachers need to be equipped with instructional skills to use technology as a pedagogical tool to help young people improve their learning. Teacher training is needed at both the pre-service and in-service levels. With in-service, much of it can be delivered at relatively small expense through on-line training as teachers continue their work in the classroom.

Sharing of Information. Because of new information technology, distances between countries, institutions and individuals have evaporated. There is now a need to share information as to what is happening in education and in research on the use of information technology. Each of us can benefit by being aware of and reviewing the work that others are doing. Mechanisms need to be found to help us in this sharing so that we are enriched by it.

Mr. Chairman, we spent some very productive time in our Commission. We had representation from many countries expressing many different views. I was impressed with the common interest that we all shared in trying to promote new information technology as an important tool to help young people learn.

Thank you for your attention.

The original is presented in English

REPORT ON COMMISSION III

Alexey Dovgyallo

UNESCO/IIP RESEARCH AND TFAINING CENTRE,
V. M. GLUSHKOV INSTITUTE OF CYBERNETICS
(UKRAINE)

Dear Chairperson,
Ladies and Gentlemen!

I would like to begin with a general impression from the work of our commission and the Congress.

On the one hand, it has been a very professional Congress. I have been in educational technologies for more than 30 years and it has been very interesting for me to listen to the plenary reports as well as to reports and presentations at the commissions.

On the other hand, what we have heard is not merely theoretical work, it is work that may become a good basis for practical plans of national programmes for educational informatization in national commissions and other institutions charged with implementation of new technologies in education.

Distance education dominated the discussion at the 3d commission. The group of Russian reports should be specially marked out.

The commission discussed the importunate issue of theoretical principles of information technologies in education. Prof. Larijani (Iran), Ukranian experts and some others made very interesting reports on this issue.

The commission also discussed the idea reflected in the recommendations, about three groups of countries defined by UNESCO, that is developing, developed countries and countries in transition. It is true that each of these groups of countries has its own specific features and should be regared separately.

I would like to mention Mr. Kalimba wa Katana, Minister for Higher and University Education and Scientific Research (Zaire) among the speakers. He expressed interests of African countries in informatization of education and prepared substantial recommendations on that account. I hope they will be included in the draft document that we have received.

Mr. Don Ferguson's report had a very important issue common with the key note speech made by Congress Chairman Kinelev. He suggested that Technology should be added to the list of fundamental disciplines, then communication technologies will occupy their proper place.

One more importante issue discussed at our sessions and put into the recommendations. I mean setting up of UNESCO Institute for Information Technologies in Education which is planned to be open in Moscow. We wish this Institute to have short term analysis of whether this or that educational technology is prospective or not as one of the priority activities. Results of such work will help to save a lot of means and efforts of specialists in various countries. Certainly these analytical reports should go through UNESCO so that they received exertise at the highest level, and countries and groups of countries could use them for practical purposes.

I will not use any data as illustartion, the Congres Secretariat has them.The only thing I would like to advise on is to take into account when writing the final list of recommendations, the documents that were submitted to the commission and to publish them either as appendices or some supplement.

On behalf of our commission, its experts, scholars, administrators I would like to thank organizers of the Congress, the Russian Organizing Committee and wish that such Congresses be held not once in 7 years, but every two or three years.

The original is presented in Russian

SUMMARY REPORT

John Foster

RAPPORTEUR GENERAL
(UK)

It is my task to summarise 45 hours of meetings in under 20 minutes.

First, I have to say how impressed I have been at the high standard of presentation that we have had in the last week. Some of it was even addressed to the correct theme of the day and even sometimes directed at the correct commission audience! But even where it wasn't, the content has been almost entirely on one of the themes of the Congress and this I find rare these days, as so often people come to Conferences and deliver a paper on a favorite topic, regardless of the Conference's theme. Perhaps we were lucky and we chose your favorite themes as our themes and so there was no conflict.

Last night I read through the speeches from the last day of the 1989 UNESCO International Congress in Paris. As Mr. *Colin Power's* speech predicted on the first day of this Congress, we have been talking about and agreeing with much of the same matter as you did in 1989. Then, as now, you were calling, amongst other things, for more research projects to give us a greater insight, tools to lessen the gap between the developed and developing countries, a sensitivity to cultural differences and a resistance to any international homogenisa-tion of education. The main difference is that today, as Mr. *Kinelev* said in his speech on Monday, we have the possibility, through the Internet, of creating a global information system with multiple possibilities for the spread of knowledge and for research and as Mr. *Rockley Miller* said on Tuesday, very fast, (and Victor Hugo said before him, rather more slowly I guess) "There is nothing so powerful as an idea whose time has come".

So we now have a powerful tool and have one less excuse than the 1989 delegates had and we must hope that my successor in the next world Congress will be reporting more progress than I can on these issues.

But then we have also had this week many warnings about this tool. The warning as to the potential damage from the information ecology (cited by Mr. *Sendov)* to the cultural ecology of the world has been being echoed throughout the Congress. The rapid adoption of a sometimes anarchic Internet, as well as possibly acting for the benefit of the world, could also bring about ruin to cultural diversity. I liked Sendov's image of computer pollution being potentially to our age what the factory chimney was to the industrial age.

Mr. *Matsumae's* analysis of the needs of Higher Education and his reports of activity in his one gave us hope and examples of benefits and potential benefits of the computer age. He also began, what has been a trend throughout the Congress, to talk about opportunities for sharing across boundaries, in cultural groupings, and, where appropriate, beyond them. Mr. *Hafaiedh* also talked of sharing and of the globalization of learning and gave a historical perspective on the development of learning pedagogies - and so we were launched into the first Commission Session for our first theme, «The Learner».

I have to say, that most of the first theme Commission papers were not, as they should have been, about Learners, and we had the problem in all rooms with speakers overrunning their time and therefore, of no time for discussion. I hope you found that this got better during the week. The Rapporteur, and UNESCO staff met with me each day to report on the activity of the commissions and the recommendations from them and it was noticeable each day that they reported more debate and more recommendations for further activity. You will have by now the draft recommendations and declaration document in French, Russian and English and you will see that there are many suggestions. You may find that your recommendation has been reworded. This is because, with so many, we have tried to roll them together to make composite recommendations. You may also find that your recommendation is not there at all. We could not include individual people's recommendations unless there had been some opportunity for them to be debated and for some consensus reported to me by the Rapporteur. I am sorry about this, but of course this does not stop you making your recommendations, perhaps through your governments, to UNESCO, through the usual channels. I will talk more about the recommendations later. And so we came to Tuesday and the theme "The Teacher" in the morning and "Technologies" in the afternoon. A superb example of the use of the Technologies for the benefit of Teachers was given to us, in the first plenary of the day by *Kumming Qian,* showing us how the Television Teachers' College of China was meeting a huge problem of underqualification of teachers with spectacular results. And this you will remember was followed by my good friend *Alexei Semyonov* with a characteristically well prepared presentation of some of the problems and solutions for teacher support and change in Moscow.

By now we were starting to get from you all some consensus and some conclusions. We were hearing of the need for teachers to become involved more in the change process that goes along with the introduction of NITs - and here I will interrupt myself. The Bureau of this Congress agreed that we should stop using this term and start saying Information and Communication Technologies (ICT). This proposal was too late for inclusion in the Declaration and Recommendation Document you have been given, but you will find it incorporated in the corrected version of the document which will be circulated in the final report.

Back to your gathering consensus on Tuesday. Other things which were reported from all commission meetings included the observation of the changing role of the teacher and the ESSENTIAL need to give her/him training and support as near to the classroom as possible. Of course if *Ivan Stanchev's* widely supported proposal gets established and the government of Member States take heed of our encouragement in the Recommendations to urge the telephone companies, Internet providers etc. to do special deals for educational institutions like giving us everything free, we would have an option for support right along side the teacher with all the advantages of an economy of scale that providing a worldwide service brings. In the afternoon we had another pair of superb presentations introducing the Technology theme. From *Jean-Pierre Arnaud's* speech I took particularly to his stress of the teacher's pivotal position in the learning process, and his warnings that this should not in any way be allowed to become subservient to the technology - important though this is.

Rockley Miller delivered my revenge to the interpreting system. My enjoyment of Professor Arnaud's talk was marred from time to time by loud cross-talk in Russian coming on my headset on the English channel. I fear that the interpreters had a very rough time trying to keep up with the flow of Rockley's delivery. But his content and argument was stimulating and his prognosis for the future was nothing if not optimistic. I have heard him speak several times and he always does an excellent job on his brief. Many keep up with his views and his vision through his publications. The examples of the technologies talked about in the commissions showed not only the diversity of the media but also the trend to their convergence. There was quite a bit of talk about cost versus educational gain and you will find in the recommendations two suggestions for research which might just help to pin down the role of ICT in the learning process. One not only asks for an investigation of the medical effects of technology use but also looking into its role in affecting student behaviour: the other looks at comparisons in the learning gain between traditional pedagogy, technology enhanced pedagogy and technology based pedagogy.

The International Working Party gave us a Congress based on a deliberate choice and order of themes. We started on Wednesday morning with «Social, Economic and Cultural Issues». By now we were getting to know each other and it was perhaps easier for us all to be honest in our discussions without taking or giving offence. *Dr. Poelchau* talked about all three (Social, Economic and Cultural Issues) and his concerns especially about the dominating forces of, especially, the US in, especially, the media of entertainment were echoed in several of the Commission sessions later. He also made many references back to our Main Working document, which I was grateful for, as we were beginning to forget it at this stage of the Congress - and it reminds me at this stage of my report, to exhort you to re-read that Main Document, especially alongside your reading of the Draft Congress recommendations which we will be taking next on our agenda. Following Dr. *Poelchau* we had a presentation which brought those of us from comparatively developed countries down with a bump to reality. You could not but be impressed by Dr. *Motsoaledi's* enthusiastic commitment against such enormous odds and his vigor at attacking such comparatively insuperable problems. The Northern Province of South Africa should be in our thoughts when we next complain about inadequate funding in our institutions. He tells me that he is concerned more with getting expert help to his Province even than he is with money. He doesn't want the flying visit of a so-called expert but the commitment of suitable people for at least a year to help him break through his enormous legacy of neglect and under achievement left him by the Bantu Education Act in particular and by Arpatheid in general. We had a recommendation almost at once that would, no doubt, help his Province as well as other developing countries. You will find it under Theme 6 (4).

The Plenaries on Wednesday afternoon were from Professors *Valente* and *Plomp.* The first presentation, from *Jose Valente,* gave us a paradigm based on Piagetian philosophy and argued for a constructivism through programming to a result in student comprehension, rather than the usual paradigm of the computer delivering tutorials, games and multimedia (the computer serving learning rather than teaching). Professor *Plomp* talked of the need for policy makers to be provided with the necessary information on which to make decisions and showed us some of the international statistics from his research findings in the early 1990s, and of his developing researches - a worldwide information and communication technology in education study (ICT-2000) which will look for emergent practices including in out-of-school use and the measurement of the effect of technology on achievement and attitude.

By Wednesday evening we were being inundated with excellent proposals - enough to spend UNESCO's entire budget for years to come. The Congress was in full swing. Increasingly we were hearing of the need for practice to be shared, of results and strategies to be recorded. We were reminded of the spectacular tools that ICT can provide for children (and adults) with special needs - an area which perhaps we did not cover sufficiently in the formal part of the Congress - and an area where perhaps there is best evidence for technology producing benefits cost effectively.

And so we came to our last theme, yesterday (it already seems a long time ago) in which in the Plenary we had three speakers. I thought I was familiar with UNESCO's work but I learned that I was not when I listened to the Assistant Director General with an unpronounceable name (Mr. *H. Yushkiavitshus)* who told us about UNESCO's work in communication, information and informatics. You will, of course, have his paper in the final report and it is as well as I could not possibly allow myself to select from all he had to tell us in the minute of time I have left. Professor *Trindade* from ICDE gave us an excellent overview of trends in Distance Education - another idea whose time has truly come if we are going to be able to report any progress by the next Congress. Our last plenary speaker in the last of our themes was *Wim Jansen* from the European Commission with far too much information to give us for the time we left him - and a man about to get bombarded with e-mails if the queue to talk to him that didn't get to him after his speech is anything to go by.

I will not attempt to draw from this afternoon's presentations as they are, no doubt still ringing in your ears and you have had an oral report of the workshops and of the commissions. It only remains for me to introduce the Draft Declaration and Recommendations Document and then to hand you back to the President to take you through the formal process of adopting them as the views of this Congress.

The original Is presented in English

ADDRESS

Colin N. Power

ASSISTANT DIRECTOR-GENERAL
FOR EDUCATION,
UNESCO

Mr. President,
Mr. Rector,
Vice-Presidents,
Rapporteurs,
Distinguished Participants,

First, allow me on behalf of UNESCO's Director-General, Mr. Federico Mayor, and of the Congress, as well as of myself, to convey our sincere congratulations to President B. Yeltsin for his impressive victory in the elections. At the same time may I take this opportunity to say that I am very pleased to continue to work with respected colleagues such as Professors Kinelev, Meskov, Tkachenko, Bolotov, Zhukov and others at the Russian National Commission for UNESCO.

We have discussed, in the last five days, during 8 plenary sessions, 18 sessions of the three Commissions, as well as 12 workshops, the use of Information and

Communication Technologies (ICTs) in education, in the light of the presentations made by over 100 speakers to 800 registered participants. In addition, we have had a splendid exhibition of the state-of-the-art application of ICTs in education and a rich menu of workshops. All these have together contributed to an active informed interaction and sharing among participants, which is characteristic of this Congress.

The Congress has now approved a Declaration and made Recommendations which clearly reflect the awareness that these rapidly advancing ICTs constitute a real challenge to the world community in general, and to education, in particular. I can assure you that the Secretariat will make grammatical and translation corrections as promised, before publication and distribution. I would like to stress that I was impressed by the very concrete suggestions made with respect to each of the themes chosen for the Congress - learners; teachers; technologies; social, economic and cultural issues; policies; and international co-operation. In response to the many needs and problems identified the role of international co-operation becomes particularly accentuated. You have asked us particularly to promote the exchange of successful policies, strategies, teacher education models, case studies and research, to promote networking of institutions in ICTs, to establish fora via Internet, to promote quality in the application of ICTs.

To this effect, I would like to invite you, as representatives of your Organizations and as experts in your personal capacity, to co-operate with UNESCO in the implementation of the recommendations you have just made. After all, you produce these policies, programmes and materials. We need the high level of expertise and depth of experience worldwide reflected here. UNESCO is you; it was created to represent teachers and those who work in the information and communication sciences, to promote the exchange of ideas, knowledge, programme and expertise. And you have produced many proposals for action - A Global Network for Teletraining for Teachers, a UNESCO Institute on Educational Policy and ICTs, the Workshop Recommendations.

You may rest assured that your recommendations will, in the forthcoming years, serve as important guidelines for the development of UNESCO's programme in the field of education and information and communication technologies, including capacity-building on ICTs, which is of particular concern to the Sector of Communication, Information and Informatics, and to application of information and communication technologies in education, for which the Education Sector and thus I are responsible. I assure you that the publication will be produced quickly.

One word of realism, UNESCO is an intergovernmental organization, therefore priorities among programme activities are determined in the end by the decisions of 185 Member States at the General Conference. Our budget and staff are small, so that we cannot cope with all recommendations; our role is catalytic, to ensure that the recommendations, the ideas of experts, are taken into account and influence policy. Nonetheless, I am pleased to inform you that there will be an immediate follow-up to your recommendations, and I will certainly present them next week to the Director-General together with the recommendations on the 45th session of the International Conference on Education, which will be held in Geneva on 30 September. There will be a special Round Table on the recommendations of the Moscow Congress, which will examine ways and means for their implementation.

The Director-General has also decided to inform and consult the Member States on the proposals and suggestions of the Congress, as well as on UNESCO's programme "Learning without Frontiers", by convening a meeting with the Permanent Delegates in Paris at the beginning of November, 1996. The meeting will focus on how ICTs can break down and not create frontiers and barriers - especially barriers of distance and cultural types. It has to promote the application of informatics and communication technologies in education -only to the extent to which it enables us to improve access to information and educational programmes to those who have not been reached; only to the extent that it helps us to improve the quality, the relevance and the effectiveness of teaching; only to the extent that it improves both teachers and learners.

Needless to say, the recommendations will also constitute an important contribution to the preparation of UNESCO's programme and budget for the forthcoming biennium, 1998-1999. The fact that your recommendations will guide the Organization in this field to the beginning of the 21st Century gives indeed a special meaning to this Congress and to its work.

Personally, I would like to express my thanks to the host country, the Russian Federation, to the rector of the Moscow State University and to his staff and students for their wonderful co-operation in the preparation of the Congress (hospitality, translation, interpretation, etc.).

I would like to address special thanks to the Russian Organizing Committee, led by Professors Kinelev and Meskov, and their team of 23 top personalities. One should admit that it was not easy to organize a congress of this magnitude and complexity during the week of Presidential elections.

Also special thanks are due to the International Programme Committee members, especially to Academician Y. Ershov and Professor J. Moonen, the co-chairmen, for the very rich programme created for us.

I thank also the Bureaux: Presidents, Vice-Presidents and Rapporteurs for their wonderful work.

Last but not least, I thank everyone in the conference room, all participants in this very important international event.

Thank you for your attention.

The original is presented in English

ADDRESS

V.A. Sadovnichy

RECTOR OF LOMONOSOV MOSCOW
STATE UNIVERSITY (RUSSIA)

Mr. President,
Ladies and Gentlemen,
Esteemed Colleagues,

Our Congress, I am convinced, has been successful. For the past five days we have either been participants in or witnesses to extremely interesting discussions on a whole range of issues relating to informatics and education, and have seen effective demonstrations of the possibilities of the new technologies.

While only a few years ago the big news in information technology was the introduction of computers into everyday life, today's Congress has been held against the background of the expanding possibilities in education, science and culture afforded by global network technologies, and first and foremost the Internet. This is hardly surprising. A decisive factor in the worldwide development of science and education today is the trend towards globalization and internationalization. The most significant research projects in the fields of space, information technology, ecology, biotechnology or nuclear physics today involve scientific institutes all over the world. The presentation and operational exchange of results, and the manipulation of data as usually presented in the relevant fields are now urgent tasks, the solution of which will determine to a large extent the speed of scientific and technological progress.

Allow me to touch very briefly on a number of issues which have been the subject of lively discussions at this Congress. These issues are of concern not only to me as the Rector of Moscow University. As President of the Union of the University Rectors of Russia, I know that they are also of concern to the rectors of other universities and institutions of higher education in Russia.

One of the most basic issues of higher education is that of ensuring a close link between science and scientific endeavour in the noblest sense of the word and the teaching process: a close link. between a sound knowledge of mathematics, physics and other basic disciplines and practical work on concrete problems at the cutting edge of science, using the most up-to-date equipment and technologies - this is the ideal towards which we should be striving. It is one of the main tasks of any university, but it is not a simple matter to undertake successfully.

On the one hand, in such institutions of higher education as Moscow University we have outstanding scientific departments headed by the leading scientists of Russia. These institutions are thus great reservoirs of the very best science.

On the other hand, these scientific departments are experiencing great difficulty in ensuring decent working conditions and renovating their scientific and computing equipment in these times of economic transition.

It is clear that unless it manages to do this, Moscow University will lose its leading position as a major centre of science and education. Therefore, we need to draw up priorities, one of which must be the most rapidly growing technologies in the world, information technology in general, and in particular the network technologies used by the Internet.

The global Internet network, and the information technologies used by the Internet are playing an increasing role in education. As you know, there are a number of technologies for distance education, based on specialized satellite networks, telephone channels, etc. However, none of these systems has a universal range comparable with that of the Internet in its present state. The Internet is particularly well suited to the internationalization of education. Certain countries are well known for the teaching of particular subjects. For instance, Russia has long been famous for its schools of mathematics. Using the Internet, it should be possible for Western colleagues to learn mathematics from leading Russian professors, and for our students to study physics at Stanford or Berkeley.

Such a system of universal education over the Internet would be mutually beneficial, and would help people to get the best from each country. Such a system should constitute the next great step towards the achievement of an open society. The large-scale daily exchange of information should help to make the progress of information technology in all countries irreversible, and to promote humanitarian values rather than ideological dogma.

In order to do this successfully there is a need for a well-developed Internet infrastructure both in Russia and all over the world. Sensing that the basis for the development of the information technologies of the future would be computer telecommunications, in the early 1990s we established, with the scientific equipment of Moscow University, a powerful teleport. Using the highest point of the main building of the University, we established a Radio-Relay Centre which today links Moscow University with the main scientific research and teaching centres of the Moscow region. We are participating actively in the construction of the Moscow high-speed fibre-optic highway, and are now in a position to exchange information with other leading scientific centres in Moscow. By laying the foundations of the Russian universities' computer network RUNNET, we have provided access to the global Internet not only to institutions of higher education, but also to schools and scientific and cultural organizations in various parts of Russia.

Moscow University does not confine itself to the solution of its own problems, but plays an active leading role in the community at large. With its own international Internet channels, which currently have a total capacity of 1.5 megabits per second, Moscow University is the largest provider of network services in Russia.

Three years ago we began building a high-speed network infrastructure on the Moscow University campus, linking separate buildings with fibre-optic cables. There were fears that there might be little demand for these services, and that lecturers and professors might not feel at home with the new set-up But reality surpassed all expectations, and all apprehensions were laid to rest. Familiarization with the network technologies is proceeding so rapidly (indeed exponentially) that we barely have time to help those who, for various reasons, are lagging behind (essentially those working in the humanities); we are too busy trying to satisfy the demands of those who have already acquired basic Internet skills and are eager to progress further.

There are plans for a complete overhaul of the Moscow University intranet using the latest standards for data transmission.

Today, Moscow University is able to provide all types of Internet services, from e-mail to audio- and video-conferencing. I hope that many of you participants in this Congress now realize this. All the plenary meetings, including today's, have been broadcast as video conferences over the Internet. We have also held live video sessions with colleagues from the Russian Universities of Novosibirsk and Voronezh. Indeed, over the past year we have held video conferences on a regular basis with our colleagues from Novosibirsk University and the Urals University.

Active use has been made of Web technology, and in particular there have been demonstrations of electronic textbooks in a network environment. At Moscow University, over 100 electronic textbooks and teaching aids have been created and are now in use. Many of these were demonstrated at exhibitions held during the Congress.

Given the current financial situation, these achievements would not have been possible without the support of the Russian. Ministry of Science, the Committee on Higher Education, and Russian and foreign (in particular French and German) scientific funds. Considerable assistance has been provided by commercial firms, such as Silicon Graphics. It seems to me that all possible support should be provided by UNESCO and other international organizations to science-education and academic computer networks forming part of the Internet system. Without such support, we will not be able to keep pace with the current demand. There is a need to concentrate funding on support for major national and international projects for the creation, of information superhighways.

An important issue discussed at this Congress is the introduction of the new technologies into the teaching process in schools. Many of today's school pupils will be the students of tomorrow. Hence the skills they bring with them to university will determine their ability to adapt to a new environment and to uncover their own potential. For this reason, we do not only visit schools and seek out young talent from the most remote corners of Russia and the former republics of the Soviet Union, we also help schools in Moscow to lay the technical foundations for the introduction of new teaching technologies. Today more than ten Moscow schools work over Moscow University's computer network.

In our work with school pupils, correspondence courses have proved very useful. We have several thousand pupils studying with us through correspondence courses. Using new equipment and network technologies, such correspondence courses have been transformed into a state-of-the-art form of distance education.

Over the years, Moscow University has acquired a considerable reputation for its facilities for postgraduate studies, requalification, and in-service training of university-level teachers and researchers working at the cutting edge of various scientific disciplines, in which a significant role is played by self-education, and which are particularly well-suited to the use of the new information technologies. We are seeking ways to introduce these technologies, and for this purpose we are endeavouring to establish sound technical and methodological foundations, which will thus determine the future shape of continuing education at Moscow University.

I am convinced that CD-ROM technology constitutes a promising trend in education. CD-ROMs provide a rational 'packaging' for a tremendous volume of audio and video information, but also make it possible to combine such information with an intellectual component, which is extremely important for the creation of teaching aids with assessment modules. We have just begun work in this area, and you have been able to see the first results in the form of the guide to Moscow University on display in the hall outside this room and in the exhibition building.

Dear colleagues,

We are well aware that the path leading to the solution of the problems raised and discussed by this Congress will not be easy. We at Moscow University and in Russia are only at the beginning of this path. However, in my view, the main thing is to be aware of the tasks ahead of us. to choose the right directions for their solution and to take action.

We are happy to have been able to help you and to have provided conditions enabling your work to be fruitful. We trust that you will take home with you fond memories of Moscow University, and we hope to see you here again. I wish you every success.

Thank you for your attention.

The original is presented in Russian

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL
CONGRESS

VOLUME IV

REPORTS' THESES

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 4th VOLUME OF THE PROCEEDINGS OF THE SECOND UNESCO INTERNATIONAL CONGRESS «EDUCATION AND INFORMATICS»

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We call attention of specialists and all interested persons to this volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics" held in Moscow in July 1-5, 1996.

The volume consists of two parts. The *first part* contains communications and abstracts of papers and appearances submitted to the UNESCO Secretariat and to the Russian Organizing Committee and subjected to expertise for correspondence to the goals, tasks, and topics of the Congress. These materials were sent by the authors at the suggestion of the Congress organizers together with applications for participation in the Congress. The major part of communications and abstracts was presented by specialists from Russia, and a comparatively small portion was submitted by foreign participants in the English and French languages.

Some authors presented these materials in the course of discussions at the meetings of three Commissions provided by the order of the Congress work. The remaining participants took part in the work of 12 workshops.

The topics of workshops were as follows:

- **Information Superhighways and Education;**
- **The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies;**
- **The Software Environment - A Perspective for Effective Involvement;**
- **Transfer of Knowledge and Skills through Information Communication Technologies;**
- **National Policy - Transfer of Technologies;**
- **Individual Distance Training;**
- **Analysis of UNESCO/IFIP Documents published in 1994-1995 (Part I: Informatics for Secondary Education - A Curriculum for Schools; Part II: A Modular Curriculum in Computer Science);**
- **Logics, Informatics and Education;**
- **Information Technologies and Humanities Education;**
- **Development of Pre-University Education via Modern Information Technologies and Methods;**
- **Medicine: Mew Approaches to Knowledge Acquisition and Improvement;**
- **Forming Integrated World Data Bases Knowledge about Planets of the Solar System and Their Use in Research and Education.**

Since the workshops also constituted part of the Congress, *the second part* of this volume contained materials of all 12 workshops: working programs and results in the form of recommendations and suggestions.

The 4th volume, like other volumes of this series, is being published in three official languages of the Congress - Russian, English, and French.

The arrangement of materials in the first part of this volume was made by experts and editors on the basis of recommendations worked out by the Congress. In particular, the materials of the volume are distributed over different themes in the order recommended by the Congress:

- **Theme 1: Learners**
- **Theme 2: Teachers**
- **Theme 3: Technologies**
- **Theme 4: Social, Economic and Cultural Issues**
- **Theme 5: Educational Policies**
- **Theme 6: International Co-operation**

Along with this, certain difficulties has emerged in the arrangement of texts of communications and abstracts of papers relating to the first two topics, because in most materials these themes are considered in interrelation. Thus, the editors decided to join the materials of these two sections into a single section.

This volume also includes as a separate section communications and abstracts presented by the participants of the workshops «Logics, informatics and education» organized within the framework of the Congress. In view of specifics of the topic itself, these materials could not be distributed over different themes, which explains the introduction of this special section into the volume.

We decided to arrange communications and abstracts in alphabetic order according to the first letter of the first author's name.

When preparing this volume for publication, a great diversity of approaches to the problems under consideration seems to be quite natural in view of the extent of these problems. The diversity of approaches manifested itself, in particular, in using different (including new) terms which can be explained by inadequate elaboration of conceptual formalism in such a comparatively novel discipline as informatics. Not only approaches and terms were different, but also the style of materials presentation. In some papers and abstracts the ideas were put forward and defended which seem to be disputable from the experts' and editors' point of view and cannot possibly be accepted by our readers. This problem was settled, however, by pertaining, where possible, original ideas and texts of communications and abstracts. At the same time, most of the Congress materials called for editorial correction which helped us to provide the proper level of publications.

The editors will be grateful to authors and readers for corrections and suggestions. Your references will help to continue the discussion started at the Congress and unify terminology and concepts used in this field.

Analysis, selection, and preparation to the issue of this volume were carried out by the UNESCO Institute for Information Technologies in Education and by the International System Research Centre for Higher Education and Science (affiliated to UNESCO). References, notices and suggestions from our readers will be accepted with thanks by the Editorial Board.

They should be sent to the Center's address:
117292, Moscow, Kedrov str. 8/3, The Center's General Director, Academician of the Russian Academy of Education, Eduard A. Manushin, fax (095) 129.3190

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2nd INTERNATIONAL CONGRESS «EDUCATION AND INFORMATICS», MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION,

V. G. KINELEV

PART I

REPORTS' SPEECHES

THEMES

- **1, 2** LEARNERS, TEACHERS
- **3** TECHOLOGIES
- **4** SOCIAL, ECONOMIC and CULTURAL ISSUES
- **5** EDUCATIONAL POLICIES
- **6** INTERNATIONAL COOPERATION

  WORKSHOP
  «LOGICS, INFORMATICS and EDUCATION»

Themes 1, 2

LEARNERS, TEACHERS

HUMANITARIZATION OF THE DISTANCE EDUCATION FOR DISABLED CHILDREN WHOSE MENTALITY IS UNDAMAGED: SCIENTIFIC, PEDAGOGICAL, SOCIAL AND CULTURAL EXPERIMENT

L. M. Abramson (Russia)

A project, corresponding to the title of this paper, is being implemented now on the line of the «Cultural Initiative» International Foundation. The project focuses on current problems of education of disabled children with undamaged mentality. These problems became especially crucial due to the total comprehensive school crisis, and they are conditioned by the following circumstances:

- legally established curriculum of «at home» training does not depend upon individual abilities of a child and requires 6-11 hours of training a week, but even these hours are not financed directly and/or in full, and the final knowledge potential of a disabled child amounts to 15-20 per cent, rarely - 30 per cent, of the state educational standard;
- the advanced educational institutions, as a rule, eliminate disabled children, while teachers of conventional secondary schools do not have either sufficient knowledge on mental defects and physical handicaps in children, or, sometimes, just an experience.

In addition, there is no appropriate system of training teachers, methodologists, and, what is especially important, parents so that they would be able to deal with disabled children; the scientific research and educational activities in this field have been practically completely cut down.

The lack of any prospects for full-value education, and, therefore, for professional carrier and growth, increases the cultural deprivation and isolation of children with physical disabilities. It aggravates their medical and psychological problems, that are complex enough without it, and does not leave any hope for increase in marginal status of families having disabled children (for example, the average per-person income in such a family does not exceed 20-25 per cent of the standard one; there are 1.5 times more incomplete families among those who have handicapped children; only 15 to 20 per cent of such children are given an opportunity to have the annual vacation with the purpose of bringing them into a healthier state; and 5 to 10 per cent of them are provided with interactive or/and specialised communication and training means).

In the developed countries the practice of organization of education for disabled children leans for support on significantly greater financial and intellectual resources and humanitarian social and cultural traditions. Children with disabilities study either at special schools giving them an opportunity to obtain the education relevant to their cognitive potential or, together with healthy children, at comprehensive schools properly equipped and staffed with well-trained personnel. However, our reality is far from that of the developed countries and their experience can serve only as a methodological and value-defining guiding line.

The direct import of foreign practices is also impossible in the sphere of distance education. The above form of education is widely used abroad in the field of higher education, advanced training of specialists, and continuous adult education. In Russia it cannot be reproduced exactly due to methodologically and technically limited interaction (student-tutor communications take about 10 per cent of all training time). In addition, distance education for disabled children is not very popular abroad since the needs of such children are meet with conventional educational technologies.

A model is proposed of poli-modal interactive distance education for disabled children with the use computer audio- and video-conferencing facilities. The objective of the above model is humanitarization of «individual-machine» interface on the account of: increase in time spent for student-tutor dialogue to 30 - 50 per cent, systematic telecommunication and periodical internal psychological and pedagogical support of the educational process (including work of psychologists with families having disabled members), adaptation of curriculum and training methods to an individual psychological and physiological and cognitive status of each child and his/her family and their cultural and educational orientation, compensation of informational deprivation and social and cultural isolation of disabled children trough the use of telemetric (including global ones) technologies and pertinent informational resources; and attracting of well-trained specialists to working with disabled children.

The experiment suggests an «out-institutional» character of the educational process to be run simultaneously with mandatory classes at a comprehensive school and within the limits of the permissible load agreed on by doctors and psychologists. The experiment is expected to make a serious contribution into the process of solving of numerous problems inherent to disabled children education, which are as follows:

- breaking of social and psychological and cultural isolation of the disabled children,
- creation, developing, and maintaining of modern cognitive and creative value-targeted orientation,
- developing of self-education methods,
- mastering of the modern style of information transfer in purpose of learning all required basic disciplines, or in extending/expending knowledge obtained at a comprehensive school, or in training for continuing the education (obtaining further specialised or general education), or in acquiring specific professional skills.

The choice of the information transfer mode depends upon children's wishes and/or abilities.

In the course of the experiment it is planned to test the semiotic approach to designing individual educational strategies and building the structure of curriculum contents within the framework of a so-called concept of artificial language (information-search thesaurus). The project offers the outlines of the basic curriculum and pattern educational strategies developed in accordance with the ideology in question.

The experiment involves 15 handicapped children of different age, psychological and social and cultural status and takes 6 years (37 stages). Provided with successful completion, the experiment is expected to result in establishment of an educational (network) institution that is intended for disabled children.

All the project participants are supposed to work on a voluntary basis; the funds allocated by the «Cultural Initiative» Foundation are used exclusively for purchase, assemblage, operations and insurance of technical means, communication channels, and software products required for organisation of distance education.

At the initial (experimental) stages of the project implementation the formal basis for attracting specialists (tutors) is the Article 48 of the Russian Federation Law «About Educations stipulating non-license character of the unpaid pedagogical activities.

All the day-to-day work on the project is being performed by the Family and Pedagogical Council of the Association of Parents of Disabled Children and supported by the Department for Social and Cultural Programmes of the «Filyovsky Park» Moscow Municipal District». The project progress is supervised by the «Cultural Initiative» International Foundation and the Prefecture of the West Administrative District of Moscow.

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COMPUTER RESEARCH IN THE SCHOOL COURSE OF ALGEBRA AND FUNDAMENTALS OF ANALYSIS

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The main objective of the school algebra course and fundamentals of analysis is the study of functions and their properties in the course of students' research work. That goal, however, was difficult to attain for a number of reasons that did not depend on the teachers (lack of time, lack of research skills in students, absence of necessary research tools).

The use of a computer is the most effective way for the solution of a number of the problems as follows:

- implementation of activity approach;
- development in the students of information and organisation skills;
- wide use of the research method.

To carry out computer studies, the students need some special software, i.e., simulating and instrumental programmes. They enable the students to manage computer models.

The present-day computer facilities make it possible for the student to examine on the display a model reflecting some features of the real object or a process. Repeated changes in the initial data and observations of the model help to obtain some useful information about the object under study or develop recommendations of the optimal parameters for the process concerned. The study provides the greatest possible intensity of cognition since the cognitive activities of the students involves practical application of knowledge that was obtained earlier or in the course of the study itself.

The students can develop research skills during the study of the material on functions in the following subjects:

- Basic properties of the functions under study (recapitulation).
- Trigonometric functions, their properties and graphs.

- The concept of continuum and its application in solving in equations by the interval method.
- Tangent to a function graph.
- Applications of the derivative.
- Application of the integral.
- Exponential function.
- Derivative of exponential function. e number.
- Logarithmic function.
- Power function.

In the course of the study the computer is both an instrument for the research process and a mean for the management of the students' activity. This involves the use of computer models that are controlled by the computer, the user not being involved; and the models managed by the user. In the former case the model is demonstrative object which is used as a mobile colour illustration of some phenomenon or a process. In the course of algebra and the fundamentals of analysis the need is great for such illustrations since the basic concepts of mathematical analysis as function, function limit, derivative and others are highly abstract. To prevent formalism in the study of the basic notions, appropriate illustrations to each of the concepts concerned are desirable.

The process of familiarization with the derivative concept involves consideration of two problems: geometrical and physical. This permits interpretation of the derivative notion from different viewpoints to promote a more profound and stable insight into this concept.

The study work by students in the above situations also involves the research methods of observation, comparison and deduction.

Let us illustrate the organisation of student research using computer models in the case when the students themselves manage the models.

Example 1. The trigonometric function graph can be considered as a model of a respective harmonic oscillation with its own parameters: amplitude, frequency, initial oscillation stage. Using the simulation programme *Graphs of Functions of the Type y = A cos(wx+b),* the students can carry out their independent research into the parameters of trigonometric functions. In this case they select one of the above functions on their own, set specific values of the parameter and observe the function graph changing depending on the parameter values.

In contrast to the conventional method of the study of trigonometric functions the models used by the students render them researchers rather than passive observers. The considerable saving of time, the quality and number of the shown illustrations are decisive in the selection of learning methods.

Example 2. In the case, when the students cannot find anti-derivative of a function in the anti-derivative table, the calculation of its integral can be performed by summing up the squares of the rectangles into which the respective curvilinear trapezium is divided. A «manual» calculation proves too laborious, and, hence, is not used at school in calculating integrals.

Let us consider the managed model which permits calculating integrals, including non-table ones, with different accuracy. The students are suggested setting the function and integration limits. Let us assume they set: $y = \ln x$, $a = 2$, $b = 3$. Thus, the problem of integral calculation could be solved.

Subsequently, the students set the number of decomposition of the segment n, e.g., $n = 4$. Subsequently, the computer monitor shows decomposition of a curvilinear trapezium into rectangles. The next stage of work is completing the table of function values. Moving the cursor along the graph and writing out the ordinate value of the marked point displayed on the screen, the students complete the table and then calculate the sum total of the areas of the rectangles displayed.

In case of great n values, the picture can be enlarged to make it more distinct. By calculating the values at different n values it can be inferred that the sum total of the rectangle areas approximates the one of the curvilinear trapezium.

Example 3. The construction of a tangent to the given point and obtaining the angular correction of the tangent is auxiliary in solving numerous problems in the course of mathematical analysis, including function study. The computer model implemented by the respective programme is instrumental in the solution to this problem. After the programme is loaded, the students state the objective of the study. The objective is only a transformed question contained in the statement of the problem, i.e. to study the relationship between the position of the secant and the value of the above angular correction.

Assume there is a certain curve on the display and a point *A* on it. One can choose on this curve another point *A1* and draw a straight line through points *A* and *A1*. This straight line is referred to as secant. Let us approximate the point *A1* to the point *A*. The position of the secant *AA1* would vary, but with approximation of *A1* to *A* it would stabilise. The limit position of the secant *AA1* in case of the point *A1* tending to the point A would be tangent to the curve in the point *A*.

Upon work with the computer model an inference is stated. Subsequently, the student translates into the language of the formulas the considered process of limit transition.

The use of computer models in the stady permits developing research skill in the students: formulation of the study problem, puttung forward a proposal, a hypothesis, and making a generalising conclusion and a deduction.

Thus the computer makes it possible a wide application of a research method in the study, which in its turn ensures productive or creative level of the study and research by students.

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PROBLEMS OF INFORMATION CULTURE GENERATION

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In connection with objective processes under current circumstances the function of education has been changing fundamentally, resulting in a necessary of hands-on professional training. A school non-readiness for fast transformation brings about the loss of interest to traditional education and the school training degradation.

The educational system should be started from new principals. A school ought to teach how to conceive how to obtain knowledge independently, how to solve various problems. To master the bulk of knowledge means, above all, to master the methods and ways of data obtaining and data processing for the solution of professional problems and tasks through utilisation of information technologies. As a result, except changes in trend and methods, the cognitive content revises, also, and the training text becomes more and more reflexive. The new information technologies yield a logistic basis for solving those problems.

From this point of view one can represent the mathematics informatics (computer science) as a way of algorithmic thinking formation. By the operation of one or other software, programming languages, it should be possible to pose the goal of algorithmisation of the cognitive process itself. An algorithm laid the groundwork of one or other program all long bears both the meaningful and reflexive aspects.

It is pertinent to note that the study of informatics and the establishment of the simplest programs are also based on knowledge reflexivity, since the way of program structuring is reflection of one or other operations of a reflective character. The use of modelling, the introduction of one or other parameters into modelling and into study of a modelled object means the reflexive level of educational material delivery. Under these conditions the cognitive process is not a simple retrieval of definite system of knowledge but a mastering of ways, methods, techniques and the order of its assimilation. Works at various databases and information systems of various levels aids this. The systems of this kind permit a learner to state (formulate), to put questions, to direct and perceive a way of information search.

In order to have more fruitful view at the problems of new information technologies, their social and cultural sense and status, it is necessary to produce the extended, promising perception of informatics as informational culture. The comprehension of this concept arises along with training of modern specialists in the field of informatics. The information culture is considered within a context of common representation of information as a basis for various processes involved both in nature and society, in alter of values orientation, in systems of legal, cultural and moral norms. The necessity of informatics study in school follows from this estimation.

An important point here is that the information culture can be treated not as a peculiar system originated from a framework of new information technologies application. The first consideration here is to take a second look at information culture in interaction with other modes of culture and, therefore, in integrity of indivisible modern culture.

A phenomenon of information culture is conventionally regarded parallel with other phenomena of modern culture. Similar considerations can be applied to the fact that the same problems are generated in the field of information culture as in other modes of culture do, namely, ecological, economic and social. From our point of view it is of value not merely dwell on these evidences, but to investigate their essential basis. The case at hand concerns about the formation, for example, of ecological culture found with training of information culture and vice versa.

In this case, when viewing the information culture, we imply its capability for elaboration by means of new information technologies the various models associated, first of all, with modelling of different kinds of ecological processes. The methodical view at the world means that any purely technological problem cannot be solved without their social, economic, political, ecological background. In the frames of informatics appreciated here as the information culture it is conceivable to reproduce the given situations in a way of models laid as a basis for training.

Basically, the ecological culture cannot be fostered by means of ordinary traditional school tools. The experiences of friendly relations with environment and ecological charge of future professional activity can be formed only on the basis of implementation of accumulated knowledge. Those experiences can be arisen within ecology and informatics joining through ecological modelling. At this point informatics acts as the information culture and enables to create an universal model of world and to reproduce the actual situations which can arise as a result of one or other technological innovations.

Hence, it follows that the information culture is a new way of thinking which, however, cannot be formed within the frames of informatics training only. In that event we again come to a conclusion that critical threshold of new information technologies application in training appears not because of their deficiency in educational process or emerge of new more modern computers or computer systems. This threshold is concerned about the utilisation of new information technologies within the framework of other training disciplines and other professional subject areas. Here the priority feature is that the processes are associated with a systematic vision of the world. Being important for a politician, manager in social and political relation the above feature is completely important for a specialist in technical sphere, since the social and ecological transformations are performed as a result of his technical solutions.

It is worth noting that the development of information culture influences significantly on the nature and the extent of application of new information technologies in social life as a whole. This technological component of information culture is associated, for instance, with a creation of «information space itself».

It may be deduced that the creation of a new information culture is, from one part, the main objective of the educational process as a whole, and, form the other part, the new information culture, based upon new information technologies of training, is a necessary condition for current economics development on the basis of «non-material» intellectual capital.

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NEW PARADIGM OF EDUCATION IN NETWORKED INFORMATION ENVIRONMENT: LEARNING FROM THE INTERNET - CONTRIBUTING TO THE INTERNET

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ABSTRACT

Society's demand on professional educational in modem Networking Information Technologies, mainly caused by rapidly developing Internet in Ukraine, initiated this pioneer work in Kiev Polytechnic Institute at CAD Department on developing original educational course and Instructional Methodology for teaching Computer Networking and Internet Information Technologies. Some interesting results of pilot implementation of mentioned courses and existing problems are discussed in the paper.

It was impossible to duplicate experience of some western universities in our environment with bad connectivity and poor information resources. New approach had to be found. We should learn from the Internet and contribute to building of our Internet and Information Infrastructure and Resources.

But in our local condition we couldn't teach the Internet technologies only. First of all, we have to equip future specialists with the basic knowledge in Computer Networking - how to build corporate and/or departmental network, and after that - how to implement integrated information services on the base of Internet Technologies.

1. PROFESSIONAL EDUCATION IN NETWORKING INFORMATION TECHNOLOGIES AS A DEMAND OF EMERGING GLOBAL INFORMATION SOCIETY

The emerging Information Society is characterized by wide use of modem computer communications technologies providing access to a variety of different information resources distributed over the global networks. Recent summit of the Group of Seven (G7) - group of senior government ministers from Canada, France, Germany, Italy, Japan, United Kingdom and United States - in Brussels in February 1995 have adopted plans for creating basic set of rules for Global Information Infrastructure (Gil) that will play key role in developing Global/Open Information Society (OIS) defined at the summit as knowledge based society [1,2,3], G7 declared their intention to welcome participation of developing and technology emerging countries in building Gil and developing it's information contents to provide them "the chance to fully participate in this process as it will open opportunities for them to leapfrog stages of technology development and to stimulate social and economic development" [3].

An important role in participation of Ukraine in GII development and creating elements of Open Information Society will belong to Universities' Academic and Research community. The knowledge-based economy demands greater openness and creativity in schools and universities and the acquisition of new skills and adaptability through life-long training. An open approach to education that combines local and national cultures and promotes mutual understanding between all people is required. Access must therefore be tackled at its roots by providing citizens with the tools to learn in an information society [3].

Successful implementation of Gil elements in Ukraine and its future sustainability requires a special concern about professional Networking Information Technologies Education and concurrent Training and User Support activity, which will contribute to the solving problem of preparing workforce/specialists for socially important area of academic, industry and business activity in the country.

Currently main and most notable activities in Ukraine are oriented on building regional networking infrastructure for Academic and Research communities in the frame of numerous state and international projects. Further development of Networking and Information Infrastructure in Ukraine will demand professional education of specialists in Networking and

Communication Technologies and wide User Training and Support.

Discussed project on development of Educational course and Instructional Methodology for Teaching Computer Networking and Internet Information Technologies was started by Computer Aided Design Department at Kiev Polytechnic Institute because of existing demands of Internet and Networking Information Technologies development in Ukraine. The project is based on effective utilization of existing professional resources and specialists in modern networking technologies and Internet in Kiev Polytechnic Institute that has experienced Campus and regional network building as well as in Internet training courses and materials development.

The realization of the project will help to disseminate widely and better use professional experience and knowledge among the most active layer of future Academic and Research network users which are tutors, researchers, students and associated users groups from scientific community.

The project has two parts of activities: professional education in modern Networking and Information Technologies, and associated with it training on Internet and services applications for different categories of users. This approach reflects existing in the world experience of two directions in wide implementation of new technologies: *professional education* that creates and strengthens sustainable basis (academic and research) for implementation of new technologies, and short term *training* and continuous professional renewal for satisfying urgent demands in dissemination of new technologies among wide group of users.

2. PILOT EDUCATIONAL PROGRAM ON NETWORKING INFORMATION TECHNOLOGIES AND SERVICES

Pilot group of 50 engineer students of the fifth year have started education from September 1995 till May 1996, part of them will continue their Master education till March 1997 and will work on their Master degree thesis on Internet and Networking Information Technologies related topics. Also, they will be engaged into development of complete educational course on technical and information base.

Complete Information Technologies implementation demands good knowledge and technical base in computer networking technologies. So, considering the local conditions with bad connectivity and low awarance in modem networking technologies among students and practical specialists, as well as previous educational background of students in computing and networking, a pilot course was compounded of three basic parts: Computer Networking, Internetworking and Internet Information Services, - completing necessary educational base for designing corporate and/or campus computer information networks.

The pilot educational program includes the main specialized courses on Networking Information Technologies and Information Resource Management that can be developed on existing information and technical base with minimum additional funding, such as:

- Information and Advanced Communication Technologies, society and organization;
- Computer Networks Basics. LAN and WAN Technologies;
- Internet working and Network Management;
- Internet Information Technologies and Services;
- Internet information resources development and management.

The pilot development of mentioned courses is intended to span the main issues of teaching Networking Information Technologies. Another purpose of such pilot work is to adopt and test Russian terminology on real lecturing and educational project development.

Some practical experience is acquired by students during practical projects designing in autumn and spring semesters that include development of real networks projects for concrete academic and educational institutions including development of necessary information services for operational needs of given organizations and/or user's groups. Also practical installation of services and pilot information resource development was performed on special educational laboratory base.

The projects should be developed by groups of three or four students and include all necessary components of real networking project design of campus or company's network including:

- Real conditions investigation;
- Defining user's groups in organizations and their information resource needs;
- Network structure design;
- Choice of Hardware, Software and Communication and Internet Service Providers for project realization on comparative basis among companies and providers available in the region;
- Information (Internet) server design and pilot services installation;
- Creation of devoted to the project WWW server information structure and its pilot implementation.

The methodological approach and course management system were intended to be based on students independent work and choice of topics of their educational course and diploma projects, including organizing optimal cooperative work of the project group.

The methodological and instructional materials for such project work are based on materials of real networking projects of KPI Campus Network, ISF Telecommunication Project for Creating Pilot IP Network in Kiev *(http://cad. polytech.kiev.ua/ projects/ projects. Html)* and other materials.

Initially, the proposed list of Internet services to be developed in the frame of the projects included all basic Internet services. But later, during the current projects design, it was realized that the main emphasis should be done on WWW technology. Now all projects have their temporal presentations at educational WWW server at CAD Department *(http://cad. polytech.kiev.ua/ academic/ nitsprj. html)*. Some HTML templates developed in such projects were used for completing departmental WWW Server. Many good ideas were developed by students. All were involved in information resources creation. Five graduate students have defended their diploma projects devoted to Internet and related topics that have summarized their diploma practice. One of the real results of such diploma practice was creating WWW Homepage of Ukrainian GalaRadio FM100 Broadcasting Company at *http://www.cs.kiev.ua/home/gala/* that serve information needs and listeners' auditorium feedback.

Four Bachelor's diploma works are devoted to development of components of KPI Campus Wide Information System (CWIS), Ukrainian WWW resources index database and graphics presentation in WWW. All projects will use extended possibilities of HTML 3.0 and JavaScripts. The future Master thesis of pilot group of students will deal with the very modern Internet information technologies and tools including C++, VRML, Java and shell programming for WWW and distributed applications.

3. CURRENT RESULTS AND ACQUIRED EXPERIENCE

The main intermediate results of pilot project realization can be stated as follows:

1. Creation of initial base of learning materials on Russian language on pilot courses;
2. Developing training materials for practical studying of Internet technologies;
3. Involvement of students in creation of educational base and learning projects examples as well as pilot testing of instructional methodology;
4. Creation and operation of educational server and development of students account management policy;
5. Acquiring necessary technical information about networking hardware and software as well as other information resources.

To provide efficient tool for testing students knowledge and feedback for course revising and improvement, special examination test system was developed. The questionnaires consist of 50 questions (randomly chosen and sorted) covering all key items of the course. Officially adopted, such test system could be used for specialists certification for organizational staff education and training management needs.

One of the interesting secondary result in teaching such course, mainly based on English language manuals and handbooks materials, is in rising aspiration of students to learn and enhance their knowledge of English. All educational project's Homepages have their presentations in English and Russian/Ukrainian languages, but some documents have only their original presentation in one language.

The obligatory condition for all students in these pioneer courses and diploma projects was the use of Russian or Ukrainian languages for preparing textual materials for projects. Such approach will help to create information data base for future course development and dissemination.

Another task of preparation stage of the whole project realization is to encourage the wide use of Internet and computer communications among professors, tutors and students as a way to develop collaborative learning models at the department. Professional academic contacts have to be established for cooperative development of the new educational courses and technologies at the University, in Ukraine and over the world.

To provide courses with current technical information and training technologies, professors and tutors of CAD Department actively participate in organizing workshops, conferences and seminars in Kiev and Ukraine with projects' promotion purposes (look at related events at *http://cad.polytech.kiev.ua/events/).* Participation in training activities helps universities tutors to understand better real needs of different categories of users and practical workers.

Basic training materials and courses on Internet related issues are being developed during realization of the pilot academic curricula. Also, regular training courses for different categories of users have started at CAD Department. The first group trained, surely, consisted of teacher's staff of the Department that encouraged them to use networking tools in academic process. Another one was a group of 30 students of KPI having been taken part in the international distance educational course of IUAP (International Association of Universities Presidents) on the book «Preparing to the 21st Century» by Paul Kennedy.

The main background conditions of successful realisation of this initiative activity are the following:

- leading position of CAD department in KPI in networking IT implementation;
- tight cooperation with Computer Communication Center of KPI;
- participation of specialists of CAD Department in real networking projects development and realisation;
- experience in conducting wide promotional and training activity on Internet technologies.

Leading specialists in networking technologies from local companies and institutions in Kiev are invited to read some lectures on their professional skills. Course is supported permanently by group of experts and consultants from cooperating organizations and companies.

The current experience allows to suppose that wide implementation of such course and whole realization of it's potentiality in present conditions will affect teaching of another IT related courses at the Department and their integration on the base of Internet networking and information technologies which was found to be very effective for such purposes.

4. EXISTING PROBLEMS

Current project realization was faced by number of problems caused by technical, organizational, methodological and funding reasons. Some of them can be discussed in greater detail.

1. *Technical problems including:*

- Low speed of existing Internet links that demands special buffering and mirroring of the main popular information resources (for example, RFC, Documents on Internet Protocols, Network Security, HTML and HTML Editors, weather server and pop-music) on educational server to avoid unnecessary traffic via very slow external link of Campus network;
- absent of special equipment for traffic separation of different segments of departmental LAN and efficient students' account access management.

2. *Methodological problems that include:*

- first of all, lack of experience of teaching such modern courses in Ukraine and FSU;
- absence of instructional materials and handbooks on Russian or Ukrainian languages;
- a small number of tutors with practical experience that can cover all items of prospective curriculum.

3. *Funding problems* including shortage and lack of necessary funding for proper implementation of such educational project.

5. SUMMARY

Intending for wide dissemination of current work, special Educational and Training Materials server integrated into POLYTECH Campus network was established at CAD Department (to be merged in the near future to the name *eduserv.polytech.kiev.ua)* that consists of basic information about academic curricula and students projects as well as basic training packages for training Internet related issues. Developed examination tests will be converted to interactive WWW form for providing interactive Internet training.

Necessary component of any implementation strategy will include stage of promotion to reach wide awareness of prospective users from academic and research communities with real possibilities of Internet and Networking Information Technologies, and multimedia in different areas of activity. Also, such promotion must be oriented on establishing cooperation and finding technical and financial support for realization of the full project.

We hope that such pioneer work will create base for wide implementation of Networking IT in University's environment and mobilise community's intellectual forces for self-supporting development of the new technologies. Some areas of fruitful international cooperation should be found in applications development areas, first of all, exchanging of the educational courses and instructional methodologies on different subjects interesting for foreign Universities and Companies.

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PROJECT METHOD AS A BASIS FOR INFORMATIZATION OF SCHOOL EDUCATION

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Computer equipment for informatics classrooms have been supplied to schools since 1985. Every such school needs to employ an informatics teacher. As informatics teachers had not been trained on a large scale, a most natural and practicable way was to retrain programmer engineers. In addition, instruction was based on learning one of the programming languages, Basic as a rule. This situation still persists in many schools despite a great number of educational programmes for individual subjects of other disciplines and those specially designed for the universal use of the computer as a tool, i.e. text and graphic editors, desk-top publishers, electronic tables and data bases. Even the transition from 8-bit to latest 16-bit computers only slightly affected their preference for Basic.

A typical situation in our school is the only teacher who knows how to use the computer is the informatics teacher. All computers are placed in the computer classroom and, consequently, can be used exclusively at informatics lessons. Moreover, the class is divided in two groups because of the limited number of computers, from 10 to 15. If a school acquires software for teaching other disciplines, such lessons may be occasionally held in the computer classroom, naturally, with direct participation of the informatics teacher as the only teacher who is able to start the programme.

Consequently, the more than ten-year-long massive introduction of computers in secondary schools did not bring about the expected informatization of instruction. The reasons are obvious now. Student workplaces are arranged basically in the form of a computer classroom. Computers are used primarily in teaching basic informatics and computer technology. As a result, *computers are used primarily for learning how to use them.* The informatization of instruction by means of computers is virtually confined in the computer classroom and limited by one discipline. Neither teachers nor educational software suppliers cannot offer the students any kind of regular and meaningful work with the computer at least in several disciplines in addition to basic informatics. Apparently, the classroom-lesson model of computer-aided learning has reached its limit. Therefore other solutions should be found to the task of further informatization of the teaching process.

One such solution may be based on other organisational models of the students' interaction with information technologies in the process of learning. Before discussing this method we should make a list of methods of the student's interaction with the computer in the process of learning and see whether they can be used in various organizational models. We shall describe the following models of using information technologies as applied to computers.

1. *The learning model.* The purpose of this model is learning and mastering the computer, a user interface and a programme. This means learning how to use a tool, or an instrument of labour. The model

presupposes the student's direct communication with the computer in order to make consecutive actions and check if the software gives adequate response. The model also has an auxiliary purpose as an introductory phase ensuring realization of other computer use models. In the majority of cases this model is applied in school instruction.

2. *The existence model.* In recent years software actualising certain artificial environments by means of the simulation method or by creating virtual reality have acquired growing significance. Multimedia facilities are also used. The user of such software, a student in our case, perceives this artificial environment as reality in which he/she for some time exists. The purpose of such software may vary. In most cases this model is realized in computer games and training programmes. The existence model is very important as it most strongly influences the user. The model is realized through direct communication between the user and the computer. Most suitable for instruction are constructive games implementing macroeconomic and social models (e.g., *SimCity, MotorCity, Civilization).*

3. *The user information management model.* This model is implemented when working with the computer the user accumulates certain information which needs special attention in terms of its storage, updating, etc. This is an independent kind of work which requires personal memory -resources. The simplest version of the user information management model is implemented by the students when they generate their own sub-directories to include the results of their work: texts, graphics, tables, etc.

4. *The technological process control model.* This model of computer use is intellectual interface between a controlled process and the operator. With regard to the learning process this model can be used in computer-aided control of physical and chemical experiments. Certain procedures for physical characteristics control in the classroom, for instance, temperature, humidity, light intensity, etc., have been developed, which can be included in the process of teaching such disciplines as physics, geography and natural history.

5. *The creativity model.* A student with sufficient computer skills, who knows how to use it as a tool (in the learning model), can be put into a creativity situation. The computer largely facilitates writing essays, making generated text designs of high printing quality. Generating computer drawings and programming can also be treated as creativity. The creative process demands a special creative atmosphere which can hardly be achieved during a lesson, and even less so in a situation when all students are expected to do one and the same thing.

6. *The communication model.* Modern computer networks perform a function of transmitting messages among their users. The possibilities they offer made them a meaningful element of human culture which cannot be realised by other means of remote message transmission (the post, telephone, telegraph or fax). Computer networks enable the users, in addition to communicating at the everyday level, to implement educational projects which contain both material for learning and certain elements of students' motivation. Furthermore, these means make remote education services possible with the help of a virtual classroom metaphor.

7. *The browsing (surfing) model.* The student with perfect computer skills usually does not start learning another kind of computer by fulfilling a task put to him/her but looking through the contents of its memory. He/she would review the directories, run programmes and look through the files which he/she finds interesting. This browsing or look-up operation is a rudiment example of actions which can be applied to Internet. It can be compared to leafing through books on a library shelf. This model is realised both to satisfy one's curiosity and as a method of information search. And it does not matter whether the person who makes the search knows what exactly one tries to find. At the moment, no experience has been accumulated of practical use of the browsing model for learning purposes. However interest in this possibility is very strong, so we may expect that methods of its use will soon be developed.

8. *The information extracting model.* This model is described here as a separate method of interacting with the computer because it makes use of other kinds of software for purposeful information search than those in the case of the browsing model. The model can be actualised when CD-ROM encyclopaedia and guides are used for learning purposes, for instance, to write an essay or a report.

9. *The mediated interaction model.* Some of educational projects do not require direct communication with the computer by all participants in the project, although information obtained from the computer largely determines the learning process [1].

All models listed above can prove useful in computer-aided learning. If, however, the *methods of the students' work organization* conform to respective models used. Below we shall discuss the former in more detail.

1. The classroom-lesson model. This model presupposes computerised workplaces of all students and the teacher. It is also presumed that all computers are united into a local network and supplied with a server. Interaction with the computer during the lesson is organized in such a way that all students perform similar or identical tasks. The teacher's objective is then facilitated. The teacher formulates problems, shows how they are to be solved and supervises the process. Control over the performance of identical tasks, as well as comparison of the results, is really very simple. This organizational model would best suit a learning model which is auxiliary to all other models. The browsing model can be used in a computer class when students do not have to perform any specific tasks but are just learning how to use the browsing procedure. All other models demand individualised actions by students and, therefore, do not fit in the classroom-lesson system.

2. The project group model. This model is based on the project method well known to educators. One of the key conflicts in the modem school is a discrepancy between the educational objectives faced by the teachers and the objectives which the students want to attain. The low significance of educational objectives in the eyes of the students does not encourage their motivation and leads to a general decrease in the interest in learning and, consequently, to lower results. One of the effective methods of raising motivation is the creation of objectives which are meaningful to the student and which can be attained through assimilation of a certain amount of knowledge. In that case purely educational objectives become a means of attaining objectives artificially set to the students. It seems fairly probable that this circumstance, which is well known to educators, can be given a new impetus due to a new opportunity of using information technologies at school on the basis of computers [3]. As the teacher masters the project method he/she focuses on educational issues, on planning changes in the educational process. The use of information technologies here acquires an auxiliary role of securing the planned changes. Since project development presupposes various roles of its participants, the computer is used only occasionally, insofar as it is necessary according to the roles distributed among the students. If several (from six to eight) project groups are in one classroom it may well turn out that one or two computers would be enough for the work of all groups. In addition, each group can use the computer in a different way than the others. The task of the teacher in such a classroom is certainly more difficult. But thanks to the students' high degree of motivation, the teacher may be at least sure that everyone is working at the lesson. The assessment of each students' results also becomes more difficult, which can be avoided if the assessment procedure is defined at the project phase. Depending on the content of the project, any model of information technology application can be, apparently, actualized, perhaps with the sole exception of the learning model. The project group model can be realized in the use of single computers or even if only one computer is available at a given school. Some projects may do with no computers whatsoever in the classroom (the mediated interaction model). In that case informatized is the learning process itself, rather than an auxiliary operation of learning how to use the computer. Practical implementation of the project group model requires that teachers assimilate new knowledge and follow a special procedure. A brief outline of the educational project development method is given below.

3. *The individual action model.* This model is best suited for home computers, but single computers placed, for instance, in a school library may be used that way too. This organizational model makes it possible to actualise any of the models of information technology use, including the learning model. Both school and out-of-school hours can be used for this purpose. If students have computers at home, the emphasis may be shifted to homework.

Educational project development technique (drawing up of instruction projects) consists of several series of stages at which the project is further adjusted. In order to develop a project its objectives and tasks must be first defined, as well as the project participants and the role of information technologies. If the description of the project conception contains answers to these questions, it can be considered ready for the next stage of project development. But before a concept can be developed it must be generated first. Analysis of a situation in which the necessity or advisability of using information technology emerged can *serve as a* good foundation for generating conception of a project. Hence, the *first stage* is formulation of the problem to solve which a project is designed. The problem should be analysed in terms of actions which are planned to be changed, flows of and methods of dealing with information which supports these actions. After that an attempt is made to formulate the name or the subject-matter of the project which would reflect its essence.

The *second stage* (project conception) begins as soon as the nature of the problem is, at least roughly, defined. Then a solution must be found. This is a stage of generating ideas. When one formulates a problem one does not yet know the solution to it, otherwise it would not have been a problem but a next stage of action. If it is a problem, not only solution does not exist yet, but even a method of solving it. So, all that is known is the available situation and the need to change it in a proper way. In order to solve the task one has to think of a method of doing this. Here a certain creating act is needed which would lead to a discovery. In other words, what is needed is a conception of the problem solution. A conception is a mental bridge linking the existing circumstance with the desirable result. There can appear several such conceptions and, as a matter of fact, it is advisable to have more than one conception, so that one could select the most productive one at the subsequent stages.

The *third stage* is the purpose of the project. In the case of a project related to the introduction of information technologies to give an answer to the question: What is the purpose of the project? - means:

- to determine participants in the project, i.e. a group of people whose activity should be changed as a result of the project implementation;
- to reveal specific advantages they will get;
- to understand what load and why should be put on information technologies.

The *fourth stage* - the time, place and the participants' roles - consists in specifying the conception. The conception is reconsidered from the point of view of who, where and when will realise it. At this stage external conditions for the p-roject and conditions of its existence are defined: the time and space limits of the project and role attitudes of its participants.

The *fifth stage* - *a* project metaphor. A metaphor consists in applying a name or property of one object to another object. Prose writers use metaphors to activate the reader's thought and imagination. A metaphor is a powerful means of uniting the project time, space and the participants' roles into a single whole. Metaphor should be sought in well-known and customary kinds of activity. A good metaphor enriches the project conceptions. A good metaphor enriches the project conception and helps to reveal its unusual aspects and new facets. If a metaphor appeared and no need arises to revise the previous stages, you may be sure it is a poor metaphor.

The next series of tasks connected with project development deals with a more detailed definition of basic concepts and terms used in the project, actions of its participants, information circulated within it and methods of its organization. The key task to be solved by this series is WHAT is done by the project.

The *sixth stage* - terminology. When the conception of the project is defined, objectives and tasks specified and participants selected and it is clear why information technologies will be involved, it is the time to agree on the language of the project. Participants in the project have been selected at the preceding stages. They are to play definite roles within its framework. They handle information, deal with various objects and act in different situations. Both project participants and those who develop it must identically interpret all terms used. For this purpose a thesaurus must be generated which would be divided into sections containing lists of terms relating to objects, situations, actions and participants of the project. Each notion in the project must be given a name best suiting it, a term or a relevant explanation.

The *seventh stage, a* responsibility table, is intended for harmonising actions to be performed under the project and agents who must perform them. The responsibility table must contain as many columns as there are different agents and a column for each role played by information technologies. Each line in the table corresponds to a certain action performed under the project. In addition to its main function, i.e. correlating agents and actions performed by them, the responsibility table enables the authors to see any errors and finalise the project. The authors of the project compiled a list of actions to be performed under the project and a list of agents at the preceding stage in the absence of any criteria as regards completeness and adequacy of the lists. Since the responsibility table reflects both lists correlated with each other, any inaccuracy can be immediately revealed and corrected.

The *eighth stage - a* «supermarket chart». The use of a supermarket metaphor for structurization of an information technology introduction project is a powerful means to find really good solutions. In order to use this metaphor one has to imagine the project as a supermarket which includes, instead of small shops and cafes, premises on which actions under project are performed. A further elaboration of the metaphor may suggest certain specifics in using the premises intended for actions under the project. The actualization of a supermarket metaphor for a specific project may demand more than one main hall, additional space in the rooms intended for actions, use of information boards in the main halls, etc. A drawing depicting the structure of the project in the form of a supermarket will serve as the supermarket chart.

The *ninth stage* - a key situation in which each person constantly performs different roles. The use of the role conception enables one to feel oneself in familiar circumstances even in a new situation. At the same time, the situation itself may suggest adequate behaviour.

When a new project is developed it is advisable to design a situation in which each participant of the project would reveal him/herself. Each participant must start working with a programme feeling him/herself in a familiar situation, in which all possible and permitted actions, as well as ways of obtaining the necessary information, are well known. Generation of special recognizable and familiar situations for the project participants must, apparently, reduce the period of assimilating new methods of work and eventually raise its efficiency. The description of a situation in which each participant will find him/herself fulfilling obligations under the project will be the key situation.

If the purpose of the project consists in software generation then the «key situation» will be transformed into a «key display». The meaning of the key display concept is exactly the same as of the key situation: the user beginning to work with a programme must always find him/herself in one and the same situation (see one and the same display). All modern software is like that: a basic working display (key display) is arranged in such a way that all the necessary information is accessible and transition to any action is possible, and having performed these actions the user will again return to the key display.

The next series of tasks further specifies the project. The basic task here is - HOW it is done. The series is realized by stages of generating procedures for man/information system interaction, dialogues, functions, states and means of transition from one level of the project to another.

The *tenth stage* - a dialogue. The dialogue is interaction either of man with a programme or by men among themselves. This interaction takes place under the following circumstances (on the basis of the stages already passed):

- selection of possible actions in the main hall of the supermarket;
- passing from the main hall to other rooms and back;
- performance of actions under the project.

Dialogues must be worked out for each situation. Descriptions of dialogues between agents should name the information conveyed.

The *eleventh stage* - a state chart. The state of the project must be reflected in the project terminology and in the supermarket chart and dialogue writing. The state chart essentially serves as a detailed scheme of the project as a whole.

The *twelfth (concluding) stage* - information on the project. The last thing to be done before launching the project implementation is to write a certain document on the project: a user manual, a brief description or an instruction. The document may be of any kind, but certain points need to be highlighted in any case, these are: formalities (authors, copyright, edition, licence); introduction (the project conception, characteristics, educational aspect); description (composition, characters, states, dialogues); instructions (for the project coordinator, for the teacher of a given discipline); supplements (technical specifications, participants' qualification).

A course designed for intensive assimilation of the project method within 10 days has been developed, on the basis of methods described above, in the Institute of Informatics of the Russian Academy of Sciences. During the course teachers assimilate the necessary theoretical knowledge, get acquainted with methods of information technology use in the learning process, acquire practical skills in project development and generate their own educational project. The results of projects previously created with information technologies are demonstrated to them, which stimulates their wish to achieve similar results by implementing their own conceptions. As the teachers feel a need for special programmes they are acquainted with the potentialities of relevant tools.

Since 1992 several courses, full or reduced, have been given. These initial attempts to apply the methods discussed above demonstrated their high efficiency both in terms of assimilating the method itself and overcoming the teachers' reluctance to use information technologies. In addition, important data were gathered on the teachers' requirements for software on the basis of which relevant functional characteristics of tools were specified and the methods of creating teaching projects were expanded and further improved. It can be safely stated that an effective means of interaction between information technology specialists and teachers has been developed which provide for introduction and use of information technologies in education and reveal what kind of information technologies are required by education.

A few years ago it was out of the question that organizational models of individual and in particular project group efforts could be implemented in practice. Curricula and lesson plans had been centrally approved and standardized nation-wide. No deviations were allowed. Today favourable conditions exist for practical realization of new organizational models of computer-aided learning, namely:

1. *School autonomy.* Each school may decide on its own what kind of study programmes its teachers will use. Some schools opt for using different methods of teaching process organisation [4].

2. *Teachers' willingness.* Ever more teachers feel a need for information technologies in teaching their disciplines. In view of this, the Institute of Informatics of the Russian Academy of Sciences developed a special course for teachers' assimilation and practical application of the project method.

3. *A new role of the teacher.* The role of the teacher as information dispenser (communicating knowledge to students) is replaced with the organizational and methodological role (organization of independent extraction of knowledge by students from various sources).

4. *The economic situation.* The project group model substantially reduces the cost of informatization of the teaching process. The same is true of the individual action model.

5. *Civilized methods.* Now schools are provided with computers on the basis of sponsor investments. Further civilizing of the teaching process might consist in applying for sponsor assistance for the purpose of not just provision of schools with computers but of implementing certain educational projects. Transition to the project group method of information technology use can give the school certain advantages in the form of adequate financing.

To sum up, the main conclusion is that the classroom-lesson model of students' interaction with information technologies has been exhausted. It must be replaced with the project group and individual models. The necessary conditions for this already exist and have been listed above. The merit of the proposed models is that the teaching process can be actually informatized at a lower cost and on a more adequate level.

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LIBRARY OF EDUCATION COURSES TO TRAIN USERS OF MODERN COMPUTERS

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The modern computer is the best tool for mastering the new information technologies (NIT). The team of programmers and pedagogues from Moscow Physical-Engineering Institute had developed about twenty training computer courses, which are intended to train students of different ages for efficient PC employment. The courses had found the application in a number of middle and higher schools, at centres of employment service, for personnel on-the-job retraining. The elaborated reference library for training courses is an important contribution to a solution of a problem of computer competence in our country.

A traditional index depicting the extent of cultural and technological country's progress is a proportion of inhabitants able to read, write and count. Presently, this list includes, by right, the portion of active population able to employ the main computer. Nowadays principal modification of basic software generations takes place. Within the next decade this process will call for mastering operating systems (of Windows or OS Macintosh type) and the test processors (of Word or WordPerfect type), as well as electronic tables (of Excel or Lotus 1-2-3 type) and databases (of Access or Paradox type) with the aim use a computer in tolerant way. The modern computer competence implies also the precise knowledge of local and global networks and of the options of computer communications.

In many respects, the computer competence is a basis to determine the extent of information technologies and technical progress evolution for a country. Russia began to move toward the informative society creation; therefore the basic knowledge shall be promptly and widely practised. There are a number of ways to solve the above problem. But it is well known that the answer to a question: «How to train the computer mastering with a minimum of expenses, quickly and effectively?» is extremely brief: «By means of modern computer».

There is no such a field of knowledge, where the application of a computer would be more rewarding, than in the sphere of new information technologies. With the purpose of realization of these capabilities, it is necessary to establish a reference library for automated training courses that can be widely implemented both for self-training and for organized training of PC users. The team of specialists from Moscow Physical-Engineering Institute initiated the investigation of this problem in the frames of specially established by the team UNIAR company [1]. Now it is one of the leading enterprises focusing its activity on the elaboration of computer training courses on the basis of the software that is much in demand. This development was included into the «Electronic textbook» programme under State Committee for High Education of the Russian Federation. Recently there were elaborated about twenty courses, which are widely used in practical work. Some of them are as follows:

Introduction to Window 3.1. The course introduces to fundamentals and options of graphic operating system that is intended for the beginners at PC work. The training system allows mastering the navigation rules and the main elements of the system. The course consists of six lessons, in one of which the operation with File dispatcher is treated in details. In the course of operation with the programme a learner can obtain necessary experience of «mouse» manipulator use through the special lesson on «mouse» operation. The programme is beyond the demands of computing facilities. It operates well under MS DOS even at a computer of PC XT type. The programme is widely accepted and recently its extension appeared. The course introduction to Windows '95» comprises the fundamentals of system construction and methods for operating with the new version of a known operating system. The course consists of six lessons, in which a large scale of options and improved operation methods for Windows '95 are systematically presented.

The «Novell NetWare» local networks course introduces to the methods of local computing networks construction and its technologies. The learners master the theoretical basis and practical skills required for operation awareness in network and for realization of separate administrator functions in local computing network. The programme is ruled by MS-DOS.

Database entry is a computer course, introducing to databases structure and to the expedients of operation with them. The course consists of six lessons and comprises the following issues: the basic terms and definitions for operations with databases (data types, data file structure, and organisation of information search in a database). By the example of DBMS dBase there are presented the problems of development of both programme visual facilities and programmes for information input. The training programme operates under the control of MS DOS.

In the last few years considerable study is given to the office systems (MS Office, Perfect Office) in the course of users training. Their appearance and wide propagation pressing an actual standard for mostly mass spheres of computer employment and increases significantly the efficiency of operation with text, graphic and various numerical data. The possibilities of these systems are practically unlimited, they set the new level of specifications to the fundamental computer training. Incorporated into the developed by UNIAR reference library, the computer courses assist any beginner to be prepared for the job in modern office.

One of the basic instruments within any modern office system is a text editor. Both recently created courses Word 7.0 «First steps» and Word 7.0 «The way to the tops provide the initial training of users of text processor which is incorporated into the «MS Office 95» set of programmes. The courses introduce to basic capabilities of processors, teach the editing expedients and text formatting, employing of styles, patterns and means for automatic operation. Much attention is given to constructing of tables and forms, inserting of illustrations, developing of macros and using of «masters». The presentation and demonstration of a new material is accompanied with practical exercises, which are accomplished in Word medium. The programme operates under the control of MS Windows.

Other mandatory instruments of the computer office are electronic tables. They are introduced through the «First steps» and «The way to top» Excel courses. The training is underway of the example of typical bookkeeper assignments. The computer courses teach in action to use a host of opportunities of the Excel system. All exercises and practical work included into the course are fulfilled directly in the medium of Excel system. The programme operates under the control of MS Windows.

The employment of DBMS results, as a rule, in the grave troubles for majority of modern computer users. The introducing course is appeared to be insufficient for operation with databases. This objective can be achieved by means of the Access 2.0 «First steps» and Access 2.0 «The way to top» training courses. These courses allow to obtain a general knowledge on databases and to be familiar with the options of the «Access 2.0» system. As a result the learners assimilate the expedients of development and employment of databases. Up to the end of the training they are able to develop the simple database for their own requirements through the Access facilities. All practical actions, executed by learner along with advancing through a course, are accomplished in the Access medium. As in the case with other training programmes concerning about a work in modern office, these programs operate under the control of MS Windows.

During «precomputer era» the mass culture of material production for addresses was comparatively not high. The development of the systems for onscreen computer graphic sets a majority of users to make a new view on the computer use. It operates in conjunction with a system of processing Power Point 4.0 for presentation, included in a set of standard means «MS Office». The learners obtain a general knowledge on the techniques for preparation of various materials and illustrations for the reports; they study how to produce high quality presentation materials for their own lectures. The required by courses exercises and practical tasks are executed in the medium of «PowerPoint 4.0». The programme operates under the control of MS Windows.

The described computer courses are successfully used:

- at centres of retraining and skill upgrading;
- at popular education and special educational instituted;
- for self-training of professional software for personal computers.

We have referred to the selected competed developments. All «UNIAR»'s elaboration are concerned about the new achievements in the sphere of computerized training and employ the unified methodical scheme:

- reveal the utilisation range of software studied;
- demonstrate the operational expedients with software studied;
- ensure the formation 'and secure the operational experiences along with actual solution of problems.

All computer courses contain the simulator of software studied, and the learners use these facilities for preparation of exercises and adaptation to practical activity. The study period of a separate computer course amounts from 8 to 14 hours, depending upon software and personal features of a learner. The availability of Sound Bluster type computer device is desirable for courses' multimedia utilization.

As for the computer training courses, developed by UNIAR, they are implemented at the centres for personnel retraining, at the middle and higher schools at the business schools and at the courses of computer competence. Developed by UNIAR computer training courses are widely implemented in educational process at a lot of popular education schools, at MOSCOW Physical-Engineering Institute and at a number of higher schools in Moscow, as well as at training centres of Saving and Central Banks of Russian Federation, and in many specialised educational, industrial and financial institutions.

Implementation of the above programmes shows that the computer training courses appeared to be the effective tool for the establishment of basic knowledge in the sphere of information technologies and magnification of computer competence in the country.

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IMPLEMENTATION OF PROGRAMMING ENVIRONMENT LOGOMIRY *TO TEACH PHYSICS IN SCHOOL*

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The development of new information technologies (NIT) has created the opportunities for fast increase of the efficiency of the educational process at school. NIT implementation results in modifications of the style and scales of search for the new information by both a teacher and students, and, as a consequence, in alteration of new educational material presentation by the teacher. Creative character of educational task fulfilment wills certain to become the standard for educational process.

NIT creation is the process of development of new processors, of new computers and, that is very essential, of new software.

Development of Mackintosh computers, carried out in the view of educational needs, and creation of *LogoMiry* programme environment (as a tool for development of the manuals and as a means for educational projects execution by the students themselves) shall be regarded as large-scale events.

After the authors gained access to Mackintosh computer and mastered the *LogoMiry* programme environment, they could prescribe to themselves the objective as follows: to develop a set of training materials, which could serve as a computer support for the course of physics at 7 classes of the basic school. Two pedagogical software (PS), « Rectilinear uniform movement» and «Archimed Law. Floating of bodies», were included into the above the set.

«Rectilinear uniform movement» PS was developed with the purpose both to help the teacher to foster in the pupils clear knowledge on rectilinear uniform movement and to help the schoolchildren to master the process of constructing and reading the diagrams of a movement.

When coming to the 7 classes, the schoolchildren have not less than two-year experience of solving the problems on the theme «Uniform movement», that they acquired at the lessons of mathematics. It is necessary to notice, that there are some «white spots» in the experience of the schoolchildren; they did not see the demonstration of the uniform movement, did not carry out their own experiments or laboratory work, did not make measurements of physical parameters.

Though at the lessons of mathematics at the 7 classes the schoolchildren get acquainted with diagrams of the uniform movement, they do not gain sufficient experience in mastering of physical sense of segments that are plotted on co-ordinates axes (on axis of time Or and on axis of distances *Ox* or Os). Therefore the schoolchildren, as a rule, experience difficulties, having received a task to specify a trajectory of a body movement on drawing with diagram a body movement.

It is reasonable to fill the gaps in knowledge on the rectilinear uniform movement during studying of an appropriate theme in the course of physics for 7 classes.

At the development of PS «the Archimed law. Floating of bodies» our objective was to present the main contents of the theme in evident and easy for understanding form, having avoided, whenever possible, reticences, discrepancies in presentation of the theme, which pupils meet in the school manuals.

What are the barriers on the way of schoolchildren in the process of mastering the essence of the Archimed law? The pupils study conventional formulation of the Archimed law, which is not general enough. We shall note, that in the conventional formulations of the Archimed law we meet such definitions as «displaced» liquid or «immersing of a body into a liquid» which have obviously restrictive character and, at the same time, which are not necessary.

We shall explain it by the following simple example. Let us assume that there are available an aquarium of 5 litre capacity and a piece of a material with the volume of 4 cubic decimetres and with the density exceeding the density of water. We fill our aquarium with 1 litre of water and then put the piece of the material into it. This piece, certainly, displaces some water, though not the whole quantity, but only a part of it. In this case it is clear, that the volume of displaced water cannot be equal to the piece volume. At the same time the piece and the water that are in the aquarium will take the whole space inside it.

So, we can make the following conclusion: for occurrence and existence of interaction between a liquid and a body, which is completely or partially in a liquid, a history is of no importance how this body appeared in the liquid, whether it was immersed in it, or not, and whether the liquid was thus displaced or not. The fact of the presence of a body or part of it in a liquid is the only important fact. The consideration of the above circumstances promotes a more clear knowledge of the Archimed law essence by the schoolchildren.

In the course of teacher's lectures on the Archimed law we recommend to attract pupil's attention to the following moments, which are, in our opinion, essential.

The tests, in which the bodies are immersed into a liquid and displace it at immersing, certainly, help to find out Archimed force and, moreover, to establish dependence between Archimed force and «the volume of a liquid displaced by a body». But, may be, it is possible to present to the pupils more general formulation of the Archimed law where the volume V in the formula, expressing the Archimed law, is treated as the volume of a part of a body being in a liquid.

In course of physics at the 7 classes the formula of the Archimed law is traditionally established for that case, when the body has rectangular shape. However, the Archimed law retains its validity in more general cases, when the shape of the body, being in a liquid, is arbitrary. It is important to lead the pupils to the conclusion, that the importance of the Archimed force does not depend upon the shape of a body, exactly as in the case of the hydrostatic pressure that does not depend on the shape of a vessel, which contains the liquid.

In summary, two facts should be mentioned, which seems to be significant for us.

At the beginning the PS development, we assumed, that only a teacher would use each training material as a support for investigated theme presentation. But the interest paid by the schoolchildren to our training materials set us to develop specific fragments, designed for individual work of a pupil with training materials. As a result, we produced the paragraphs of «the living book» instead of the paragraphs of «the electronic textbook». That is why we think that the future of «the electronic textbooks» is «the living electronic textbooks».

It is natural, that at the completion of the work on the training materials we have found out some imperfections in our development. In the process of eliminating of the above imperfections, we have understood that it was easier and faster to write a new fragment of the programme, than to correct former variant of the programme fragment. Thus, we were convinced that *LogoMiry* became very effective and very productive tool in our hands.

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THE INVESTIGATION OF VISUAL ATTENTION OF JUNIOR SCHOOLCHILDREN BY COMPUTER METHOD

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Attention, as a predominant way of cognitive activity realization, ensure a successful training through both the traditional methods and the new information technologies. The computer training can be successfully put into effect, if such grades of visual attention as selectivity, concentrating, stability, switching, distribution and volume would be formed by children adequately. Insufficient development of main types and grades of children's' attention brings to its disadaptation in primary classes. Inborn or acquired in early ontogenesis, the significant reduce of eyesight is followed by a deficit of visual attention.

The evolution of visual attention is coupled with a formation of experiences to reveal and to recognise the objects at various parts of space. The exact concentration of attention at one or another part of perceptual field, where the object is revealed, is the necessary condition for realization of perception. Physiologically vigorous stimuli, which a child is able to perceive should be chosen to form such experiences. The level of resolution of image features is of great importance: their brightness, colour saturation, contrast, relief and so on. At the same time it is desirable those stimuli to cause an interest and emotional reactions with children. The surprise of object presentation is an important term to attract an attention to it. The activation of attention can be reached under the change of probability of object-stimulus appearance in view field and perceptive task, when the stimulus confers a signal way, or by introducing a feedback, or in visual searching, etc. All these circumstances can be achieved by computer method as means for investigation and evolution of visual attention and perception.

The program for realization of this method was worked out by the mathematician - programmer E.Rytsareva with a view to PC of the type of IBM PC AT (EGA or VGA monitors). The method is aimed to investigation and formation of resolution concentration, switching and distribution of attention.

From a distance of 50 cm a learner is looking at the black recording circle of 10 mm diameter in the centre of display screen. Suddenly at different distances from it along horizontal, vertical or diagonal (without warning signal) in quasi-random order the geometrical figures are presenting with dosed time of exposure. The suddenness ensures the most efficient mobilization of viewing mechanism of attention. According to a preliminary instruction a learner is required to push a key as soon as an image appears at a viewing field, and to switch over a glance to it to recognize its shape and colour. The principle of feedback is realized here along with operation. If the shape and colour were determined correctly, the green circle situated in the left lower corner, flashes with 1 Hz frequency, but, if a learner makes a mistake the red circle of 20 mm diameter flashes. The learner has to distribute its attention between stimulus and return signal. At different positions of perceptive field images can appear with equal or different probabilities. The rate of stimulus detection will prevail at more probable positions, than vice verse. PC storage automatically records the digital data concerning about reaction time and a number of mistakes in recognition of shape and colour, and the mean time of reaction is also calculated. A quality analysis of mistakes carries out the teacher. The shortage of a reaction time and decrease in number of mistakes give evidence of attention quality improving.

The technique was approved in the experiments where 37 of normal eyesight and 25 of low eyesight (0.01 - 0.1 keenness of sight) children of 7-12 years old. The analysis of results revealed the significant fall of a number of mistakes in recognition of figures and reaction time shortage for a group of normal eyesight children of 9-11 years in comparison with children of 7-8 years ($p<0.05$; $p<0.01$). The discrepancies between mean values characterizing the number of mistakes in recognition and for reaction time in groups of 9-10 years and of 11-12 years are minimal and doubtful. A scatter of values for reaction time is small for groups of all ages and shows the validity of a technique.

For children with low eyesight in all age groups the growth of the number of mistakes and the reaction time, as well as a scatter of these indexes, was caused not only by violation of sensor function, but also by non-readiness of basis qualities of a view attention. When it was required field and selective sensing of target figure, children made much more mistakes of recognition than children of the same age with normal eyesight. The reaction time was twice as much the normal value. Thus for children with residual sight (0.01-0.04) and deep weak sight (0.05-0.1), which have not gone through correction background in kindergarten and went to school, the violation of sensor-perceptive process and lack of cognitive motivation for visual subjects were combined with non-readiness of features of sight attention.

In an effort to compensate the violations of sight attention and perceptive within one academic year for appropriate children a course of perceptive training was arranged in combination with physiological and physiological methods. The control test after the course and had shown a considerable drop in the number of recognition mistakes and a shortage of reaction time over nearly all stimuli applied.

The comparison of the results obtained with neuro-physiological data allowed to suggest that the deficit of sight attention for appropriate children is caused by immaturity of cerebral activation systems because of sensor deprivation. It is shown the important role of perceptive training in compensating violations of activation processes and mechanisms of sight recognition.

This study substantiates the necessity of organization for children with violation of attention and receptive the special perceptive training, involving a marked room for computer methods with promotion of cognitive motivation. The method of this work verified as a computer technique can be applied both as diagnostic test and as a correction method developing the sight attention and a receptive in their interconnections.

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DIALECTICS OF CONTRASTS OF A MULTIMEDIA SYSTEM

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Every object regardless of human will and desire can be conceived as a dialectic unity of the positive and the negative. There is no doubt that depending on certain conditions its positive or negative qualities show themselves to a different extent. Multimedia system, a result of computer technology advancement, can also be related to such objects. Much is being said and written about the multimedia systems by both specialists and dilettantes and everybody sets big hopes on multimedia.

«Multimedia» is a new word, it has not yet been included in Russian encyclopaedias and that is, probably, why it is interpreted differently. According to one interpretation multimedia is the combination of several channels of transfer of information (sound, image, sometimes - motion of real objects) from a person to a computer; it is also implied that there is a feedback allowing a person to directly influence the sequence of events in a system.

The developers of modern multimedia systems aim at the most accurate simulating of the reality and at creating a virtual world where a human being could accomplish what he/she is not able to in a real world and where he or she would play the major role.

The multimedia technologies are very instrumental for educational process. Multimedia systems allowing for delivering the required information through different channels significantly aid in mobilization of human memory, which is especially important, for instance, for learning foreign languages.

At the present time multimedia systems are at the initial stage of .introduction into the educational process. The oncoming near research work of teachers and psychologists will demonstrate the effectiveness and efficiency of using multimedia in education.

Work with a personal computer looks like a simple pressing the buttons and, though, there is enormous labour of programmers behind these plain actions, the educational process may become rather mechanical than creative. Such education provides for only descriptive and superficial knowledge about an object or a process whereas every subject requires the ability of logical and creative thinking.

The programming of functions of artificial intelligence devices demands extensive knowledge not only about management facilities, their structure and specifics but also about receptive qualities of a human being and the laws of perception of visual, acoustic and tactile images. The software controlling such devices is very sophisticated being a product of efforts of a narrow circle of high-rank specialists. The further development and update of multimedia tools including those used for educational purposes is one of the most important tasks of the present time.

Another application of multimedia is computer games, which arouse a desire to outrun and win natural to every human being. The monotonous rhythm of a multimedia game stupefies the human mind and allows for easy influencing person's sense and feelings, which is far not always done for decent purposes. This is one of the negative qualities of multimedia but, certainly, not a reason to stop their development. Reasonable and measured application of multimedia will definitely contribute in improvement of the educational process and, subsequently, in development of an individual and the entire society.

The ideas discussed above constitute one of the possible interpretations of dialectic dualism of multimedia. It is hard to deny that some of those ideas are debatable but it is the debate that gives birth to the truth.

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COMPUTER MEANS FOR TEACHING IN HIGH SCHOOL AND TEACHER TRAINING

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Last years there has appeared a lot of programme means (software) intended for utilization in the educational process in the high school. This fact is the result of great demand for training software. The programmes are intended for application of such modern informational technology achievements as moveable patterns, sound following, multimedia means and computer networks for distant training. There has been created a lot of programmes for teaching of different disciplines, mainly special programmes, which are ready to be used directly in the training process. There appeared possibility for educational programmes exchange through Internet international networks, WWW. Along with this the experience of computer educational means implementation into the training practice has revealed a lot of problems including the problems that are directly connected with didactic process and teacher's work.

Without large exaggeration one could state the prospects of training computerization and efficiency of computer means application for the teaching improvement in high school mainly depends upon teachers, on the fact, at what degree these means would be demanded by them and how skilfully and wide they would apply these means in their practice. There are several problems connected with involving of the teachers into the process of active implementation of the above means and methods. Let's consider these problems basing on the experience of work and communication with teachers from high schools of Russia and CIS countries, who study at retraining courses under Moscow State University (MSU). Here, at the Chair of pedagogics, psychology and teaching methods in high school at the Psychology department, a psychological-pedagogical cycle for teachers of all specialities is carried out.

One of the main problems is poor psychological-pedagogical training of most of high school teachers that is aggravated by general lack of development of some didactic in the high school. Actually, during last years only few works were edited on the above problematics; and, just the contrary, it cannot be said about the number of works on didactics in secondary school. At the same time, the high school didactics as well as high school pedagogics, in general, has several specific peculiarities, which has principle character. Namely, in connection with this fact in the Centre of Scientific and Pedagogical Staff Retraining under MSU by the efforts of the above-mentioned chair a psychological-pedagogical cycle of disciplines is read, including the «Computer teaching means» course.

In contemporary conditions the motivation for the use of new educational means becomes weak. The teachers work is not in any way encouraged in this field; in the best case it is accounted as «secondary» one, low prestigious, methodical. At any rate, such work is considered as less respected than scientific and research activity of the teacher. The intensification of the above-mentioned motivation ought to be carried out not only by means of introducing of various encouragement and bonuses, but also by means of stimulating steps of the management of both high schools and its chairs, by means of creating of corresponding psychological climate around this type of activities. A significant role belongs to the competency of a teacher in the field of computer engineering and training technology. In this case the improvement may be achieved not only by efforts of higher schools themselves, but also in the framework of teachers upgrading through creating active communications with the courses of psychological-pedagogical cycle in general and educational activity computerization, in particular. It seems that this might be stimulated by unrolling of scientific-research investigations on the teaching computerization, supported by State Committee for Higher Education of the Russian Federation on high school education, by other sponsor programmes and grants.

The other group of problems is connected with peculiarities of the software in the field of computer teaching technologies (CTT). In estimation of corresponding software it is necessary to start from the fact, that the teacher, doubtless, is a creative person with his own view on what and how be ought to teach in the framework of the discipline (surely, in the frames of the curriculum and course programmes). He has his own opinion on the educational course organization, used methods and means of training. Ready for use computer programmes concerning «teacher's own» discipline, as a rule, rarely correspond to individual tastes and requirement of the teacher, since they do not take into account neither individual condition of teaching in this high school with given contingent of students, nor the peculiarities of the given discipline contents. That is why there appears a problem to develop such programmes and instrumental means, with the help of which the teacher might become either designer of certain computer programmes of teaching sphere, or obtain the possibility to break into the contents of already existing programmes, adjusting them to his demands and tastes, for examples, to choose necessary tasks from data and problem banks, to change the parameters of used computer models, to have freedom of volume and succession of training type etc. In this relation a special attention ought to be attracted to the development of instrumental means and programme envelope, such as automated training systems (ATS) as well as technology of «own» computer training courses preparation.

Currently, there has been developed several programme envelopes of ATS type of various complicity and degree of perfection, such as *«Lesson», «Adonis», «Dolphin», «Rainbow», «Ackson», «Tutor»* etc. They are not concerned to expert (or intellectual) class, but a lot of achievements of modern computer technology are used in them. Most of above mentioned systems (except for *«Ackson»* and «Tutor») present the teacher absolute freedom of activities in composing of training program. The presented possibility is followed by necessary fulfilment of the following requirement: in order to fill the programme envelope by training material, e.g. to create a computer training course, the teacher ought not only to develop the content (subject) part of the course (the whole training material), but also to create detailed step-by-step scenario of the whole training process, e.g. to carry out modelling of absolutely all possible study activities of the student.

In spite of aspiration of the system designers to make easier and several attempts to automate this work, which is not typical for teachers in «non-computer» technology conditions, it, nevertheless, maintains as sophisticated and alien, non-peculiar for teachers profession activity. The other difficulty in the development of «own» computer course in the framework of programme envelope and utilization of its information possibilities, is the necessity not only to study these possibilities and to know, how to use graphics, movable patterns, to introduce formula etc. but also to learn how to create the necessary illustrations, to realise them with skills, to introduce into computer etc. This activity requires professional skills of other experts: psychologists, painters, pencil artists etc. There appear difficulties in the design of own computer educational courses (CEC) which one stipulated by the necessity to deal with non-peculiar for teacher work. A certain way out of this difficulty is presented by computer training technology developed by prof. S. I. Kuznetsov (Moscow, 125080, Volokolamskoye shosse, 11, Moscow State Academy of Food Industry, department of ITE) according to which the teacher's work is limited by the scenario creation, while the rest part is delivered to professional group didacts, painter-illustrator, pencil artist etc. (Brief data about the systems - see collection of *papers «Computer training facilities. Didactic Programming».*

Ed. Krivitsky B.Kh. «Znanie», M.:1994. See also: Brusentsov N.P., Maslov S.P., Kh. Ramil' Al'vares *«Microcomputer system of training «Tutor»*, Nauka, 1990). The drawback of such technology is not only complicity of interaction between individual experts, but also in the fact that the teacher in somehow pushed aside from direct work with the computer. The access to the developed material is somehow impeded for him, he does not feel himself any more as an owner of the developed by him course, all the corrections and additions require work with other persons. The «dynamism» in the work is loosed, the teacher stops to feel himself as an author and designer of the course. This especially reveals at the initial stages of accustoming of the teacher to the work with computer educational means, at which he often decides, whether he would introduce there means into arsenal of usable ones, or they would appear beyond the frames of his activities. Since the initial stage is so important, it deserves a special care. It's necessary to create such conditions, in which the teacher, having minimum experience and knowledge in the field of computer techniques, could be able independently, without assistance from elsewhere and participation of other persons, to create and tune his course. Approximately such conditions are provided by *«Ackson»* and *«Tutor»* systems. Namely the easiness of mentioned systems make them preferable for teacher's work at the initial stages of attaching to CTT.

If one would take into account the necessity to increase the student's motivation to work with CTT (here it's necessary to obtain maximum accessibility and freedom of activity of the student), than it would be clear the aspiration to make the program of *«Ackson»* type as playing one, however under the condition that the organisation of such game in the problem of computer, not of the teacher. The activity of the teacher concerning the creation of computer course ought not to change in any way. After obtaining of the initial experience in the development of the computer educational courses and computer training materials the teacher may be proposed the systems with higher technological possibilities, for example, one of above mentioned.

The intellectual computer systems of educational purpose deserve a special consideration. We mean such systems as «Intertutor» and «Reviewer» (see the above mentioned references). It seems that the main problem here maintains the filling of envelopes by didactical subject knowledge.

Surely, the teacher may not limit himself by the development of CTT. There are a lot of means of training process providing, where the teacher appears in the role of a user of ready for use programmes. But they must provide the opportunity of variations while selection of the material and allow at least limited break into the choice and contents of training tasks.

Apart from above mentioned, there are a lot of other problems of psychological and pedagogical type, which though require additional theoretical investigation, ought to be enlightened in the courses, which are presented at the teachers' retraining. Let's mark some of them.

The first is the problem of the training material selection. This problem may be and even ought to be «delivered to computer». At this point it's important not only to account the possibilities of CTT, but also to determine functions, which maintain and ought to maintain in the teacher's competence in the educational activities. The other problem still is the analysis of those peculiarities and negative consequences, which are stipulated by the unlimited implementation of CTT. Some of them are already solved, while others are waiting for their investigators. It's well known, for example, that too much animation with computer training not only shortens the duration of vital human contact of the student with the teacher, but also stimulated in the student to special «computer» thinking, lacking in diversity and flexibility, typical to human thinking. In care of too much animation with computer study the practice of oral student's activity shortens in a significant degree, which is in any case insufficient. The duration of interaction with other persons during preparation of joint work also shortens. At the same time the group activities is a character feature and significant peculiarity of further practical work of the experts in modern conditions. It's important also to unroll the gravity of remote consequences of training computerization in the activity of future specialists; this is the problem, which also has not yet found its investigators.

Among urgent problems one ought to mention the problem of informational work improvement which concerns CTT and investigation of its didactic peculiarities. The main programme means of educational purpose are collected currently in the Information Systems Research Institute of Russia. The research works in the field of didactic feat uses and efficiency of these means utilization are not unrolled here thanks to some circumstances. Probably, favourable media for such work may appear at the chairs where teacher's retraining on computer educational means is carried out. This would be promoted by reading of full value courses on CTT. The organization of systematic seminars with the discussion of psychological and pedagogical problems might be useful in the evaluation of CTT. As an example, one might present the seminar, organized by the department of applied mathematics of Moscow Power Institute. The seminar is diverse according to its subject-matter; it is very useful for high school teachers on physical-mathematical cycle disciplines.

It seems that the problems affected here are typical not only for Russian reality, but present more wide interest and are actual for other countries, especially in the threshold of approaching wide inculcation in practice of distance training and Interactions between high schools through Internet.

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THE ROLE OF COMPUTER TECHNOLOGIES IN MODERN SPECIAL EDUCATION AND METHODOLOGY CREATING COMPUTER PROGRAMMES FOR CHILDREN WITH BREACHES IN DEVELOPMENT

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The Institute of Correctional Pedagogy of the Russian Academy of Education posed a problem of computer technologies introducing into the system of special education of children with breaches in development as a methodological problem. There was comprehended and described the role of computer technology introducing in the special education system, development of professional thinking of the teacher-specialist on mental defects and physical handicaps, general development of anomalous child of school age.

Wide introducing of computer technologies into special education in Russia has started in the end of 80-th - beginning of 90-th years, much later than in other countries of the world. By this time there was already comprehended hopelessness and uselessness of the attempts to train the anomalous children in the languages of programming. The complete change in the ideas on the computer use occurred, since then it can be considered as a new learning facility. However, either in mass, or in special education the hopes were not completely justified that the implementation of this new, powerful and attractive mean would substantially influence upon the quality and results of children education.

The experience of computer technologies introducing into special education clearly shows, that the efficiency of this process depends upon the quality of computer technologies at much lesser extent as compared to the factors of psychological and pedagogical essence of the subject, of the functions prescribed to them, of the role that they play in the educational system, and of the teachers' inclination to use these technologies in the training process. The progress in the new computer (hardware) models development and implementation of higher computer technologies into education not necessarily indicates the increasing efficiency of anomalous children training.

Implementation of computer technologies into special education does not always present progressive phenomenon. In this case the computer technologies shall lean upon various productive psychological and pedagogical ideas. Entering into already formed pedagogical systems, these new media might influence these systems in various ways. For example, in computer form some offending training methods may be repeated and replicated such as not at all the best examples of tasks, methods and skills of teaching, as well as conventional, but already outdated approaches. In this case, the computer technologies note and prolong the action of the outdated approaches in attractive form, thus hindering the development of learning systems. At the same time computer technologies are able to support and replicate new progressive psychological and pedagogical approaches, thus assisting the practice of their «comprehension» and promoting the development of the educational system development.

The question concerning new means for the system development has become extremely significant due to the fact, that the time of computer technologic implementation, i.e. 90-th years, coincided with the transformation period of state system of mass and special education under the influence of social, economic, and political changes in the country. In such critical moment for the special educational system the introducing of the above-mentioned new and powerful means might play different roles: to promote either the improvement and further development of the system, or to support the existing practice.

As to the logic of the development of the national system of special education planned and constructed on the L. S. Vigotsky's concept, which concerns developing mission of social education, new computer technologies, first of all, ought to support and note modem psychological and pedagogical approaches to the developing training of handicapped children.

The methodology was developed for computer programme creation for special teaching of school age children, processing pronounced damage of development (deaf, weak-hearing, week-seeing, children with damage of speech, delay of physical development, definite degree of intellectual damage).

Computer programmes ought to present special types of pedagogical tools, which are called to fulfil the following functions:

- to make «visible» latent in traditional training problems in child development;
- to make «visible» similarity and difference in the development of children of the same form;
- to show how one might transform the allotted problems of child development into special problems of his training;
- to show how one could interrelate the «steps» in child development with the «steps» in teacher's methods;
- to draw attention to the main substantial directions of child development and corresponding tasks of training;
- to show pedagogical ways to decide the new, earlier not existing, problems of social training.

In the framework of proposed methodology there has been designed a first specialized computer media - *«The world beyond your window»* - for primary children training with pronounced damage in development (authors: O. 1. Kukushkina, T. K. Korolevskaya, E. L. Goncharova). It consists of four parts: «Times *of year», «Weather»,* «Dress *according to weather», «Stories about times of year».*

The first part - *«Times of year»* - is a pedagogical instrument to reveal the character of child's personal experience with its special needs, measures of its generalizing, systematization, word mediation. The program propose the following principle: from vital noticing experience and child's impressions, through conscious cognition activity and modelling, to systematic generalising.

The second part, *«Weather»,* presents a pedagogical instrument for revealing problems of communicative and social-emotional development of child, assisting the teacher to see, what namely the child, without special training, is often not able to express his emotional attitude to a fact, don't understand, that other has his own attitude, don't suppose, that these estimations may not necessarily coincide. The methodological followings shows, how one ought to transform the problems of social-emotional development into the problems of special training. It shows, how one might use provided by the programme exercises for forming child's emotional reflection, methods for word expression, for transformation of the emotional relations and estimations into the object of cognition process.

The third part, *«Dress according to weather»,* is a pedagogical tool for revealing in the child the skills to utilise the knowledge for everyday problem solution. The exercises of this part of the program helps the child to learn how he/she should choose the clothes using as a reference-point firstly the landscape beyond the window and entire temperature, than the weather prognosis, and, finally, time, goal of his/her voyage, supposed type of activity.

The fourth part, *«Stories about times of year»,* presents a pedagogical instrument for revealing of hidden problems of reader's development which lead to misunderstanding of text essence. It consists of three great blocs, the titles of which reflects their objectives, such as «Preparing», «Try to think».

The *«What's the problem?»* bloc is an instrument for transfer of the «latent» problem of readers development into «visible». For solution of this problem the child fulfils lot of times one and the same exercise: «What is the time of year?» He has in his disposal four corresponding answers: «Winter», «Spring», «Summer», «Autumn». The strategy is strictly followed by: only one task and a lot of texts (60). The texts are combined into libraries, which are selected according to principle: vocabulary is always easy, the grammar is also easy, but it is gradually more and more difficult to comprehend the text. Successively increases the difficulty of essential analysis of the text. Each library presents a certain type of text, a certain mode of analysis, a definite level of text comprehension difficulty. In order to understand about what season is the conversation in the first library it's quite sufficient to «see» the key sentences with the description of clear signs of different year seasons. It's a little bit more difficult to understand the texts from the second library. In these texts there are no evident and clear directions on the year season. The child would determine the time of year only if he/she would recognize in the text the signs of the «second order». It's even more difficult to comprehend what is told in the texts of the third library. The presentations about times of the year are set in latent form, while different parts of the text born hypothesises, which contradict which each other. In order to comprehend the texts from the fourth library the child ought to allocate signs of year time and to «summarize» them in brain along side with reading the text. *«Stories about times of year»* present the instrument for determination of reasons concerning misunderstanding of the text by each child, which lie in the field of the analysis skill readiness, skills of mental activity, directed to the text comprehending as a whole.

The present media contains several hundreds exercises each of which has variable (verbal and visual) forms of presentation, successive «step by step» complication, gradual system of support, that is principally significant for successful training and teaching of all kinds of children possessing deviation in their development.

«The world beyond your window» is an example of an approach to the development of special training computer media for children with deviations in their development. These media are adequate to the tasks of contemporary stage of special education system development. In the framework of this methodology in computer form there are presented specific ways of child training with special needs, necessary for his development. Namely that is why these types of programmes may be used for anomalous child training, independently of the fact whether he studies in a special or mass school. In mass school these computer technologies would help teachers to reveal the development problems, to understand the reasons of child's failure, to open to them special, roundabout ways of children training with special needs. These technologies are developed in the frames of special psychology and pedagogy.

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SCENARIO APPROACH — A CONCEPTUAL AND METHODOLOGICAL UNIT OF DISTANCE EDUCATION

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> ***«From all types of brain torporing in the result of education the most fatal for genius is dogmatic method of teaching...»***
>
> *J.Bernal*

In post-industrial epoch of development and informatization when concept «Education without boundaries» becomes priority and mostly acknowledged, one can surely speak about educational system paradigm change. Complication of cognitive process makes to re-comprehend the traditional repetition-reproductive principles and supposes the appearance of «computer link». Effective method innovations of heuristic character are actively inculcated into the educational process. In the conditions when principal change of communication means is carried out and as an important component of teaching appears «computer page», contemporary progressive training technologies have a right to rely on adequate estimation and active application.

The proposed model of scenario approach includes one of the most effective mechanisms of dynamic teaching methods and presents a conceptual-method unit either distance and open or postal and stationary education type. In its base there was set a four-block algorithm, which realises during logic-methodological and psychological investigations step by step model of decision acceptation. It includes the stages as follows: informational, selective and estimation, expert and specialised (final) blocks (stages). Each stage has a fixed with it certain tasks and functions. Each block is oriented on satisfying of special cognitive demand in information, selection and evaluation, expert analysis, final generalizing and prognostics. Their combination supplements the training model up to the necessary and self-sufficient integrity. The subject of training process, mastering step by step the functions and tasks of each block, masters the methods of essential training and literate constructing of the materials.

The main goal ***of informational stage*** is maximum wide information about the problem, based not only on «book» knowledge, but also on personal experience, own representations and suppositions. In this primary information the limitation on the material selection are illuminated in order to stimulate the heuristic search, and reveal the authorised portrait of the trance. Only initial elements of structurization are maintained. The informer is proposed to comprehend the goal of his presentation, fixate certain ideas and main settings, open his own views and carry out personally important conclusions. The ways of thinking might be different, they depend upon individual tendencies of training subject appeared in the block of informers, and logic that was chosen by him. As an account form it is supposed to prepare an informational page (abstract text or base synopsis).

The task of ***selective-estimation block*** consists of selective chose and estimation of the material on the studied subject-matter, elimination of non-strict, tautological formulations and accentuation on the proper settings. Here so called «opponent principle» is used: to reveal the advantages, formulate critical remarks, to tell the proposals. The account form supposes the packages of control questions on the theme, in the list of which not only direct and leading question are allowed, but also the questions relied on the erudition, supposing multi-aspect vision of the problem (ethic, aesthetic, utilitarian, historical, economic). Apart from package of questions, the account form contains problem cards. In these cards there is supposed to present the interpretation of the chosen fragment of the original text, or to comment the possible non-standard situation. All possible formulations of creative tasks are welcomed. It's supposed, that these forms would allow to reveal the creative potential of the participant of the education process.

On the third-expert stage it's in prospect to create a scenario, in which the main accent falls on the revealing of key ideas combination, their interconnection and hierarchy. The main and additional problems are classified in it, the dominating and determining problems are defined, the system of organization is mastered. Apart from them the reason-consequent connections and temporal graduation are revealed. The scenario is considered as a hypothetical succession, which answers on the questions: how could the proposed task or problem develop step by step, what are the methods to preparation of this or that result?

In the process of scenario construction several approaches are possible. Traditional, approbated by centuries method of training in accordance with principle «Do as I do» supposes detailed following the classical narrative scheme of material delivering from easy to complicate. «Method of socratical ironic» allows moving of contents confronting the opposite position. This method contains step-by-step setting of the question, acceptation of this or that variant of answer, and again successive correction in meeting of new question. So called «*Janus thinking*» tunes of disproof of proposed decision and confirmation of alternative one. Another approach also is possible, in which from the central idea the successive position increase and develop.

The account form is the scenario of expert proposed with the account of frame law. The trainee himself proposes the graphic scheme, while its internal content ought to be strictly connected with professionally mastered material.

The final (specialized) stage is connected with the fulfillment of integrative function. Here one ought to present the result of the theme study, e.g. to fixate strict and unrolled plan of the answer or the hole study. It's possible the coexistence of alternative essential approaches. The account form - scenario of the specialists - is devoted to illustration of dominating idea, formation of the answer structure, revealing of culmination points in the content of the considered material. In this scenario one ought to outline the trajectory of the idea moving with the account of successive of bearing points: problematic standing of the question; hystorical-phylosophical, scientific, culturigical excurse; the theory of the question, prognostics, prospectives and tendencies. On this stage the trainer is supplied by special creative and managemental functions. Towards this functions is aimed the last of above mentioned positions, which foresees the way out of the limits of found and estimated information; defining of its personal significance and practical applicableness; acception of recommendations of methodological, ideological and practical character; extraction of moral aspect of the problem.

The proposed four-block algorithm is principally new method, which present «wasteless» training technology. In its use the subject of training, successively processing each of the roles and participating in the work of all blocks, is able to use the obtained skills, simultaneously reproducing of all functions in short and concentrated form. Apart from that as account forms he should present the material of selftraining, which present not only indication of material mastering level, but also may be used as a method production, as data base or patterns for further course provision.

The model also contains the elements of search investigation activity. The problem, determining the sense of each stage, becomes personal problem of the trainer in connection with the necessity of preparation of corresponding account form. This is the base for evident interest in reaching of its solution, the way and method of which is mainly dependent on subject's preferring, his erudition and intuition. The real possibilities of creative personal selfpresentation consist of the fact, that the tasks, fulfilled by the subject of the sense of their originally may overcome the algorithm of the model.

The system is early unamenable to application in the conditions of rating control. The fulfilled tasks according to the blocks are estimated by comparison with standard models, giving a unit scale of evaluation. The model overcomes the limitations of narrow specialization in the boundaries of disciplines of humanitarial profile, allows to eliminate the problem of monopoly of private narrow specialized methods. Combining the advantages of traditional approach with principal innovational generalizings, the proposed model allows to solve a set of problems:

- to inculcate the skills of system thinking and reach the completeness of the material mastering;
- to process the methods of defining of key ideas and promote appearing of linguistic freedom of the material presentation;
- to work out the graphic scheme of contents construction and maintain the right for free search of truth in the channel of considered thematic;
- to initiate personal system of argumentation, strictly fixate value-estimation metrics of the answer and professional competence.

For a long time traditionally accepted and in many cases antiquated model, so called questional-answering or repetitional-reproductive model, has fulfilled functions of unified, obligatory, educational standard. Empirically it has discredited itself from various points of view, but its drawbacks are not revealed methodologically up to now. Owing to the inertia of method thinking the main efforts are directed not on constructive reorientation and conceptual transformation of antiquated noneffective system, but on its modification and toughening of normatives, requirements, proscriptions and reglamentations. Among with this in the conditions of changing educational paradigm, based on computer technology opportunities, it becomes evident, that old model is not able to fulfil functions of unite obligatory for everybody standard.

From the point of view of contemporary methodology the main criterium, which qualities the appearance of new educational paradigm, is change of the educational process. Namely the mechanism of selforganization is indisputable method advantage of the proposed model of scenario approach. A specific significance is presented by laid in the method opportunities to create an atmosphere of stressed intellectual search, so called «brain attack», which allows to consider sophisticated theoretical questions and decide them in the context of contemporanity.

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NEW PRINCIPLES IN THE DEVELOPMENT OF SPATIAL THINKING USING NEW INFORMATION TECHNOLOGIES

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When investigating the problems connected of the inception and development of spatial thinking we are guided by the following thesis: new information technologies determine new principles in the inception and development of spatial thinking at various levels of the learning process. School teaching comprises a major stage in this integrated process. Modern school should provide for the level of a learner's spatial thinking which would be adequate to his/her natural desire to develop as a balanced personality.

Scientific disciplines, such as physics, chemistry, biology and geography have a serious contribution to make into the attainment of this purpose. However, the priority in the development of spatial thinking has traditionally belonged to mathematics, geometry in particular. It is quite understandable considering that geometry is concerned primarily with the study of the objects of the surrounding world and their interrelationships on the basis of their mathematical models.

Russian schools place much importance on the subject of geometry. This attitude has found its reflection in the fact that, beginning with the seventh form, geometry is taught as a separate subject. However, in most of the schools in Russia and other countries where geometry is taught as a separate subject it is traditionally broken down into plane geometry (study of flat surfaces) and solid geometry (study of three-dimensional objects), with the former predominating in the schools curricula. In our opinion, it is an imposed distinction which is not at all in line with the pronounced aptitude for spatial perception of the objects in the surrounding world found in the learners within junior and teenage groups.

That is to say, the level of spatial thinking in the learners which we would like to-develop in the course of school education on the basis of new information technologies would be impossible without relinquishing the traditional system in favour of new conceptual approaches to th& school course of geometry. One of these, in our opinion, would be to compile a course in basic geometry (for 7 - 9 forms) based on the principle of full or partial fusionism, that is, approach it as an integrated course without breaking it up into a school course in plane geometry and a school course in three-dimensional geometry.

Currently, intensive research is carried out in Russia in this direction and experiments are conducted in schools to explore the implementation of the fusionism principle at various levels of the course of geometry study. The fact that the problem has attracted the attention and efforts of mathematicians, psychologists and experts in mathematical education allows to regard fusionism as one of the current trends established in school education.

When working on new principles for the application of information technologies in the educational process at school, we proceed from new approaches to the composition of a new basic course in geometry and from the fundamental goals sought by the study of mathematics at school, which are to help the learners develop:

- spatial thinking;
- conception of mathematical simulation, including its applications for the purposes of scientific research and natural exploration;
- concepts of new methods of information storage, processing and transmission.

These educational purposes have a pronounced generally human aspect, are interrelated and cannot be treated in separation. Proceeding from them, we can formulate the role of computer technologies in the study of geometry as a concise but hopefully expletive thesis: *we regard the computer as a means for studying spatial geometric objects depicted on a flat surface in the regime of learner-computer dialogue.*

Therefore, we are actually dealing with computer simulation of spatial geometric objects, allowing us to accomplish the following:

- explore variations in the model's behaviour in relation to the changing characteristics (in particular, its position in relation to the picture plane and the observer's eye);
- mark sections of the spatial image and operate with the marked sections in accordance of the set tasks;
- mark two-dimensional figures of the depicted object and examine them using the method of transition to the original;
- make geometric constructions on the depicted object in conjunction with the posed problem, and transform the image to achieve the desired figure;
- enter the results of the learner's operations in the computer's active memory and carry out their computer analysis and control.

These possibilities, combined with the principles of graphicalism and fusionism, can lead to the formulation of new principles of the development and stimulation of of spatial thinking in learners attained within the basic course in school geometry aided by the application of new information technologies. We believe that the new principles can be formulated as follows:

- identifying a class of geometric problems designed to develop and stimulate spatial thinking, which provide the basis of computer education and form a corresponding computer data base;
- development of computer means for the solution and examination of the problems;
- providing for the entry of the learners' results into the computer's active memory and development of an effective system of computer analysis and control these results;
- organising a context-oriented computer aid providing for work with several active aid windows and for monitoring the basic stages in the solution of a given problem as depicted at the changing graphic model.

These principles underlay our tutorial designed for development and stimulation of spatial thinking in the learners within a basic computer-aided geometry course. In our belief, the development of this kind of tutorial may be of immense importance, since it is the first ever case in the world practice that the significance of computer technologies for development of spatial thinking has been approached from the angle of psychological motivations, analysis of new trends in the education in geometry, examination of domestic and foreign teaching practices, and, what is especially significant, with special consideration taken of the special features characteristic of the thinking process in the learners within junior and teenage brackets, who have an "extensive practice" so to speak, of existing in the real physical space. Our psychological and methodological guidelines determine the computer's didactic functions, of which the main one is to ensure a differentiated approach to education in geometry, exercised with a view to a learner's individual aptitudes and abilities. This is intended to apply the process of learning geometry a creative and interesting activity, within the scope of practically every learner, which is in line with the current tendency for humanization of mathematical education.

These new principles of developing spatial thinking with the aid of information technologies and the tutorial system developed for the purpose require the development of corresponding teaching software. Their subsequent advisable implementation in school may, in our opinion, promote the attainment of a desired educational effect from the application of new technologies which is, so far, still ahead, as far as geometry is concerned.

To this type of software we attribute novel computer geometry-teaching aids, which have no direct analogues in the world. Their distinction from existing educational software lies in the availability of the following subsystems:

- a computer data base, compiled of the problems comprising the basis of computer-aided learning of geometry and aimed at development and stimulation of spatial thinking in the learners;
- among the major computer methods of manipulating spatial figures we list, in part, computer simulation of a figure's rotation in space and transfer of its plane elements to the original. With the help to these methods it is possible to explore the model's affine as well as metric characteristics;
- a system of computer analysis and control of the actions taken by the learners to solve a geometrical problem. This implies that, for every problem, there exists a system of expert knowledge, that is, a multitude of possible solutions of this problem, represented by a certain aggregation of data . The main function of the computer assessment and check-up system consists in generation of a multitude comprising the results produced by the learner in the course of his/her computer session and in correlation of this multitude with the given system of expert knowledge;
- a computer aid system comprising: (a) diagnostics of the errors; (b) access to a solution of

a similar problem.

The computer base comprises the following major categories of the problems resolved by manipulation of images:

1. Finding visible and hidden elements of a polyhedron, depending on its relative position to the picture plane and the observer's angle of vision; picture to picture passage.
2. Identifying the juxtaposition of points, lines and planes determined by the polyhedron's elements.
3. Constructing figures with preset properties on the polyhedron's image.
4. Analysis of the juxtaposition of two or more polyhedra and determining their intersection proceeding from their images.
5. Determining a polyhedron's configuration proceeding from its image by investigating its plane elements.
6. Constructing the polyhedron's net and investigating the polyhedron's properties using the unfolding techniques.
7. Transforming a given polyhedron into a required type by the method of image transformation.

Computer methods of solving and analysing the problems within the seven categories described above have a common foundation and only a few distinctions referring to details. These methods include:

- *construction / elimination / marking* of a point, segment, half-line, line, or face;
- computer simulation of a geometric figure's spatial rotation;
- transition to the original of the plane elements of a spatial geometric figure.

The efforts towards the creation of a a computer system of analysis and assessment of the learners actions in the solution of the problems headed under the seven categories as described above involves the creation of the mathematical basis of such a system. This basis, in our point of view, is provided by pattern recognition problems, that is, the problems of correlation (understood as comparison or matching) of two aggregates, X and Y, presented as certain data structures, whereby X is the aggregate of problem solutions and Y is the aggregate of a learners results. We believe that the data structures required to represent X and Y are those ordinarily used for depicting a graph as a computer image. Representation of a polyhedron as a graph results in the aggregates X and Y comprised of a finite number of graphs which are sub-graphs of the initial graph corresponding to the given polyhedron. In this case correlation of the aggregates X and Y is a relatively easy task leading to the creation of an effective system of computer analysis and control.

So far, our considerations pertained primarily to the new principles of developing and stimulating of spatial thinking in the learners within medium school age groups learning the basic course in geometry. The same principles, however, could be assessed and applied for to the study of geometry and relative fields at various stages of learning, including the higher education establishments. At these levels, the development of spatial thinking should be exercised with regard to the learners' professional orientation. Needless to say, there should be some differences in the level of spatial thinking developed in the profession of economist, engineer, or teacher of mathematics, etc.

New information technologies help approach the problem of professional orientation in the development of spatial thinking from a principally new level, based on the development of a system of problems underlying computer education and designed for the development of spatial thinking with regard to the future professional interests of the learners. Problems in linear and non-linear programming resolved with geometric methods are intended primarily for a future economist, for example, while a future engineer's problems are those dealing primarily with computer graphics algorithm, and so on.

We are well aware that a certain amount of knowledge in this field has already been accumulated in the world. However, the analysis of this experience from the angle of new principles of the development of spatial thinking, the analysis of existing and design of new educational software, the assessment of accumulated knowledge and development of a common educational strategy in this area can, in our opinion, become a major promising line for the UNESCO Institute for Information Technologies in Education.

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PROBLEM OF ADAPTATION OF THE EDUCATIONAL PROGRAMMES TO INDIVIDUAL PECULIARITIES OF THE STUDENT TRAINED WITHIN THE FRAMEWORK OF ECOLOGICAL PARADIGM

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The research object of forming now area of knowledge as ecological psychophysiology is studying physiology of mechanisms of physical processes as general acts of interaction with natural and social environment.

The problems of ecological psychophysiology with reference to educational process can be formulated as follows:

- specification of the mains factors of environment influencing to activity of the teachers and of the students;
- analysis psychophysiology of effects arising as reply to influence on the individual factors of environment, and effects of their cumulative influence;
- study of mechanisms determining result of

pedagogical and educational activity;
- modeling of educational process and development of the recommendations on its perfection.

The process of training is provided by set of the simultaneously influencing on man factors. They can render as repressing process of knowledge mastering, even damaging influence, and developing, enriching influence.

Important stage of modeling of educational process is to create right classification of the forms of behaviour and conditions appropriate to them forms of educational activity. However, in connection with constant change of the contents and conditions of educational process, the number of the factors loses its importance, and conventional educational technologies are changed for the new ones. (Computer training method is one of such new technologies). Such variability complicates the creation of completed classifications of the factors of educational activity, since it requires its continuous review.

Research now under way of the important factors of educational activity and results of their multiplied influence has allowed to specify the main forms of behaviour and activity of a person in educational process, but also conditions appropriate to them of training of the students in high schools and colleges. Besides there were specified representations of the students concerning the most favorable conditions of realization of the various forms of educational process.

As a condition of creation an effective system of educating is formation of the positive emotional attitude to the future professional activity, process and conditions of their purchase, and we specified emotional tone of environment types that differ in purpose. The interesting in this question is explained by increase number of cases of occurrence at students from a higher school psychosomatic infringements, necessity of founding behaviour types of algorithms in various conditions, specification of ways of decrease probability of occurrence of deviations social behaviour learning.

We had lead a series of experiments on tone study of emotional reactions, arising at youth of student's age in communication with the various forms of activity and by conditions of activity. Doing this part of research has allowed to develop criteria of differentiation and emotional estimation of the diverse forms of activity and conditions appropriate to them of professional education.

Studying of emotional tone of the various parties educational and not education activity of the students has shown, that neither of aspects this activity has no steady negative colouring.

In separate series of experiments there was shown the connection of the characteristics statistical models developing with EEG-indicators of such various on functional purpose properties HNA as force, liability, and equability [Molchanov A. S., 1989]. It gives the basis to believe, that the applied ways of representation of data can reflect steady peculiarities emotion of student.

Research of emotional tone of the various functional parts of educational process has allowed to specify conditions, which provoke chronic emotional intensity, ways of its decrease, ways of preventive maintenance of occurrence of deviations in social behaviour and psychosomatic infringements. Doing of this stage of work makes clear the way of correction work, developing in pedagogical psychology, besides permits to lower an emotional pressure and, as a consequence, the probability occurrence of early psychosomatic pathology.

Especially difficult is to model individual peculiarities of emphatic students reactions. In this connection we studied the opportunities of the formal perception processes description, of mechanisms included into the system of the emphatic reactions (identification of stimulus causing the emotion, expressing displays of the observable person and etc.) [V.N. Krut'ko et al., 1993]. These processes are making afferent link of reflection of mechanisms emphatic reactions. Besides identification of expression behaviour of the observable person there was used the opportunity of the formal mechanisms of identifications description of a context of the whole situation was investigated, which role are ambiguously by the various authors [A.A. Bodalev, V.V. Stolin, 1987].

Received results let us to assume existence of hierarchical organization considered cognitive and emotional processes, where mechanisms of emotion and the environments identification are systems of a lower level, in comparison with process of an emotional estimation of educational environment and whole educational process.

It is necessary to pay attention on similarities and distinctions between representatives of various cultures concerning perception and emotional estimation by them various types of environment. The established facts permit creation of the reliable tool of forecasting psychological effects arising as a result of an environment influence.

As the result there were established criteria for the quantitative measurement of an estimation of quality and conditions of education in high schools including material and psychology aspects. It has allowed to pass to development of a technique of an estimation of professional training conditions of the staff in higher school.

The formal description of emphatic reactions is suitable for their computer modeling and development of individual correction algorithms of functional infringements in emotional sphere.

Thus this research opens the opportunities for development and inclusion the block of an estimation individual psychology peculiarities student in trainee computer programmes and by that to raise qualitatively of teaching level. Psychology analysis of individual peculiarities of the person and behaviour of the student in educational process will allow to choose the most suitable algorithm of computer education.

On the basis of this work it is possible to include the block of research and account of individual peculiarities of cognitive and emotional student sphere in trainee programmes and it is possible to construct educational process on the basis of individual students psychological peculiarities according to these peculiarities restructures the training programme.

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DIAGNOSTICS OF THE PECULIARITIES OF COGNITIVE ACTIVITY OF SCHOOL STUDENTS USING COMPUTER TECHNOLOGIES

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To reveal the cognitive activity of children for forming classes in the system of differential teaching and also to correct developmental deviations it is necessary to use methods permitting to obtain not only qualitative but also quantitative characteristics of the levels of the development of various psychic functions, which permits their quantitative assessment. It is feasible to include in the psychodiagnostic set used for these purposes to sets of complementary techniques. One set would promote revealing of the level of development and the state of psychic functions, operations, and processes, i.e. the peculiarities of development and state of assessment and emotion-volitionary sphere, i.e., the properties of voluntary regulation of activity, which essentially determine the receipt and processing of the input information and solution to intellectual problems. The concept of the need of the use of two sets of interactive methods to assess the state of the psychic activity is based on the modern concept of physcho-neurophysiological mechanisms of higher nervous functions (Luria, 1973; Farber, 1978; Khomskaya, 1987; Peresleni, 1984; Peresleni, Rozhkova, 1990, 1993; 1995). This selection of techniques is particularly important in the examination of junior school students that approach medical and educational consultations due to problems of knowledge assimilation.

A set of complementary techniques permitting assessing the level of development and the peculiarities of different psychic functions and to reveal some neurophysiolgoical mechanisms determining them was developed.

The method for the research of prognostic activity (PA) *(Ugadaika)* advanced by L.I. Peresleni and V.L. Podobed (1982) was constructed on the basis of the findings of the studies of psychophysiological regularities of the development of probabilistic prediction. Earlier, we widely analyzed the relationship between attention, memory, perception and thinking. The importance of the investigation of these processes to reveal the specificty of intellectual development resulted in a technique to elucidate the qualitative and quantitative characteristics of predictive activity and determine information indices for the assessment of psychic properties in both normal children and those with intellectual deviations.

The revealing of the PA properties using *Ugadaika* to a larger extent than other psychodiagnostic methods permits approaching an assessment of the state of intellect in the understanding of the psychophysiological mechanism, which is constantly active, serving as a condition for the establishment of essential bonds in the relationship between the events.

The indices obtained using the proposed method permit judging of the properties of the long-term and short-term memory, thinking and such attention properties as stability and switchover capacity.

The technique uses the situation where the subject is to establish independently the sequence of alternation of two events on the basis of correctness or incorrectness of their predictions taking into account the appearance of these events in a sequence. The technique involves three sets of cards with printed letters *A* and *B* on one side. In the form of game the subjects are exposed to the cards on the display. Each letter is presented as the subject presses the key corresponding to the letter being predicted. The letter sequence patterns are set by the program and vary depending on the age of the subjects. For junior school students the following three sets are used: 1 - 20 cards with an *«ABAB...»* sequence, repeated in 10 cycles; 2 - 60 *«AABB...»* sequence cards are used, which are repeated in 15 cycles; 3-60 cards with an *«ABB...»* sequence - 20 cycles.

The computer treatment of data permits representing in text and graphic form the indices characterizing the properties of the solving of a prediction problem: (1) the number of erroneous predictions; (2) the number of errors associated with unstable attention; (3) precision of the reproduction of the perceived sequences; (4) specificity of the strategies used. The data base also contains information about the temporal parameters of the prediction process. The different characteristics of the 4 basic indices described permit distinguishing different types of cognitive activity, reflecting the properties of the development of particular psychic functions.

In order to reveal the neurophysiological mechanisms determining the properties of the cognitive activity, the psychological data are compared to the electric cortical (reaction of activation) and vegetative (skin galvanic reaction) components of the orientation reaction (OR) to the sensory stimuli of different signal significance and also to the specificity of the bioelectric activity of the brain in the state of rest. The registration, processing and analysis of electrophysiological indices are made using the hardware-software complex *Neurokartograf,* developed by the *MNB* company (Moscow).

The study of the subjects of different sex with different cognitive characteristics correlating with the success of learning or with the problems in learning of different ethiology (due to retardation of psychic development or speech retardation) has revealed an interrelationship between the behavioral characteristics of cognitive activity and the properties of the OR and the background EEG.

It has been established that subjects with normal intelligence that did well solving a prediction problem, the duration of the reaction of desynchronization of the activity of the occipital and central zone of the cortex exposed to both indifferent and relevant stimuli substantially exceeds that registered in individuals with the peculiarities of PA determined by deficiency of attention or/and memory, which indicates the insufficiency of ascending activating and corticofugal regulatory effects. The disturbance of mnemonistic functions is associated with an absence of strengthening of the reaction of activation in the central region with an increase in the significance of the stimuli, which is considered to be a manifestation of insufficiency of associative processes. The weakness of the activation reaction is also correlated with a less pronounced skin galvanic reaction, particularly when indifferent stimuli are perceived.

In case on ineffective prediction in individuals with learning problems of different ethiology of middle and senior school age, there is a paradoxal increase in the duration arousal in the projection zone of the cortex into indifferent stimuli; along with that the activation reaction to the relevant stimuli remains to be weak. In addition, the associative zone of the cortex remains to be insufficiently involved in the OR.

The different types of PA correlated not only with the OR features, but also with the characteristics of the bioelectric activity of the brain in the state of quiet wakefulness indicating the specificity of the functional state of the central nervous system. In fact, subjects with insufficient effectiveness of PA, in particular with memory disturbance revealed a weaker development of the alpha-rhythm, which is manifested in its irregularity and a low spectral magnitude. Along with that, in the cases children could not make efficient prediction, high-amplitude, hypersynchronous alpha-1 rhythm was often recorded. In the cases, when inefficient prediction resulted from retardation of psychic development of the children, a high frequency of the occurrence of EEG signs was recorded thus indicating a dysfunction of the stem structures of the brain and the immaturity of the cortical rhythmicity. Children with speech pathology, along with involvement of stem and medium structures of the brain also show focal changes in the cortical rhythmically, more frequently, in the temporal regions of the cortex.

Thus, the results of the comparison of behavioral reactions of the process of prediction with the OR features and the background EEG in different-age subjects permit a qualitative and quantitative assessment of the development of a number of psychic functions to reveal the neuro-physiological mechanisms responsible for the deviations in the intellectual development revealed.

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TRAINING TECHNICAL COLLEGE TEACHERS IN ENGINEERING PEDAGOGICS

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Russia with its immense scientific and pedagogical potential is one of the leading countries in the area of training workers in engineering occupations. The Russian school of higher education, based on a rich and diversified national tradition has sought to apply available achievements of modern science attained by domestic as well as foreign researchers and experts in teaching, which has earned the it a well-deserved recognition in other countries.

The changing socio-political situation in the world dictates the need for the Russian institutes of higher education and their teaching teams to try and take an adequate position in the fast-changing situation at the world market of educational services. The establishment of the Russian Monitoring Committee (RMC) for engineering pedagogics accorded the status of a national division of the International Engineering Pedagogics Group (IGIP) is designed to facilitate the attainment of this noble goal.

One of RMC's major objectives is assistance to IGIP in the compiling of the International Register of Engineering College Teachers (IGIP-Register). Entered in the Register are specialists of the qualification level and practical experience which satisfy the requirements placed by IGIP upon the teachers of engineering subjects. IGIP-Register entry automatically affords the title of the "European engineering college teacher" (ING-PAED IGIP).

The Register makes available to the potential employer the obtaining of detailed information on the educational and professional level of the registered members of the teaching profession, as well as guarantees regular confirmation of the teachers qualification by way of permanent control and check-ups designed to ensure that the members qualification corresponds to the theoretical and practical standards as worked out within the international framework.

On the whole, the enrolment of Russian members of the higher engineering teaching school in the IGIP-Register should have a favourable effect on the current trend of extending services in the training of foreign learners. The Russian teachers entered in the IGIP-Register may freely pursue their professional activities in Russia as well as abroad.

To be entered in the Register, a teacher should be able to pass certain qualification standards based on the fundamental principles as described below.

1. Sound technical knowledge is a basic requirement upon a teacher of an engineering profession. Therefore, IGIP-Register membership requires a higher technical education and experience of practical work, which corresponds to the FEANI "European Engineer" (EUR-ING) qualification. It is desirable that the engineering qualification of an applicant should be up to the EUR-ING standard. The applicants with the qualification satisfying the FEANI standard receives the titles of both "EUR-ING" and "ING-PAED IGIP" and his/her name is entered in the Registers of both these organisations (FEANI and IGIP).
2. It is equally important that the applicant should possess adequate engineering-pedagogical knowledge. The applicant's training in this area should be based on the minimum of 200 academic hours (a full higher school term). The content of the engineering-pedagogical training should incorporate the engineering-pedagogical model and the curriculum worked out by IGIP.
3. The preliminary condition for application is the minimum of one year of practical engineering-teaching work.
4. The applicants are required to have an active knowledge of at least one foreign language.

IGIP recommend that the engineering teacher-training curriculum should incorporate the following subjects (the figures in brackets indicate the minimum number of teaching hours):

- fundamentals of psychology (16);
- fundamentals of sociology (8);
- fundamentals of communication (44);
- fundamentals of compiling a technical text (16);
- fundamentals of technical training (12);
- biological fundamentals of development and training (8);
- the didactics of laboratory studies (12);
- fundamentals of engineering pedagogics (36);
- teaching practice in engineering subjects (36).

Specialized teacher-training centres for advanced and refresher courses have been set up at seven institutes of higher education under the State Committee for Higher Education of the Russian Federation for the purpose of promoting and improving the teachers qualification in the field of engineering pedagogics.

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THE NEW INFORMATION TECHNOLOGIES: WHAT ARE THE POSSIBILITIES FOR HIGHER EFFICIENCY AND MORE EQUALITY IN EDUCATION ON THE VERGE OF TWENTY FIRST CENTURY?

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ABSTRACT

The systems should be profoundly reformed in order to meet the demands and challenges of the 21st century. As a matter of fact, if school takes into account the quick evolution of knowledge through the impetus of the new information technologies, it would have to set up educational strategies suitable to the cultural, scientific, technical and technological, but also economic context.

The necessary reform of the educational systems is a must for all the countries. The growing unemployment of the product of the educational systems reveals the failure of the training provided at present, to adapt all teaching levels including university. The feelings that school is worth nothing, that teaching finally takes to nowhere, can be rectified and corrected by raising the cultural and scientific level of each country through involving the parents into the education process for their children, through consideration of great variety of the social groups.

Therefore, the educational systems should explore new strategies, which will make all actors of school (students, teachers and parents) learn how to learn and learn how to undertake.

At the beginning of the third millennium, educational projects should be constructive; they should aim at more effectiveness, at more efficiency and equity. The opposition between formal and informal education should be banned.

INTRODUCTION

1996...1999. 20th century is nearly beyond us. Less than in four years we'll celebrate the end of this century and the beginning of 21st. Are we ready to meet it? Are we ready to overcome all the problems, which are looming on the horizon? Are we ready for innovations, which cannot be accomplished without modernization of the educational and training systems? Are we ready to meet challenges arising from entering of young people into active life?

Perhaps we are dealing with capability of young people to respond to a challenge of time? Perhaps we are dealing only with the ability to solve the problems to be sought by modem youth?

Let us think about the words of the President Abdou Diouf [1]: «Let us train teachers. Let us send girls to school (educated women are the basis of social progress in future). Let us. arrange the textbooks and training appliances. Let us not forget about adults, about their urge towards the study. They must not be separated from their children by a cultural barrier that, in addition, constantly grows». «To train teachers» -this could be served both as a statement and a sketch of sight. The statement in the sense that modern system of instructors training does not look completely efficient; while the sight tells about the necessity to put teachers in possession with professional tools, which could help them to be on the height of numerous problems.

The slogan «To send girls to school» might be understood as follows. The women constitute the larger part of the mankind, and this fact that shall be taken in consideration in the process of project development for higher and secondary education.

«To arrange the textbooks and training appliances» would mean the acknowledgement of outstripped training tools and, therefore, the anachronistic character of knowledge and skills, which school enables now.

«Not to forget about adults» would mean that any school project is doom to vegetation, if it ignores the training appliances, which a learner can and should obtain out of his environment, as well as, if school culture is completely drawn away from social and cultural environment.

But perhaps the abyss breaks apart only young people and adults, men and women?

As a matter of fact, the modern world is deeply marked by antagonisms, which equally interfere for flourishing of individuals and development of society. These obstacles break down also all efforts, directed to mutual understanding and tolerance within the relations between the nations, peoples and cultures. The strongest antagonisms can be presented by cultural, scientific and technological gaps between North and South, city and village, well informed groups of people and those who are not provided with sufficient information.

The education, in general, and a school, in particular, would, however, not intensify contradictions, but erase or weaken the existing distinctions and the most typical antagonisms of our era. The new information technologies present them such opportunities providing that there will be exploited all their probable or imaginable advantages.

In fact, the cultural (in a broad sense) and pedagogical innovations which the new information technologies, so to say, impose to modem educational systems, could be expressed by formula «to accommodate or to perish». To accommodate to modern life, to accommodate to practically permanent, and as if instantaneous, renewal of knowledge and skill, is a universal challenge:

1- for adults,

2- for educational systems,

3- for a society.

1. ADULTS

This conclusion is applicable all over the world. In fact, in great majority of cases the adults are, so to say, illiterates in context of the present time. They are illiterate, since they are afraid of new technologies, afraid to investigate novelty, afraid to cast doubt on their knowledge and ability. On the contrary, when we simply follow the young people mastering the modern techniques we always admire their deftness to subordinate them and to become accustomed to these new means (especially at the level of users).

Illiteracy of adults most strikingly is expressed through distinctions between nations. In countries, where a school was imposed by colonial history, one can state two factors. From one side, a school tile nowadays had not received wide acceptance, from the other side, it distributes its blessing through a language, which is often a foreign (not mother tongue). This double statement means, naturally, a serious obstacle for any effort in favour of development.

New information technologies provide almost ready for use means for abolition of the above barriers. The educational systems should be rearranged in a way that a school could take over the task of reinforcing and conducting a policy in elimination of illiteracy in national languages, the task of distribution and popularisation of scientific and technical information on the same languages owing to mass media: the press, radio, TV broadcasting. Acting so, a school could have been promoting to step up a standard of culture and science of each nation.

The new communication technologies can promote the elimination of people illiteracy since they ensure the effective neutrality, relaxing the search for the best combination between formal and non-formal education. The task - to step up a standard ofculture - also would allow to enable more fairness, fairness from the standpoint of accessibility to modern knowledge and to guarantee the terms, under which the abilities to meet one's demands would spread fairly.

Among positive consequences that could induce the step up a cultural standard of nation in the area of education and specialists training, the possibility for observation after school children teaching may be cited for parents. The step up of nation cultural standard would allow for parents to participate directly in school deals of their children. The latter would obtain the necessary pedagogical support from their parents. The direct pedagogical assistance at home would improve the school results.

The utilization of new information technologies in educational system for adults serves, therefore, as an important means for enforcement of internal efficiency of educational system. It does not seem to be a chimera to use the new technologies in the interests of the system of scientific training of adults and, by and large, to set up nation cultural standard. In fact, the use of everywhere radio and TV broadcasting would allow to elaborate programmes of remote training for a lot of people. With this in mind, the teams, including communication and remote training specialists would be entrusted to create the special programmes, to develop the appropriate strategies of those programmes evolution with estimation of their efficiency. Thus, the programmes on the basis of radio and TV networks would combine the educational tasks and analysis of their audience features. The new information technologies would also promote the enforcement of sequence extension of educational transmissions, bringing them to designated population sections. For instance, the optional programmes introducing to new technologies would promote the relaxation of social burdens in the countries, where the relations between people are of great importance in social life. The popularization of telephone communication service would be used for improving of quality and quantity of contacts between members of the same community. The telephone service would allow to spare time in this event. As a matter of fact, cheap telephone contacts would permit to shorten the family visits. In big cities, where the urban transport is an expensive pleasure from the point of view of its price a telephone would obtain the significant economy resulting in investments of spared funds into culture.

Finally, the new information technologies make it possible to reconcile the formal and non-formal education: they would supplement each other. And it would become possible to break down a crosspiece, which separates them now.

2. EDUCATIONAL SYSTEM

It seems to be trite to state that the educational system is experiencing any crisis. Schools run into crisis of «choice», supplemented by a moral wear of school programme contents. The crisis of "choice" had touched all educational systems. The more and more young people put themselves a question: what for to go to school for, if in graduation they are waited for unemployment. In reality, this crisis of "choice" reveals the lack of ties between a school and its social environment, the shortage of adequacy between knowledge and ability in school, from one side, and the professional skills and knowledge, from the other side. The impression is posed that a school trains for skills, which are failing to exist by the time when the training is completed. What could you say then about the professions, which will be required to a society in 21[st] century? Today nothing is known about the vast majority of professions from tomorrow and about their essence.

The young people, who are going to begin their business activity in 21[st] century, do not venture to be deceived by the "games" of adults and do not trust them. They realise that their future is vague. They think that at school they lose their time in vain and that they will be badly prepared for real life when they leave school. Therefore, they strive to other educational system; the adults are most commonly not ready neither to propose such systems, nor to present and to implement them.

In spite of all disappointments, induced by training, the demand for education is growing everywhere. An increasing number of parents are dreaming to send their children to school; this is their right, this is their duty. At increasing number of school the children are dreaming to prolong their education in higher school; this is their right too, and our duty is to help them, even in those cases when we do not know, for what university to prepare the children. In fact, under the combined of demography, democracy and information, and in spite of contradictions, a school remains the most important source of knowledge. A school, in representation of people, remains one of the rare chances to avoid a worse destiny. Thus, a school appears to be a place where knowledge acquired, in order to be realised as individuality, as a producer and citizen in a society.

Under the combined exposure of demographic, democratic and economic factors the estimation of efficiency of educational systems is related to evaluation of fairness extent. On the contrary, the system can burst and cause the social disturbances with unpredictable consequences.

The efficiency and fairness suppose that a school will help people from professional, social and personal point of view. Dialectics of the concepts «to be» and «to have», evolution of expectations and demands enforce the educational systems to renew permanently, in order to renew the content of training. Also, the methods of training must be renewed frequently. Didactic techniques must be revised from time to time. Besides, the tasks of education need to be revised and newly stated.

The new education becomes really encyclopaedic. The volume of knowledge, that finds no application now, constantly increases while the most essential is not separated from auxiliary.

More than ever the matter about the training methods is appeared to be in the focus of educational world, preparing the specialists. It may be of interest that methods, based on passing of the own knowledge are out of date. Certainly, and active pedagogy, based on scientific psychology (to teach pupils how to learn) are also shown evidences of some exhaustion.

As of now the new information technologies and changes, which they generate in all orbs of activity, pose the teachers confront the new problem. Because of development of technology and means of communication the information became a raw material for all areas. By means of information a man discovers the abilities that he did not suspect earlier. That's why it is necessary to develop urgently such pedagogical approaches that are able to evolve the learner's capability to absorb, accumulate, process and use the information.

The unwinding of data banks and their place in knowledge obtaining make the pedagogical methods, based on a new structure of school and even on other principles, actually required. The search of efficiency and of increased fairness, which are in the centre of school care, make it to take into account the specificity of different groups, which it accepts. They dictate to school, first of all, to evolve the pedagogy of success and to finish with pedagogy based on a selection and on defeating. Thus, there is a new paradigm: learn to study.

If a school can teach to master learning from school ages, to get accustomed, in particular, for searching an information, to analyse the available information, in order to find the most adequate and most suitable information regarding to posed aims, to master business from school ages, being accustomed with independence and, later, to arrange one's own working place and one's own company. A school then would not be forced to prepare the pupils to payable job, but it would impart an ability to be adapted to a crisis of employment.

The new instruments, which are needed for mastering, and the methods, which will allow the learner to master them, pose the other educational tasks. Among them, the priority should be granted to the aims of integration. The splitting of those instruments for a number of subjects must be conceded to formulating of subjects that enter various disciplines. The objectives to be pursued along with training process shall be, unless real situations are stimulated at least, approached to them. As a result, the goals of certification, which are so dear to recent systems, give way to fundamental knowledge or to minimum set of knowledge. But this generates the necessity of other ways and other criteria of evaluation.

In the long run, the information technologies impose to schools the way to be followed. The case in hand is, specifically, the necessity to bind a school life and survival after graduation in a better way. The better co-operation between a school and labour should be under seeking too. A school must act reciprocally with environment. At the same time a school is forced to be involved in a process of remote training and continuous process of adults' education for nation cultural standard set up. The industrial world and enterprises, being equipped with newest technologies, shall be a peculiar providing ground for pedagogical tests in real conditions. In other words, the educational systems must have intention to conclude contracts with surrounding companies, because it seems to be of low-probability and of expensive deal to equip schools in such a way, that they would be able to provide the education with true correspondence to technological standard.

The contracts signing between elements of educational system and economical infrastructure suppose synchronously, that a search in school and university medium must be in combination with taking into account the true demands of civil society. Moreover those draft- contracts will bring quietness to local communities and will allow getting the sources of self- financing in educational systems.

3. SOCIETY

The new information technologies incline the whole society to be matched to modern technological environment and, first of all, they force to observe attentively over its evolution. It should be necessary, also, to participate in technological development, trying to control it that is to manage of ruling with it.

As a matter of fact, the careful analysis testifies that world itself is now more than ever a "global village". In this sense, an interdependence of nations, now more than ever, is a reality. Social and economical and social and cultural development of each country forces it to co-operate with other world countries. The modern states shall be inevitably incorporated into sub-regional and regional unions. The general-purpose culture of mutual understanding is necessary for prosperity of each, out of lawful part of modern world.

The consequences that are presupposed by new information technologies in our modem states are noticeable at different levels as follows: philosophical, political, legal, economical, scientific, technical, technological, religious etc.

From the standpoint of pedagogy, which is our interest the new information technologies require our countries to issue a new educational philosophy that in greater extent will promote the economical and cultural integration. From this point of view, the national educational systems, closed by definition, shall make room for more open systems. "To be more open" means that the educational systems are obligatory to determine the minimum of universal knowledge and competence. And the diploma ought to be given a new definition in order to provide mobility for learners - the potential workers and instructors.

It is known, for instance, that the obstacle for development of higher education in Africa, to the South of Sahara, is often the absence of high ranked professors, summoned to deliver their lectures and to guide the researches at post graduate level. To overcome a deficit of high ranked professors, the universities at South are enforceable to call not infrequently the scientists from North. Such movements and the allowances for business trips are a heavy burden. The budget framework, that the universities can not overcome, enforce them to make scanty choice: whether to refuse from arranging of local training which standard corresponds, more or less, to third cycle, or to send students, capable to claim for training level like this, to other countries.

The use of pedagogical possibilities, presented by the new information technologies in social and economical and social and cultural medium, less binding from juridical point of view, would help to avoid the dilemma of this type. In fact, the universities would be able to use for educational tasks the possibilities of remote training, proposed to them by electronic communication.

The use of e-mail for the tasks of educational and professional training assumes a number of preliminary terms. In this aspect, the determining of tariff rates, differentiated over the customer's services, would be a subject of special investigations for the national communication services. In many cases such events are summoned to respect some administrative and lawful restrictions that restrain their technological capabilities. All main limitations bear an evidence of ideological and political character.

The timid attempts in the region of private TV broadcasting and the counteraction to leasing of vacant channels at satellites interfere to development of qualitative remote training, acceptable in connection with a price and time. However, the direct access to a satellite jointly with TV stations establishment, is a compulsory condition of remote training in harmony with technological development.

In many respects the ideological and political practices are appeared to be the major barriers for education development in many countries. It may be argued that surrounding us political culture is a main break on a way to unify the basic training. It is precisely these political traditions and behaviour, which they induce among the society strata leaders, is a real obstacle to the ascent of scientific and cultural standard. As a matter of fact, the technologies, capable to promote the establishment of quality TV- training, are mastered enough, however, the "political will", probably, not always follows in this direction.

In Africa, to the South of Sahara the universities and higher education, which are often collide with the problems of infrastructure and staff, could help to wider strata of population in each country and in groups of countries, if the powers could agree to realise less elite policy, and, therefore, more democratic policy, if they would have more broad view on sovereignty, on knowledge and education.

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INFORMATICS IN SECONDARY SCHOOL AS AN APPLIED SUBJECT

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Within the framework of the school programme on informatics and computer technology the ABF Publishihg House has issued a textbook "Information Technology Basics" intended for Russian secondary schools.

There is probably no one other sphere of human activity that would be growing that vigorously and provided that variety of approaches as informatization and computerization of society does. The history of information technology development is characterised by rapid change of conceptual notions about the role of various methods, equipment, and people involved in this business. The fundamental monographs and small brochures on the subject written only 5 to 10 years ago are now despairingly obsolete. The information technologies based on huge computers equipped with displays-terminals and, as a rule, not having their own processing units have become the history, though, at that time they seemed to be very promising.

Only 3-4 years ago a slogan saying "Programming is the second literacy" implying that every educated individual has to know how to create algorithms and use programming languages such as FORTRAN, BASIC, etc. seemed indisputable. However, a powerful flow of the state-of-the-art software poured into the Russian market during last two years made for a situation when "home-made" programming became not only unnecessary but impossible. More and more people wanted to know how to use industrial software products instead of mastering classic programming.

I would like to stress that the textbook we published cannot be compared to any other one published before. The reason is not that our book is worse or better, it is just different. All the previous textbooks on computer science are the extension of a school course on mathematics implying that their readers have in-depth mathematics knowledge. Apparently, this approach is suitable only for students of specialised physics and mathematics schools, gymnasiums, and lyceums whose future professions will be directly or indirectly related to programming. However, the overwhelming majority of all school students will face a completely different problem - the total coverage of all spheres of our life by computer technology.

Unfortunately, either evidentiary programming skills or knowledge of Prolog language will be useless under this new environment consisting of files and floppy-disks, word processors and electronic tables, data bases and Windows - the fireworks of software and hardware embarrassing even for experts.

On the other hand, the authors of the textbook cannot accept a counter opinion on the problem of teaching informatics at school which suggests mechanical training on selected software products.

That is why the textbook is focused on informatics as an applied course intended for school students to understand the basic principles and capabilities of modern information technologies including principles of operations of hardware and of the most widely used software applications. Generally, the textbook is a well-structured course of modern applied informatics concentrating mainly on Microsoft technology (Windows) which actually became a generally accepted standard in Russia. The textbook describes the major principles of text and graphic user's interface and the techniques for creation of graphic images by means of Paintbrush software.

Three chapters of the textbook are devoted to the most commonly used triad of operations: word processing, operating spreadsheets, and managing data bases. This triad was not selected occasionally or according to the likes of the authors, this knowledge is demanded by today's computer technology environment. The powerful integrated applications use the same triad (e.g. Word-Excel-Access in Microsoft Office). The authors attempted to shatter the current delusion that the informatics is needed only for those who is going to deal with exact sciences or, for example, with accounting. The proficiency in information technology will be equally useful for a doctor and a lawyer, a historian and a journalist, a writer, a composer and an actor. The authors made an attempt to intelligibly explain the readers the structure and capabilities of databases, their benefits for people of various professions (focusing more on humanities than on science and technology), the techniques of databases creation and operating, etc.

The concept discussed above does not imply that the authors of the textbook undervalue the importance of developing student's algorithmic thinking. The book offers a lot of examples and problem-solving questions illustrating the main ideas and approaches, the principles of operation of a personal computer as an automaton capable only of phenomenally fast performing four basic arithmetic operations and comparing values. In addition, the textbook gives the readers an idea of what is programming. Much attention is given to general vision aspects of informatics.

It should be noted that the textbook has also some conceptual peculiarities. First, the training is supposed to be based on modem industrially produced software products instead of artificially selected "school" languages and obsolete programmes. Second, the textbook is intended for school students of senior grades, i.e. those who already have serious background.

The authors tried to avoid abstract formulas preferring to either thoroughly examine a problem or briefly explain its essence and solving techniques.

Example 1. When describing relational data bases (the basis of modern information technology) it is insufficient to discuss the simple two-dimensional tables and suggest a student making up an example on some familiar subject. The experience shows that this seemingly simple problem is full of pitfalls and difficult even for a specialist if one is not familiar with the principles of data structuring and normalization. That is why these issues are explained and analysed in details in a separate chapter of the textbook. At the same time, the authors devote significantly less time to description of data bases operation techniques relying upon practical training with a teacher.

Example 2. Boolean algebra is fairly considered to be one of the main elements of informatics. Unfortunately, it is sometimes too abstractly communicated to students and it is very difficult for one to puzzle out of those "conjunction, disjunction, and implication". We tried to explain the principles of the Boolean algebra briefly and clearly as well as to demonstrate its role in the processes of information retrieval from data bases and spreadsheets.

Example 3. When preparing a chapter under the title of "Computer in a modern society" it was planned to include a section in it containing problem-solving questions on optimal programming (considering the fact that the compact packages on this subject are available). However, the material appeared to be so extensive that we decided to omit it limiting the chapter to brief explanation of the essence of optimum choice problems.

An important element of the textbook is the glossary including generalized definitions of major terms used in applied informatics. Basically, the glossary is a brief summary of the textbook designed to assist a student to arrange and verify the information obtained. The inclusion of the glossary was determined by not only the availability of various terms and concepts (mathematics, cybernetics, etc.) but also by their different interpretations depending upon specific tasks and objectives. For instance, logic operations being discussed in two chapters of the book required a single commentary which was included in the glossary.

The textbook questions and assignments were selected in accordance with our approach to the problem and with school reality characterized by a variety of computer facilities available and by different orientation of schools. All the questions aim at developing objective-targeted and logic thinking of students, their decision making skills, etc. The practical sections of the book offer relatively small number of basic examples (pictures, texts) based on which a teacher will be able to select interesting assignments considering the capabilities of the equipment available.

Our textbook gives a teacher freedom in selecting theoretical and practical material and methods of conducting the lessons. One is free to use supplementary textbooks, books and other reference literature (the list of such literature is available at the end of the textbook).

A crucial moment of training is the strategy of conducting practical classes which are actually the key element of training. Our textbook can be used with practically any kind of equipment and software, however, the selection of specific configuration depends upon specific school, its objectives, and its financial capabilities.

There is no upper limit for equipment and software products to be used with the textbook. For example, if school computer facilities are equipped with 386, 486, and Pentium computers, the training can be based on Windows applications: Word (word processor), Excel (electronic tables), Access (databases). But even then the authors believe that it is necessary to start with studying basics including DOS and Norton Commander as these very systems allow for easy mastering filing, retrieving information, and other important skills; without knowing DOS it is hard to acquire serious information technology knowledge.

The students should master fundamental principles of information technology and learn to find their own way in the ocean of computer information to be able to solve any specific problem they face. Various reference books, textbooks, specialized periodicals both for beginners and advanced users will help them to achieve that. The major objective of our textbook is the same as of those on fundamental sciences: "Remembering facts is not that important, much more important is understanding the subject".

The above is a summary of a certain concept declared. This is for critics and teachers to assess the results of its implementation. The authors realise that there is no ideal, meeting everybody's expectations, solution for such a complex problem of teaching informatics. Other opinions and approaches are unavoidable. That is why the authors welcome any suggestions, reviews, comments, and remarks, no matter how critical or sarcastic they would.

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COMPUTER AIDED ENGINEERING EDUCATION IN A CHANGING ENVIRONMENT

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ABSTRACT

In this paper, we will discuss the use of computers in engineering education as a tool to complement the teacher. The reasons for such use and their ever increasing necessity are also presented.

INTRODUCTION

Well-trained engineers are essential in successful implementation of economic development plans. At today's pace of new technological innovations, the professional life-time of engineers is constantly shortened. As the economy expands, the shortage of up-to-date and qualified engineers is being felt increasingly. The cost of retraining new engineering graduates and the time it takes put extra pressure on universities to train the engineers more effectively, and to emphasise practical skills while preserving the fundamental concepts. Industry needs engineers who have a broad view, are flexible and have been trained in such a way to easily absorb new information and adapt to new situations [3]. In addition to retraining new graduates, we should also plan for retraining those engineers who have graduated in the past and need additional training to enable them to follow new developments in their fields. In addition to all this, we are constantly faced with requirements to retrain existing engineers who have worked in one field but are now required to undertake a different task in a different field.

The situation is more critical in developing countries, where a visible lack of established industry with well planned and effective on-the-job retraining and continuing education programmes and facilities add to, other difficulties that emanate from social and economic settings; in addition, the shortage of qualified teachers at all levels force us to consider innovative approaches such as computer aided engineering education to improve the productivity of the educational system in general, and that of institutions of higher education in particular.

We can benefit from computer aided engineering education to overcome some of the difficulties that were mentioned so far. Careful implementation of such programmes can assist us to realize desirable results. However, one should not forget that computers are tools in the same manner that text-books are. We can not replace teachers with computers for the same reason that textbooks alone can not produce well-trained engineers. Engineering education is expected to develop judgement, insight and intuition [1] as well as skills. Teacher's role as mentors and «intellectual parents» who not only transfer and propagate their knowledge but also their standards and ideals can not be undertaken by replacing them with computers. It is not clear how creativity and insight are taught. It is for these reasons that we have to emphasise the importance of teachers as irreplaceable assets in any society.

THE CHANGING ENVIRONMENT

In recent years, we have been experiencing considerable changes in our expectations from engineering education programmes. Industry is undergoing fundamental changes and technologies face us with new challenges. We are also witnessing shifting patterns in the traditional club of economically developed nations. New comers are making their ways and force others to shift, re-allocate and accommodate them. There is one factor that is common to all, be it from developed, newly developed, least developed, or developing nations: and that is changing expectations from the engineering educational system. Such demands and expectations have forced all of us to re-examine our role, to redefine our objectives, to modify our system, and to use new tools.

Traditional curricula are undergoing fundamental changes. An early exposure to engineering challenges in parallel to learning the basic sciences is the cornerstone of today's modern innovative reengineering of engineering education [4,5]. The use of computers in the process of education can make this change a productive and a desirable one.

COMPUTERS AND EDUCATION

Computers can be extremely helpful in improving the basic skills. They have a number of advantages since they can provide the student with the ability to learn at his/her own pace without being disturbed by others' negative judgements on how slow or how fast the student is learning the subject. A more profound understanding of the subject would replace the sometimes shallow comprehension. Computers can also relieve the teacher of some routine tasks, thus provide him/her with the opportunity to consider special cases and to reflect on the coming challenges as well as to assess his/her achievements and failures.

Computers can help us to benefit from exploratory learning, while at the same time strengthen our abilities to develop basic skills. Creative research requires that the pattern of solving well-structured problems be broken. It requires to deal with problems that are much less structured compared to what we usually deal with in the class-room. An early exposure to engineering challenges is now feasible, mainly due to the capabilities that computers can offer. Here, the role and the impact of computers can be quite monumental and considerable.

We have experienced the use of computers and informatics in our graduate programmes. Students use computers to solve real problems and to produce final results very similar to what they would be making when they are working as engineers in the industry. One word of caution: we should not let the complexities of today's' computers to distract the students from gaining insight into the problem they are trying to solve. The objective is to use the computers in order to assist in the understanding of the subject. This objective should not be mistaken with learning how the computers work, or how complex they may become. For this purpose, special software packages that do not require extensive programming by students are essential. For two graduate courses, we have assigned to graduate students a task to develop easy-to-use, menu driven software that can be used by undergraduate students or working engineers to examine various alternatives and to compare them in a way that would broaden their comprehension of the subject. In one particular example, we were able to convey to students the behaviour of a system in three-dimensional space in a variety of conditions. We felt that a profound interest in the subject was inspired that was incomparable to our earlier experiences.

Computers have made other striking and considerable impacts on our educational system. Electronic mail and computer networking have made it feasible to benefit from unlimited resources and to obtain advice from cyber-space on the world-wide-web. One limiting factor has been the high cost of long-distance links to other sites on the network.

CONCLUSION

We have witnessed that students who have used computers as tools have developed a thorough understanding of the subject and are able to follow new developments. They have been able even to contribute to innovative approaches. Nevertheless, due to limited scale to our experience, one can not take it for granted that the same positive impacts we have experienced in our pilot programmes can be expected if they were to apply in a wide-scale use.

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PRACTICES OF UTILISING NEW INFORMATION TECHNOLOGIES IN MUSICAL EDUCATION OF SCHOOL STUDENTS

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The emergence of hypermedia technologies combining hypertext and multimedia technologies has significantly increased the interest of teachers of the humanities to computer-aided training methods.

The problem of using computers in musical education currently arise numerous debates. Teachers of music today are not yet well familiar with computers and their capabilities. Therefore, they need to acquire new knowledge and skills to use computer technologies in the educational process. Obvious is the fact that the tremendous opportunities offered by computers should be utilised in all spheres of pedagogical practice including musical education.

Is the use of "musical informatics" mandatory for a teacher of music? The employment of computer training programmes affects the problems of innovation and creativity in the educational process. The problem of integration of new information technologies into the educational process leads to the necessity of revaluation of long-run objectives of school education as well as of selection of tools for setting and meeting those objectives. The school, lyceum, and gymnasium curricula give the definition of musical education objectives which suppose development of student's abilities to perceive the riches of the art through such phenomena as language, sound, shape, individuality, emotion rather than to acquire some theoretical and technical skills needed to a musician, i.e. a student is supposed to know rather how to listen and hear than how to create.

Courses of informatics as well as courses of music employing computer training programmes give students an opportunity to experiment with electronic sounds. The new information technology-based training methods are apparently free of any pedagogical strategies and their effectiveness depends entirely upon the mastery of a teacher. This brings up a problem of interaction within a triad: a teacher - pedagogical tools - a student. When the methods and tools are selected they play the role of linkage between a teacher and students.

The objects of the musical education are to help a student find his or her place in a constantly evolving sound universe, to satisfy and develop one's needs in self-expression and communion, to encourage one's imagination and creativity, to aid in understanding the variety of the sound world (including, certainly, modem music), utilising one's own potential and in finding oneself in innovative activities meaning various forms of musical expression (this is where the computer technologies can help greatly).

The selection of tools for this type of music lessons is the question of teacher's strategy, personal competence and interests to methods and media to be used by a teacher and students. Due to the lack of good training software in Ukraine it is only possible to count on fragmentary computer support for music lessons. The same computer-based musical training programmes can be used at different stages of musical education. The specialized schools of music can use various musical databases on CDs such as "Bolshoi Theatre", "Mozart's Magic Flute", etc. for the courses on music theory and music literature. The professional musicians can make use of a computer as a simulating and information search tool.

In addition, computer technologies offer the possibilities for storing and processing musical information. For instance, the machine classification of folklore works allows for not only storing but obtaining the information based on formalized qualities and parameters of song music and text. Such information-reference systems as UKRFOLK, the Ukrainian folklore songster, have been developed by the staff of the V.M. Glushkov Institute of Cybernetics (Kiev). In addition, computers are utilised currently for conducting research in the field of musical styles, genres, compositions, etc.

The application of computers in music classes of schools, gymnasiums, and lyceums is quite different. There was almost no consistent, goal-oriented attempts made in Ukraine to employ computers for musical lessons either at specialized schools or at comprehensive schools. However, the combination of capabilities of up-to-date computers and other means for transferring audio-visual information will definitely enrich the educational process. The modern information technologies provide for the following opportunities:

- accessing libraries of moving and static images with and without sound accompaniment;
- selecting of any required audio-visual information from databases;
- operating programme libraries;
- reshuffling information including texts, graphs, sprite-oriented diagrams, animation with and without sound accompaniment;
- multi-window data presenting.

All this variety of options will contribute in development of students' creativity initiative in the course of acquiring new knowledge, their ability to extract necessary information, manipulate this information, analyse and classify it.

This approach allows for completely different motivation and development level of acquiring new knowledge, comprehending new concepts and ideas.

The results of our research show that the computerization of the educational process should both aid in developing personality and creative capabilities of students and completely change the entire training technology.

The experience proves that the employment of a computer at class does not always produce that very effect a teacher counts on. This is explained by a number of reasons:

- absence of substantiation and appropriate methodology;
- difficulties of organization of subject lessons in computer-equipped classes;
- incompetence of teachers themselves;
- lack of broad-based software products meeting the requirements of all teachers.

In addition, the software available has both its advantages and weaknesses. On the one hand, it provides for a freedom of creativity, but, on the other hand, it does not answer the complex requirements of the educational process. It is necessary to conduct comprehensive research in Ukraine aimed at adaptation of foreign- and domestic-made software designed for lessons of music, develop the methodology for conducting such lessons, analyse the digestion of knowledge by students resulting from computer-aided classes. A teacher will have to solve a task of integral incorporating the computer technologies into the lesson canvas and developing new psychological, pedagogical and methodical techniques while preserving traditional ones which already proved their viability and efficiency.

There are some computer programmes designed for musical education which can be used as fragmentary support for one or two lessons. Other ones are data bases or encyclopaedias which imply that a teacher should select the necessary material for a certain lesson. These CD-recorded data bases can also be used by students for their individual work. Visual presentation of material provides for its easy digestion, the technology of retrieving the information from a CD allows for finding, reviewing, and selecting the information needed easily. These programmes give a student the opportunities to satisfy one's individual needs and interests, rapidly obtain brief information on specific subjects as well as to find supplementary information if desired. The practice of utilizing computer programmes at class prove the possibility for their integral inclusion into the educational process as well as the versatility of their application as they can be used for different purposes:

- explanation of new material;
- material reviewing and summarising;
- control over knowledge;
- work in creative music laboratories.

The use of computer support for music classes at the International Relations Lyceum of Kiev within the framework of 5-year experimental programme was combined with such traditional methods of training as discussion, work with literature, listening to the music, choir singing, and using other didactic means like handouts, illustrations, etc. Various forms of conducting music classes utilizing computer technologies were successfully added with different methods of teacher's organizational work: class work, team work, and individual work.

Taking advantages of computer music capabilities cannot yet be considered traditional for educational activities in Ukraine. However, a teacher can start with simple computer programmes such as music editors processing musical texts written by students themselves and proceed with more complex musicology systems designed on the basis of *hypertext technologies*.

The most interesting and promising tendency in employing computer technologies for teaching music is working with CDs based on *multimedia technology*. The growing interest to this technology is conditioned by a number of reasons. One of them is the availability of so called author's systems giving one an opportunity to create his or her own applied multimedia programmes even not having extended experience in programming as well as to combine several types of traditional (texts, table, pictures, etc.) and original (speech, music, film fragments, animation, etc.) information in one software product.

Multimedia technology is expected to be one of the major direction of enhancement of computer technology in this century. Nowadays, multimedia systems are successfully used in the field of education. Of particular interest for us are the computer-based training multi-systems allowing to enrich and deepen the students' knowledge providing gigabytes of information as well as to reduce the training time. The French lyceums, for example, already offer an experimental course called "Musical informatics and education" [1], taking which the students acquire knowledge either in information technology or in music. The experiences of experimental application of different music software demonstrate that such programmes as CD "Bolshoi Theatre" can be used for 5^{th} grade of comprehensive school for studying topic "Music and literature". The CD introduces the most known productions of the Bolshoi Theatre, its history and the people whose creative work brought fame to the theatre. Music, slides, and video fragments available at this CD let students to get an idea of many theatre's performances. Those curious will find a lot of interesting things in the appendix-glossary "Intelligibly about ballet" explaining various ballet terms in an easy form. The glossary is also illustrated with slides and video fragments.

Another CD programme "Maestro +, Create Your Own Melody" is also interesting and useful for the educational process. This programme is both entertaining and educational one allowing to create melodies and music compositions. It teaches to understand and differentiate main components of sound (acoustics), to rightly use them, and to develop and improve hearing perception through listening and analysis of various music.

The application of computer programmes at class is the creative process for a teacher as well. For instance, another programme called "Organ-grinder" offers children an opportunity to rapidly master musical notation through performing various assignments developed by a teacher according to the lesson subject. In this case computer is used as a fragmentary support. The students study musical ABC, simultaneously solving interesting creative assignments. Such lessons have a double objective of informing and developing creative thinking.

Teaching music we act based on the assumption that sound brings out our feeling and reaction to external world. It is necessary to help children communicate the harmony of sounds, feelings, and thoughts. Improvisation is one of the ways to achieve that. The students make up their own musical accompaniment to literature passages conveying the mood of poems through the sound, sound pictures and video fragments creating their own musical fantasy (it is also possible to draw under impression of music). The subject of improvisation is given by a teacher or suggested by students. This work can also be performed using a programme for IBM-compatible computers called "Musical-box". It allows one to choose a musical instrument which is best suited for expressing the specific plot (the programme offers 20 musical instruments). This package requires lesson-by-lesson work in the course of which the students will pierce into the secrets of musical language (melody, rhythm, timbre, etc.). The objective of such a lessons is to most precisely express the given subject and draw one's own sound picture. These lessons provide students with an opportunity to independently manipulate sound pitch and rhythmical relations which is next to impossible at a conventionally conducted class. The children (especially boys) develop interest to studying music as a complex concept. They want to get acquainted with more musical compositions, play musical instruments, sing.

The improvisation assignments enhance imagination, teach to think musical images translating them into real sounds. The lessons of music, efficiency of which increases through the use of computer technologies, open the boundaries for musical and art activities of students and allow to set up inter-courses relations combining music, fine art, and literature.

The new information technologies are very instrumental for creation of musical programmes. We are currently developing an information and training system called "A Fairytale in Music" (the authors O. Cheremis and V. Shtepa). The system is based on GIPSI hypertext system developed in the Hypertext System Laboratory of the Institute of Applied Informatics.

The application of this new programme at music classes makes the educational process dynamic and playful and lets a teacher to monitor the activities and knowledge of every student. When working with the programme a student is free to improvise that contributes to development of his or her interests and creative capabilities.

Therefore, the experimental work in this sphere shows that new information technologies can and should be used for teaching music. A teacher should analyse the PC capabilities needed for teaching the specific subject and the possibilities for its rational employment to increase and improve the students' knowledge. It should be stressed that great attention is to be given to development of new computer software for musical education purposes.

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THE CHILDREN, DRAWING, SYMBOL, COMPUTER

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Was it a god who charactere'd this scroll,
The tumult in my spirit healing,
O'er my sad heart with rupture stealing,
And by a mystic impulse, to my soul,
The powers of nature all around revealing.
Am I a god? What light intense!
In these pure symbols do I see,
Nature exerts her vital energy.

J.W. Goethe «Faust»

(Quoted from: «Goethe's FAUST» in two parts' translated by Anna Swanwick, LLD, London. George Bell and Sons edition, 1902. page 106. stanza 80 - 85)

Each person may be thought of as an individual world with its special knowledge, feelings, representations, which is to say that for each human creature the possibility is of vital importance for transfer of these knowledge and feelings to other people, both to those living beside him, and to his progenies. The whole history of mankind comprises the history of communication among both individuals and human communities.

The communications are connected with exchange of some information and assume some diversity of forms for representation and the ways for information transfer. The development of communicative abilities of children is closely connected to the language mastery process for such a dialogue. Universal languages of the communications are symbol systems.

In this connection the study of historically arising communicative technologies and determination of their place in the modern world are of considerable interest.

The pupils of 6-9 forms carried out a set of works on symbol systems by means of so called «method of projects» during optional lessons on informatics at Experimental Industrial Workshops (EIW) in 1992-1996.

The themes of the projects were as follows: «History of Writings», «Heraldry», «Symbolic of Ancient Russian Embroidery», «All Flags Visit Us», «History of Advertising», «Festival of Numbers».

The result of the above works is the set of computer programmes for chosen themes.

METHODS

At all variety of chosen themes during the work over each project it is possible to allocate general stages.

SEARCH. Reasoning from the requirements of the educational process, a teacher chooses the theme and carries out scientific and pedagogical research, which can be used in the development of the given theme.

CHILDREN. WORK ORGANIZATION. Those children are invited for project development who want to work with computer. The age of the children is thus taken into account: 11-12 years (a group of the beginners), 12-14 years (a group of those who continue the work with computer), experience of work with computer and experience in drawing are also taken into account. Each group of children works over one project during an academic year.

TECHNOLOGY. The pupils study fundamentals of computer graphics, they learn to use «mouse» manipulator, «Graphic editor» programme, operations with scanner and computer networks; the issues connected with drawing and painting are also considered.

PROJECT EXECUTION. The novelty, actuality and importance of the chosen theme is discussed with pupils, and the fact is emphasised that the work is collective, in which each pupil makes its contribution. The scenario of the programme is further made. The program represents computer analogue of an album, consisting of slide pages, over creation of which children will hereinafter work.

With the purpose of acquaintance with the chosen theme and selection of work material the pupils visit museums, look for information in various books, encyclopaedias and dictionaries.

The work shall be planned in the process of execution of individual tasks by means of computer. There are special requirements for slides. When the work over project approaches to completion, the following components of an album are made out: cover, epigraph, menu, conclusion and slide of the participants, in which all authors of work are listed. Then the whole album is assembled with help of the «Scenario Editor» programme, and the pupils prepare their report that comprises demonstration of the completed programme.

PROJECT DEMONSTRATION. The children invite their parents, friends, and also teachers for the presentation of completed project. During project presentation the achievements of each pupil are emphasised and successful overcoming by him of arising difficulties is demonstrated. Aft presentation each pupil is awarded.

PROJECT DEFENCE. The completed projects/programmes were presented at «Search-95» and «Search-96» research and practical schoolchildren conferences at «New information technologies» section. The pupils prepared the reports, programme demo-versions and presented their reports during the conferences. The submitted projects were marked by the diplomas, the thesis of the reports were published in the materials of the above conferences (it was the first published work of each pupil), the authors of the projects are awarded by souvenirs.

PROJECT IMPLEMENTATION. The programmes can be used as a training material at the lessons of history, geography, literature, Russian, Informatics, technology, mathematics, sewing work and fine arts; they can also help a beginner in the field of advertising.

Now the above programmes are used in educational process at EIW and at schools of Moscow and St-Petersburg.

Those pupils, who attend optional lessons, take part in «Young artist» magazine activity together with their teacher. Their drawings illustrate the articles on fundamentals of computer graphics in «School for beginners» heading.

The works of the children were demonstrated at various seminars and presented at «Children - Art - Computer» exhibition within the frameworks of «Synthetic intellect in 21st century» International Conference in Moscow (1995).

Implementation of the proposed method gives possibilities for realisation of the active approach in the course of educational process and enables a teacher and a pupil to carry out joint creative work.

PROJECTS SUMMARY

«HISTORY of WRITING» programme comprises an album, telling about the history of writing by means of pictures.

The writing is really ranked as one of the greatest cultural achievements of the mankind. That is why both the knowledge of history of writing and its interpretation are so important.

The writing may be defined as a symbol system for speech fixing through which information transfer by means of graphic elements and information saving can be carried out.

The well-known examples of four kinds of writing are presented in the album. They are as follows: pictographic, ideographic, syllable (word - syllable) and letter-sound (syllabic).

Further development of writing has resulted in creation of the alphabetic writing systems. The first European alphabet was the letter symbol one. It was developed by Phoenicians.

Both the scheme of writing system development and the examples of ancient Greek and Latin alphabets are presented in the album.

A separate chapter of the album is devoted to the history of creation of Slavic writing system by Bulgarian educators, brother's Kirill and Mefody. Presented in the album samples of Cyrillic, Glagolic and Uncial (Writing) of «Ostromir's Gospel» (1057) were made by means of scanning and further editing with the use of special graphic programmes. *(Ostromir's Gospel is the first Russian Gospel with established date, 1056 - 1057. Ostromir was a governor of Novgorod. He ordered to rewrite the Gospel in Russian. Comments of translator).*

The program «HERALDRY» represents an illustrated album, telling about heraldry.

Heraldry is the special historical discipline studying the system of the coat of arms and of knowledge of them.

The purpose of initial acquaintance with heraldry is to get an opportunity «to read» the coat of arms, to classify it and to decipher its coded information.

Heraldry plays an important role in determination of the origin of historical monuments, supplied with the coats of arms. It helps to find out the authenticity, fitting, authorship, time and place of manufacturing of mode of life subjects, art, books and manuscripts.

The basic elements of a coat of arms are a shield and an image on it. From the representational point of view the shield appeared to be rather capacious system for information record and transfer.

The scanned images of the redfigure seal of Ivan the Third and ancient Moscow coat of arms are included into illustrated story about heraldry.

The album is supplied with the images of the coats of arms of the cities the Gold Ring of Russia. This part of the work was carried out on the basis of the reprinted edition of «The Coat of Arms of Cities, Districts, Areas and Settlements of Russian Empire», (St-P, 1900) by von P.P. Vinkler.

The program «SYMBOLICS OF ANCIENT RUSSIAN EMBROIDERY» represents an album, telling about the surprising phenomenon in a global history of arts that is ancient Russian embroidery.

The mode of life of the ancient Slavs was firmly connected to applied art that is wood fretwork, colourful embroidery, intricate woven patterns. Towels, table clothes, the clothes, head dresses were decorated with embroidery.

The language of Russian national embroidery is the sort of the system of writing, where ink and paper are replaced by canvas and a thread, which is frequently red.

The deciphering of the symbolical images of embroidery elements was among the objectives stated by the authors of an album with the purpose of « reading the texts» written on canvas by means of a thread.

With the help of Russian national embroidery we can imagine the mode of comprehension of both the world and the nature by the ancient Slavs and penetrate into the depth of their national poetic mythology.

The story about symbolic of ancient Russian embroidery is illustrated by drawings of embroidery samples and supplied by explanation of the basic elements. The samples of embroidery are accompanied by the explanations from the catalogue. The album is supplied by an attachment «Some secrets of drawing» by means of which one can follow the process of creation of children's creative work.

The program «ALL FLAGS VISIT US» represents an illustrated album, telling about the flags.

The album consists of several chapters. The first one is devoted to a special historical discipline dealing with the history of flag origin, i.e. to vexillology. The chapter «All flags visit us «tells about the history of Russian flags and is supplied by the drawing and descriptions of flags of international organisations such as UNO, Red Cross, Olympic Games etc. International Status-Book of Signals, which is used for communications on sea and also the flags of some states of the world are also described.

The «HISTORY of ADVERTISING» programme constitutes an illustrated album, telling about the origin and development of advertising as of a symbol system. In the album the examples are collected of various representational and verbal means, used in advertising.

The album is opened with the chapter «Childhood and adolescence of advertising». In the above album there are considered protoadvertising and various forms of advertising, which existed before the rise of the written language. Such concepts as catalogue, summary and publishing mark are explained with the help of the example of development of advertising with appearance of bookmaking. The next section is devoted to the history of advertising in Russia. Examples of splint, poster, bill are presented, the advertising by V. Mayakovsky is examined. Then the concept of company style is investigated.

«The Dictionary of Advertising» is the important part of the above album; it contains about 40 terms and definitions, supplied by explanations in the appropriate sections of the programme.

The program "HOLIDAY of NUMBERS" in the entertaining form tells about a history of occurrence of figures and various notations, about the first adaptations for the accounts.

The composition of all albums includes a cover, epigraph, illustrations and explanations to a considered theme, conclusion and slide with enumeration of all participants of work further follow.

All programs are prepared with the help of a graphic package CPEN, they occupy volume 450-800 Kb everyone and are started in MS DOS on IBM PC. The programs-albums "are going through the pages" by a key "space". The choice of the unit of the program is carried out with the help of the menu and sub-menu. An exit from viewing is *Esc*.

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COMPUTER CREATIVITY: DEVELOPMENT OF ART ABILITIES OF CHILDREN AND COMPUTER ARTTHERAPY

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As experience shows, the computers can play a significant role in training not only schoolboys of younger forms, but also pre-school children. Already from five years' age children can successfully master and use the computer as the tool for the writing, drawing, as a whole - for development of creative thinking. It is necessary to emphasize, that in training with the help of computers the speech should not go only about study of a necessary educational material. The computer training should promote all-round and harmonious development of the person, first of all of its creative abilities.

We consider the training to art creativity as the important component of formation of individuality of the man.

Experimental researches, which were carried out on preparatory and art departments of Children's school of arts № 2 in Kiev, have proved that use of the computer as new, modern means in training of pre-school children and younger schoolboys to principles of art creativity and fine art is very much expedient and perspective.

20 children in the age of from 4 up to 6 of years and 40 schoolboys 7-10 years learning I-III of forms of Children's school of arts and comprehensive schools of city took part in the experiment (at the desire of children and at the consent and support of research by their parents).

During an experimental research, which began in January, 1995, we had an opportunity to be convinced that the computer, though is object of technical environment, enters very successfully into synthesis with traditional, natural environment of school of arts, harmoniously supplements this environment and considerably expands opportunities for intensive, emotionally active introduction of the child in the world of art and art creativity, promotes expansion of consciousness of the child and formation of sincere keenness. The bases of information culture imparted to the pupil, considerably optimized educational process as a whole, have raised interest of the pupils to training.

At lessons the computer training and developing programs developed by the domestic and foreign experts and presented by the Ukrainian Foundation of educational software were used.

Both individual and group (small groups in 4-6 schoolboys) lessons on the personal computer with children once a week were carried out. Teaching on author's techniques of such art disciplines, as the art creativity for pre-school children, basis of painting and composition (for younger schoolboys), very successfully supplemented the traditional forms and methods of training to fine art.

The computer gives the teacher an opportunity to use widely a method of art - pedagogical playwriting on each lesson. At these lessons music, fine art, the literature and history of art harmoniously incorporate, and, as a result, the child is directed by the most optimum way - through all-round aesthetic education - on a way of independent creativity. The little schoolboys are trained not only to draw on the screen of the display, but also to duplicate the drawings, to supplement their compositions by the texts of own poems, fairy tales, stories, creating unique monochrome and multi-colour art - graphic compositions.

The modern computer programs for drawing and designing (graphic editors) enable the child to use any art material, which computer can simulate in perfection, - pencil, felt-tip pens, ink and pen, various paints, backgrounds, etc., creating figures, applique works, photocollages, and also to work at graphic forms, painting, design.

The teacher has fantastic opportunities for operative realization of his (her) creative conceptions concerning preparation and manufacturing of visual aids, teaching materials, creation of methodical collection of the best children's drawings etc.

We developed and prepared for the edition by trial circulation the learning manuals (on art creativity, drawings, computer design) both for the work during the lessons and independent training for the children (age from 5 to 10 years) who have a possibility to operate with a computer at home, and for those who prepare to meet a computer in school.

At the lessons of fine arts the implementation of the computer support results in the growth of knowledge level and capabilities of junior pupils. As an instrument, a computer promotes children activity and more profound understanding of the main concepts of drawing, composition, as well as of such section of painting like colour management.

The exhibition of computer drawings as a result of our successive work with learners proves that the use of a computer promotes the appearance of children's attention and interest to various aspects of national culture (folk songs and dances, dress, architecture and way of life, traditional trades and others).

On the basis of research results the first artistic and methodical exhibition of children's computer drawings was held in Ukraine (more than 300 coloured and black-and-white compositions, printed by laser printer).

Thus, the use of computer technique at the lessons of the fine arts can provide:

- significant increase of an efficiency of knowledge mastering on the basis of training intensification and optimisation;
- real opportunity for realisation of personal approach in education owing to its wide range of training and controlling possibilities;
- both supplement to the traditional methods and techniques of fine arts training and wide range of new possibilities along with formation and development of artistic capabilities of pupils;
- good incentive for the development of intelligence, thinking, creative erudition of pupils, accustoming the foundations of information culture;
- favourable conditions for fostering a continuous interest to national artistic culture, national folk art and fine arts as a whole.

We believe that in the process of artistic and creative evolution of a child a computer can not (and must not!) substitute the traditional training technologies. It must be used in a training process as a modem tool, implying the richest possibilities for diverse creative uses.

Our experience shows it is possible to develop, train and cure children through balancing their psycho-emotional state by means of new information technologies.

In medical quarters art therapy (or therapy by fine arts) is a well-known term for a long period of time. For specialists the possibility is now quite evident for successful medical treatment by means of fine art, psycho-emotional correction of children and adults with the use of harmonic music, spontaneous dancing, meditative drawing and painting or the combination of these arts. In the field of medicine and psychiatry art therapy is actively implemented both abroad and in Russia, though in the last case to a lesser extent.

Recently a new trend arises in medical treatment by art therapy that is computer art therapy supplied by the traditional methods and techniques.

The children with psychiatric breakdowns initially are as if being condemned to spiritual and information deprivation, since their education and training are traditionally oriented to their defects. In Kiev Research Institute for Common and Judicial Psychiatry the work was carried out with application of non-traditional methods of training and development through computer possibilities during 1995 for children and youths with various psychiatric deflections. The evaluation was conducted by means of a complex of clinical and psychopathological and neuro-physiological methods.

The traditional training in school have been pursued with word and sign system prevailing, oriented predominantly on left brain hemisphere, that leads to overlapping of all other sensor and motive perception channels and, to some extent, it is a reason for unidirectional brain evolution with the use of precisely those its structures and functions which are imperfect in our patients. In our case the attention was concentrated on a complex development of right- and left-side brain hemisphere functions along with training and balancing of psycho-emotional state according to methods which were expressly elaborated by authors. The work was accomplished according to the following directions:

- development of artistic capabilities by means of the specially elaborated techniques of computer graphic and elements of computer animation;
- development of children cognitive abilities by means of evolving computer games and training programmes.

42 persons (children and youths of an age from 3.5 to 15 years) attended the training and medical treatment course during 3-4 months.

As a result of computer art-therapy application the children and youths had revealed the similar dynamics of change in psychiatric state.

The children had been overcoming their internal barriers, psychological discomfort, states of psychiatric deprivation, and neurotic states. They became able for individual growth and development. The possibility for access to computer technology had caused (in 100 % cases) the increase of positive consciousness and the formation of positive part of «I - concept». In the course of training with the use of a computer the estimation had been changing of the children by their parents to positive direction, that improved the relations between children and parents and created a favourable family microclimate.

There were observed the growth of motivation along with fulfilment of training tasks, the development of volitional features while reaching objectives and the overcoming of technical «non-ability». The need was intensified in contacts and interaction. Such creative capabilities as independent vision, combinative, searching activity, as well as emotionality and ability for co-feeling and spiritual demands were improved.

The perception was changing, that is, the following characters were formed: a delicacy of differentiation of artistic images and environment, the space feeling and special perception. Also, the increase was noticed of ability for independent concentration of attention and independent regulation of activity. The memory improved, the volume of short-term memory grew. The motion co-ordination improved, the formation of fine differentiation motor system occurred. It is of general experience that the above facts indicate the extent of puberty of brain structures.

The method of computer art therapy has a lot of priority features as compared to conventional methods of psychiatry. The method comprises harmonically and independent creative power of a child (that serves for him as self-expression and exteriorisation of accumulated problems) and the fulfilment of specially structured tasks, affecting the functions of various parts of brain. The balancing of mental and emotional state of a child occurs. In the course of training the complex effect of the following factors takes place: emotional and well-meaning contact with pedagogue-psychiatrist; influence of specially selected music; independent activity of a child; developing and training computer programmes.

Great potentialities of computer programmes allow sustaining a child's activity in the «zone of the nearest development» (according to J.Vygotsky). Thus the situation is formed of concentration and training of resource capabilities of mental processes, stimulates their development and allows preserving the situation of success and achievements. In the course of computer art therapy accompanied by neuro-physiological control it is indicated a significant restructuring of bioelectrical brain activity.

The use of new information technologies in the course of training will give the positive effect only in the case of fulfilment of the recommendations of psychiatrists and hygienists regarding to work organisation with microprocessor technique.

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Theme 3

TECHOLOGIES

ELECTRONIC BOOK AS A MEANS OF COMMUNICATION UNDER CONDITIONS OF INNOVATIVE TEACHING

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A characteristic feature of the modern stage of informatization in the sphere of education is a qualitatively new stage in the development of hardware and software designed for the application in teaching. This is primarily manifested in transition from the use of personal computers for their solution of purely computational applied problems to their application as means of information and methodological support of one's own learning process. One of the most promising trends in this direction is a search for the ways of the creation of computer systems designed for individualization of teaching, taking into account the creative and psychological properties of the student.

A transition to innovative teaching implied the presence of four major aspects of the reorganization of the management of the teaching process [1]:

1. a transition from a peremptory role of the teacher to democratic co-operation, aid, inspiration, relying on the personal initiative of the student and the growth of his personality;
2. change in the process of knowledge assimilation: transition from routine learning to the organization of productive creative process in the diversified forms of thinking;
3. focus on the social nature of any learning and development of the personality;
4. elimination of the destructive role of marks, which focus on the striving to attain a pre-set standard in actions and behaviour and invariably resulting in conformism and lack of individuality in students. Whereas the conventional approach to the problems of teaching is predominantly aimed at special knowledge transfer from a tutor to a learner, the innovative approach is characterized by a focus on the development of both personality and various thinking types of each learner during the learning process.

Whereas the conventional approach imply such traditional types of teaching as simulation, imitation and following the models, the innovative approach is based upon the great variety of interactions that promotes actualization of personal experience of each learner. In each particular case of the innovative approach the leading type of communications is that providing the best possibilities for achievement of high activity level for each learner.

From the aforesaid it might be assumed that that at least two problems shall be solved with the purpose of transfer to the innovative teaching principles. They are as follows:

- Firstly, the teachers themselves shall be trained in implementation of the new work methods, new technical means and computer technologies.
- Secondly, a teacher needs special technical means that provide both efficient co-operation with a group of learners and possibility for control and management of the process of learning without suppression of self-expression liberty of a learner. Being modern and efficient communication mean, electronic book is one of such technical means.

In the literature dealing with new information technologies and modern means for communications we meet such terms as "electronic book" and "electronic edition" with increasing frequency. Though meaning of the above terms is not is not yet defined precisely, the great majority of the authors take these terms to mean quite distinct sense, i.e. referred to some subject area the set of texts, illustrations or various musical or conversational fragments which are written on a digital carrier, for instance, on a laser compact-disc. In addition to data carrier we need special hard and soft wear to read such a book.

The recent years have seen an advent of a large number of electronic publications which content is invariably associated with learning. Great variety of teaching systems, such as electronic encyclopaedias, dictionaries, simulators, etc., falls in this category (see, for instance, *Transactions* [2]). Along with that we should emphasise that among the philologists and book-keepers the opinion exists that electronic book has no advantages as compared to conventional "paper" book (or hard copy) from the point of view social communications, particularly when it is used in course of teaching humanities. A sceptical attitude of some specialists in humanities to the possibilities of computer means of learning appears to be associated with the fact that the authors and developers of the software pass over the old methodological method to the medium of new information technologies. This results from the lack of conceptual approach to the issues associated with the creation and development of the electronic book.

An integrated approach to the electronic book problem implies an investigation of the man-computer-information environment system, where the man is a major component. It follows that the development of the systemic principles of developing a friendly and efficient dialog is associated with an integrated study of psychological, semiotic, ergonomic and other aspects of the communication of the man with the computer.

The computer system forms a communicative system of interaction with the man, where information is exchanged in the symbolic form. A basic requirement to the developers of such a system is an efficient solution to the user's interface problem. Its solution involves at least two approaches.

The first approach is based on the user having the opportunity of understanding the essence of a man-made system, to easily learn and memorise the rules of handling it. The second approach is based on the intention to render the work of the user with the intellectual system an interaction between equal partners, the man using the language environment and the metaphor system well familiar to him, and the computer having the task of supporting the user, taking into account the peculiarities of his behaviour in the course of interaction. Practically, the problem of the interaction of the user with the communicative systems is handled on the basis of a compromise between the above two approaches.

In the 1970s, a view was widespread that it is only the natural language that would ensure the most convenient method for the man-computer communication. This assumption was relied upon to create the «fifth generation» of intellectual computes. But the correctness of this assumption is far from being self-evident. The natural language (even on condition of absolute understanding of the utterance meaning) would not always ensure the completeness of a description attained, for instance, when contemplating the image of a fairly complicated object.

It has become evident now that an effective interaction of the man with the computer is only possible on condition of the use of different communication languages, including those activating the image mechanisms of thinking (iconic language, the language of actions, musical and colour codes, etc.). This is supported by a widespread distribution of systems based on new technologies of multimedia and virtual reality, simulators and other software, whose dialog component relies on active use of computer graphic methods.

The problem lies in the fact that the symbolic and language means of the dialog are often used by the developers subconsciously, intuitively, without due knowledge of the problem of user's interface. The programmers, normally focus on the functional characteristics of the software, neglecting the user.

The reason for this state of events is readily understandable. Firstly, the users do not expect much of the software offered to them since they are unable to adequately assess its quality. Secondly, the programmers are not competent enough in creating users' interfaces.

It took some time to realize, that the problem of the man-computer interaction is integrated, requiring joint efforts of different specialists, and that the man is the basic, and the most complex component in the man-environment-computer system. A new scientific discipline has appeared: a human-computer interaction, where new research specializations are actively developing. These, for instance, include computer semiotics, whose purpose is analysis of computer systems in terms of their use as signs interpreted by the users depending on their intentions and ergo-semiotics (it is treated in detail in the monograph [3]).

The informatization of the society on the basis of massive advent of the computer technology is an irreversible process, but this is primarily a process but not a single action. It appears that it would take much time before the fruit of computerization become manifest. Its present stage is only initial one. Irrespective of the scale of the problem of transformation transfer from the paper environment to the computer, it will have to be solved, otherwise all the talk on informatization will remain mere talk. The first attempts to solve it are already there, and they are fairly successful; it is expected that by the year 2000 in the USA all the publications will be accompanied by their electronic versions [4].

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NEW EDUCATION TECHNOLOGIES IN ECONOMICS AND MANAGEMENT

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The present-day situation in Russia dictates the need for training, including in service, workers in the fields of economics, business and management.The task is fundamental revision of the learners' views on the principles of economic operation, as well as instilling a system of values, views, skills and knowledge that would comply with the dictates of the present-day market economy. Hence the urgent need for changing the technologies of the teaching process and the range of fields of professional training. Currently, both classical university education in economics and management and the "long" and "short" educational programmes of various business schools are carried out in certain conditions as described below.

For one thing, there is a limited number of specialists capable of providing training up to the international standards, especially as concerns economics and management. The seeming simplicity of the principles of market competition or operation of the stock market is deceptive, in fact. There are surprisingly few instructional programmes that go beyond purely theoretical rendering of customised educational resources.

The second factor is the shortage of time allocated for in-service and/or other retraining courses. Significantly, the training time is limited both at the macro-level (in the sense that the constructive changes in the economy and management should be carried out in the shortest possible time) and the micro-level (the level of individual manager or administrator). Those engaged in practical management, in small-scale private business in particular, would virtually "steal" time from their occupational duties, and hence their in-service training time has to be as short as possible.

The third factor to be taken into account is the shortage of retraining funding. The educational programmes are fairly expensive, while the payment rates even of the best qualified teachers and instructors are still below the world standard. Applied to an individual, the problem could be defined as follows:
under socialism, the life style did not call for purposeful saving or significant expenses on education, hence the need for a radical social and psychological reorientation. In the current conditions of transition to a market economy, investments in personnel education and occupational training is a very risky form of investment with a long payback period - and consequently very low priority.

These factors necessitate the use of such forms of occupational training as evening, correspondence and distance. Many of the university and college teachers and instructors in Russia have developed a negative attitude to correspondence education in the mode which existed in the former USSR. We believe, though, that life dictates the revival of this type of education, but in another form - that of distance education which would incorporate Western technological achievements as well as some features of the Russian traditional educational system. The advantages offered by the application of distance education today lie in the fact that its application makes it possible to use a relatively small number of qualified instructors for training a large number of managerial workers and other specialists. This type of training is cheaper than the training involving full-time attendance, and besides, it allows to combine occupational training with the conduct of occupational duties.

Today, the learning technologies of any type of training for the work in economics or management should be based on informational technologies, such as the computer, audio and video facilities, complete with respective courseware. Creating common informational environment for the learners, exposing them to the use of informational technologies for the study of most of the general disciplines, as well as specialized courses, figures as an important factor. The learners must be provided with various tools, such as word processors, electronic tables, economic information analysers, statistical packets, etc., and various automated training systems for individual work. The major problem here is, not so much the technical base as the correct choice and development of software, as well as adequate qualification of all the teachers and instructors.

An important factor of the training for business, management and economics is the availability of a computer modelling test-field for evaluating theories, verifying hypotheses, etc. In this case it is reasonable to use a more or less universal computer modelling system with an open aggregation of models instead of separate simulator models of various objects and phenomena.

A modelling system is a tool for making simulator modelling an everyday activity which is available any PC user. The application of computer programmes of this type to the learning process requires a high level of training and qualification and a desire on the part of the learners to familiarize themselves with the functioning of economic mechanisms within the limited time period allocated for the purpose. The IMITAK system, worked out by the State Academy of Management, can be used as the basic model for instruction in most of the economics and management courses.

This modelling system represents a modified version of the method of systems dynamics and provides for the following objectives to be obtained within the mode of a friendly dialogue with the user:

- broad-class simulator models with a feedback;
- computer experiments with the models, with screen display of the results;
- a user training mode of modelling methods.

Three versions of the IMITAK system are used in the educational process:

1. the version for conducting tests with standard models of processes and phenomena;
2. an instrument for the professional development of simulator models by teachers and learners to be applied for research in the fields of economics, social systems, etc.;
3. a facility for providing computer support to the study of various processes and phenomena based on the learners' building the models on their own.

Various dynamic models - economic, social, technical and others - may serve as objects for modelling. Since it is so easy to change the models, they are always adequate to the task despite the changing economic situation. Standard models and those built by the learners, along with case studies, underlay practical and individual studies of the learners at various phases of the learning process.

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WORLD PLANETARY DATABASES INTEGRATION. USERS ACCESSIBLE EXPANDING POLICY

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STRATEGY ASPECT

The mankind have collected huge amount of knowledge about other planets. This knowledge need to be saved for the next generations and became not passive, but active through education.

We believe that those people who will not know the geography of the Moon, Mars and Venus could not be called "educated" in the XXI century.

TACTIC TODAY

The interest of young people to the precise and natural sciences has decreasing now. This tendencies becomes critical, especially in space and planetary researches.

However this tendency can be compensated by rational use of the modem information technology for more and more easily access to data and knowledge, especially in such interesting area as Solar System exploration and exploitation. The solution seems to be the usage of such well tested approach : the involvement of schoolchildren into the direct work with leading scientists at the largest science centers. But now because the usage of computer and communication technologies, the opposite procedure becomes possible: to bring knowledge and experience of the leading scientists closer to the young people. So more people can be involved.

TECHNICAL ASPECTS

• Now the real work with huge volume of collected by different counties planetary data in its present form is difficult even for scientists - planetologiests, not only for schoolchildren and students.

• Some information on planetary data received by old space missions need to be not only restored and saved, but — recovered.

SOLUTION AND ACTIONS

The solution is to create World-wide Accessible International Planetary Data Base for Science and Education. The main differences of this database from existing archives will be:

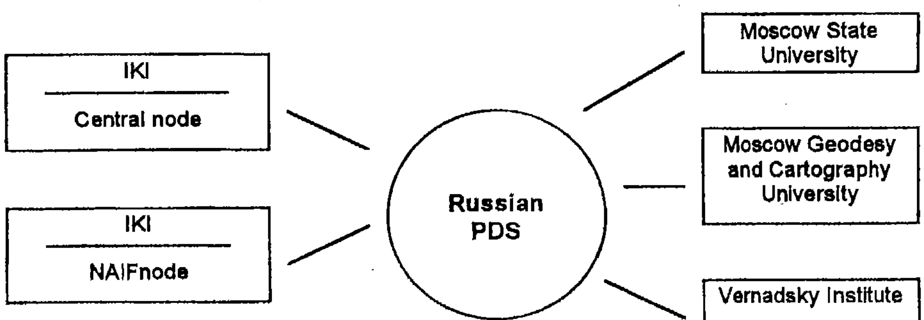
• knowledge level users orientation - from schoolchildren to scientists,
• map-oriented access technology usage,
• hypertext technology usage,
• multimedia technology usage.

The activity in frame of implementation the solution is providing by IKI (Space Research Institute), Russia and Washington University, USA in closed collaboration with

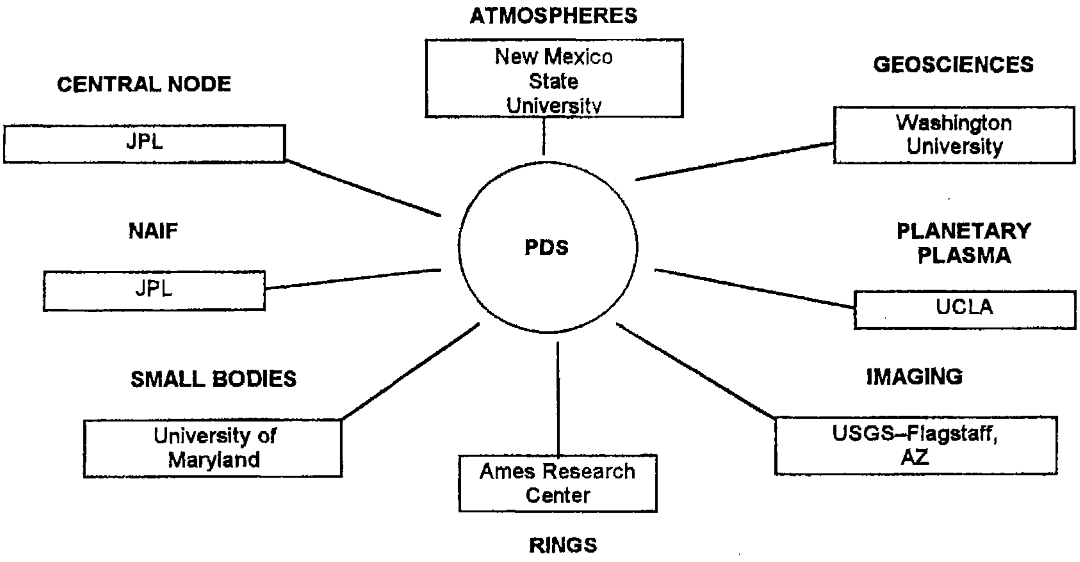
• IPE Institute of Planetary Research), DLR, Germany
• JPL (Jet Propulsion Lab.), USA,
• Vernadsky Institute, Russia,
• Moscow State University (MGU), Russia,
• Moscow Geodesy and Cartography University, Russia.

THE FIRST STEPS:

• creation of International Mars Database included mainly the data from overed missions «Mars», «Viking» — and «Phobos» missions, also the future missions «Mars-96» and «Mars Global Surveyor»,
• creation of International Moon Database included mainly the data from overed programs «Luna/Lunokhod» and "Clementine".



Russian Planetary Data System Prototype



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SOLAR SYSTEM PLANETARY DATABASES STRUCTURE FOR EDUCATION

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THE MAIN EXISTING SOLAR SYSTEM PLANETARY DATABASES AND DATA SETS FOR EDUCATION

1. HTML-programs accessible via Internet that work with the data found on the World Wide Web:
- "Welcome to the Planets"
- "The Nine Planets"
- "Solar System"
- "Mars Atlas"
- "Martian Space Science System"

etc.

2. Educational CD-ROM with the best images collection of Solar System Planets.
3. CD-ROM collection with Martian images of "Viking" mission: full professional set.
4. Planetary missions images archives stored in different US PDS nodes.
5. Catalogs of HTML-programs for quick search of images in archives: "PDS Clementine Navigator" – for "Clementine" mission to the Moon. "PDS Mars Navigator" - for "Viking" mission to Mars.

FUTURE WORLD-WIDE ACCESSIBLE INTERNATIONAL PLANETARY DATA BASE FOR SCIENCE AND EDUCATION. PRINCIPAL FEATURES

The main differences of this database from existing databases and archives will be:
- easy to use: attractive and user-friendlydialog interface,
- integrated systematic approach,
- knowledge TV-users orientation - from schoolchildren to scientists,
- map-oriented technology usage,
- hypertext usage,
- multimedia technology usage,
- more pictures.

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DEVELOPMENT OF "MULTIMEDIA" TEACHING AND LEARNING ENVIRONMENTS IN AUSTRALIA: DESIGN PERSPECTIVES

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ABSTRACT

Examines informatics and its application in tertiary education in Australia. Analysis, design, implementation and use of interactive multimedia (IMM) tutorials are discussed and a number of examples are described. Important issues that relate to the effective design and implementation of informatics in tertiary education are identified and future areas of research are suggested.

KEY WORDS AND CONCEPTS

Informatics in tertiary education; Requirements Analysis; Information Technology in Education; Multi-Media Teaching and Learning Materials; Software Engineering; Curriculum Design.

EFFECTIVE USE OF INFORMATICS IN EDUCATION

What does effectiveness mean when it is applied to the use and adaptation of technology in tertiary education? Teaching things that we always used to teach to more students more cheaply? Using technology to extend the possibilities of what we can possibly teach? When the telephone was first invented it was thought that the most useful purpose to which the technology would be put was as a broadcasting technology. Early testing of the technology involved a number of testers at different locations holding phones to their ears listening to a broadcast of an opera! Uses of telephony have come a long way since then, although early experiments were necessary stages along the way. Some of these were unsuccessful, but as for any new revolutionary use of technology - NITs being no exception - the lessons learned from each step provide the means to take the next one.

In the Department of Computer Science at RMIT in Melbourne we are using and evaluating a number of implementations of NITs to support our teaching. By these developments we wish to define the important design issues, to investigate the appropriateness of various software development methodologies and to examine the potential of a variety of delivery platforms. In one initiative, we have been developing IMM (Interactive Multimedia) materials for approximately 12 months. We teach a large number of Australian students who have recently migrated from non-English speaking countries as well as a considerable number of international students. Typically, a significant proportion of these students experience some difficulties with understanding written and spoken English. Our first development for this, was a small project that aimed to improve our effectiveness in delivery of courses to these students. To assist students to understand course terms and concepts, who otherwise would have to rely on reading lengthy texts when revising, we decided to investigate the of IMM authoring software. Using Asymetrix Toolbook authoring software, we developed and distributed an Interactive Multimedia (IMM) online reference for the second year course entitled "Data Modelling and Relational Databases". This application, which has now been developed, uses hypertext, graphics and keyword(s) searching to assist the students to develop an understanding of important course concepts (for example the Relational Data Model and application of Structured Query Languages).

The tutorial software was distributed to students on two floppy diskettes and can be run on a 386DX PC (or better) that uses Microsoft Windows. At the end of the course, student evaluation of this package was carried out. All students indicated that they had found the tutorial was useful. As well as providing easy access to explanations about the concepts and terms that had been covered in the lectures they had found the electronic reference to be very helpful when revising. As a result of this development we learned a lot about the use of appropriate development methodologies and delivery platforms for IMM tutorials . When we first started the project however, we had little understanding of the capabilities of the software and although we were not devoid of educational training, we still failed to understand how educational theory should inform the design of IMM tutorials. In our initial design of the tutorial, we needed to develop more imaginative ways of looking at the knowledge structure that we wanted to elicit, and to define how the 'knowledge' should be presented to support this.

Teaching of programming and programming principles is a major part of the Computer Science undergraduate degree and is the focus of a lot of the teaching effort. Having learned much from our first IMM tutorial, we are currently using Asymetrix Toolbook to create a tutorial module that simulates the operation of data structures in computer programs. The first module - which is now developed - demonstrates the workings of a binary tree. Students are able to generate numbers randomly then each number can be dragged and dropped into a node of a graphical representation of a tree. The system checks correct and incorrect placements of numbers and provides diagnostic assistance. We plan to use this module as the beginning of a larger tutorial that uses simulation to explain the various levels of abstraction that are involved in operation, design and implementation of computer programs: how computer programs work; generic aspects of program design and implementation; and examples of implementations of these aspects in a number of programming languages. Interactive tutorials that utilise simulation provide a unique vehicle for demonstrating concepts that are hard to visualise. Phillips [5] points out that simulations provide unique opportunities to communicate specific kinds of information to students. He cites a number of examples of these - dynamic processes in which it is important to understand the relationships of moving objects; communication of subject areas which have a broad context and in which a number of ideas need to be linked to form an understanding of the whole (not just the parts); and simulations of expensive, complex or dangerous processes. It is intended that as modules are developed that they can be used on their own or in combination with other modules that have been developed. We are planning the navigational structure of the module to support novice and advanced learners so that novice programmers can be guided through the tutorial material step by step using a linear, hierarchical navigational structure, while intermediate or advanced students will be given some opportunity to browse the tutorials more freely should they wish to.

For a different subject area, an implementation in the Faculty of Nursing at RMI.T provides another example of the use of simulations that aim to provide students with practice in making patient assessments. Animation, sound, graphics, text and full motion video are used to convey patients' conditions and case histories. The material requires students to make diagnostic assessments and to recommend appropriate courses of action based on these. By this, the students are given the opportunity to treat dangerous conditions without the risk of losing the patient. One of the case histories, for example, simulates a heart attack patient's condition and students are required to diagnose the condition and to recommend treatment. In order that the situations are as true to life as possible, a lot of video and sound files have been included in the completed application. These require large amounts of storage space and processing power and therefore the software has been distributed on CD ROM. Tutorials are provided for students' use in a specially equipped laboratory of multimedia Pentium PCs with CD ROM drives, video and sound cards and headphones. As our experise in this area develops, we wish to gather evidence about the effectiveness of IMM tutorials in providing quality educational outcomes for students. We also wish to investigate what effect factors such as subject area or learning task complexity have on design of IMM tutorials.

Estimation of the cost of the IMM tutorial development is an important issue when deciding upon its feasibility. The Science Multimedia Teaching Unit at the University of Melbourne for example, has been developing tutorials to replace 'wet' laboratories that were provided to first year Chemistry students. Approximately 1500 students (many of these studying Chemistry from other courses) study Chemistry in first year. This number shrinks to approximately 200-300 students who study second year Chemistry. Criticisms by staff about wasted resources in the 'wet' laboratories in light of the standard of educational benefits that these were providing, resulted in studies being carried out that used video cameras to investigate how effectively students were working in introductory practical classes. It was revealed that, on average, students were unproductive in these laboratories for 70% of the time. A plan was then developed to produce IMM tutorials to replace the 'wet' labs.

Nott [4] in his report about this initiative estimated that the cost per student hour of the multimedia presentation was approximately $3.00 compared with $6.00 per hour to provide the 'wet' labs. Cost-effective solutions using IMM technology are only possible if careful analysis of the problem and thorough estimation of the cost have been carried out. Phillips suggests that "...in too many academic projects, few estimates are considered in detail and the grant application process involves only a cursory analysis of a poorly defined problem". Poor feasibility analysis and inadequate estimation of cost carry significant risk for the implementation of IMM tutorials. Phillips estimates that 1 hour of interactive multimedia tutorial takes somewhere between 300-500 person hours to produce. Ineffective planning will cause project development time - and of course costs - to be increased. Nott has estimated that the cost per hour of a traditional lecture to a group of 300 students costs $0.50 per student hour. Before proceeding with IMM development, it is important to investigate whether there are cheaper alternatives and to carefully estimate costs. In addition, the educational purpose of the development must be defined and cheaper alternatives that may achieve this purpose equally as well must be considered.

INNOVATIVE USE OF DELIVERY PLATFORMS FOR NITS:

Diskettes and Internet delivery: In the case of IMM tutorials, choice of delivery platform depends on the educational requirements that have been defined and on the software design itself. Programs that are deliberately kept small (by limiting the use of video and sound for example) make it possible to distribute the software to students on their own floppy diskettes or for the programs to be downloaded to remote sites over the internet should this be required. In the Computer Science Department, we have provided students with the tutorials in the form of mastered executable files that they can take home on 2 floppy diskettes and install on their own systems. We are also able to provide internal access to executable course materials via the internal departmental network and have developed the capability to provide external access to the executable materials via the World Wide Web so that the tutotrials can be run on their home computers.

LAN services: Local Area Networks (LANs) provide opportunities to use inexpensive groupware applications in innovative ways to improve communications-based courses. In Software Engineering courses in Computer Science at RMIT we require students to build larger systems in groups (typically these project groups have 4 members). Software Engineering 1 involves approximately 200 students across 2 campuses (the City and the Bundoora campuses which are approximately 15 km apart and connected by a microwave link). Administration of the assessment of the individuals in these groups has created some challenges.

In the past, we have found it difficult to assess individual's contribution in groups when there has been a lack of commitment by some group members. To address this problem, we have produced an online application which requires students to enter individual diary details on a monthly basis in the first week of every month. Each student from both campuses is required to enter the details of their work in their software engineering project team over the last month. They are also required to describe the contribution of their peers. We also students to make general comments about the progress of the group and the advancement of the project. Students' monthly 'diaries' are then e-mailed to the staff member who has the responsibility of coordinating the project. This has allowed us to gain a practical insight into the workings of the group and to assess the contributions of its individuals. Since implementing this approach, it has become evident that their has been a general improvement in the progress of all the teams and that students have improved their ability, both individually and collectively, to evaluate and to manage their group's processes.

In another initiative to encourage collaborative learning in Software Engineering 1, we have established the requirement that each group maintains all agendas and minutes for group meetings and that these be stored on a central UNIX account. These are required to be accessible to all members of their group as well as to tutors and lecturers. We also provide a newsgroup on a UNIX server, on which students can ask and discuss questions about the project. Using this newsgroup, project managers and lecturers are also able to clarify important details of the project if appropriate.

EDUCATIONAL THEORIES AND IMM DEVELOPMENT

We suggest that a well-designed piece of software should incorporate the most appropriate aspects of 'each learning theory. Effective design for NITs aim to provide cognitive engagement for the learner and must be an integrated extension of existing courses.

Interactivity in IMM tutorials can have a number of meanings. On face value it can simply mean that the user interface is interactive, that the user can click on a button or can make a graphic appear or disappear for example. In effective design for IMM tutorials however, we suggest that designers need to structure the entire design so that students become interactively *engaged* in the learning process itself. This provides a challenge to designers to present the chosen content so that students *learn* rather than get *told.*

Educational processes represent complex activities and these are, difficult. to describe. Educational theorists, use continua to describe the dialectics of concepts and processes that relate to the educational context. We suggest that designers of educational software must consider these and should identify the point in the continua that describe the design or effect of the educational software that they are producing. It is not possible to design effective IMM tutorial implementations without considering the ways in which epistemology - philosophical theories about the existence of knowledge - and pedagogy - the means of presenting knowledge-inform educational theory.

Objectivism suggests that knowledge exists independent of human experience. An objectivist pedagogy assumes that knowledge can be constructed in a logical way and that it can be broken it into small components that have learning objectives associated with them. Objectivism assumes that the learner is an empty vessel that needs filling with knowledge. CBT material that involves drill and practice or that has its major focuses on the answering of Multiple Choice Questions falls in this category. Phillips suggests that this form of CBT may be an appropriate technology to use in training a large number of staff to remember a set of predefined procedures. One of its strengths is its ability to address novice learning and skill development situations. Laurillard [2] argues however that designing presentational to provide component parts of the knowledge, fails to cater explicitly in the design, for synthesis of the knowledge.

We suggest that the learning processes that are a result of the use of IMM tutorials need to be integrated into the complex web of processes that are a result of all of the learning experiences that have been provided in all aspects of a course structure. We have looked at some examples that aim to integrate new kinds of tutorials in tertiary courses. A problem can occur when CBT is seen as a standalone addition to a course because it assumes that the role of the teacher can be replaced by a series of learning objectives. When this is incorporated in a computer program it is logical to assume that the computer itself replaces the teacher. Phillips argues that computers can be used effectively in courses if they are used to *support* the complex process of learning. Use of computers can not replace the quality of dialogue that effective teachers can maintain. We suggest NITs need to be designed so that they can be integrated into courses to complement and be complemented by other course components.

Constructivism on the other hand, suggests that reality is in the mind of the knower and that the knower constructs or interprets a reality from his or her perceptions. An IMM simulation application that imposes no navigational structure on the user and that allows the user full freedom to change factors that affect the environment being simulated and to observe the results is an example of an application that falls in this category. The constructivist viewpoint suggests that although reality exists independently what we know of it is what we construct individually. It is not useful therefore to impose another's perception of the knowledge structure on the learner, rather the learner must be provided with experiences that allow him or her to synthesise an individual perception of the knowledge.

USER CONTROL AND NAVIGATION IN IMM TUTORIALS

In light of these theories, designers must give consideration to matching the intended content matter, with the learners needs and with planning of the degree to which users will be given control over the navigational structure through the body of knowledge. Whether to use a linear, hierarchical or mixture of these will depend on the degree of responsibility that is to be placed on the users and on whether the content lends itself to elicitation in steps (for example a mathematical derivation) or conceptual treatment in the broad (for example the effects of market forces on national economies).

FEASIBILITY ANALYSIS

As the requirements are being analysed it is of critical importance to examine the feasibility of the project by identifying alternative solutions, estimating project costs and expected development time, and investigating available hardware and software for development and delivery. It is also necessary to decide WHY an implementation of a NIT solution will be appropriate for the defined problem and to investigate whether anybody else has done a similar project before.

SOFTWARE ENGINEERING

A Requirements Specification must clearly define the required functionality and scope of the project including an overview of the project structure and an overview of the content that is to be covered. Ideally, it should contain details about high level navigational strategies that will be used to move through the content, the design of the user interface and guidelines about graphics design. A storyboarding approach should be used to begin developing the content by deciding about what content will be on what screen. Simple storyboards can be created with pieces of paper on a wall, linked by pieces of string to model the navigation.

The software methodology that we have found to be most appropriate for development of IMM tutorials is that of incremental prototyping in which paper prototyping is employed. Irrespective of the development phase (or development task) that is being undertaken - Requirements Analysis and Definition, Feasibility Analysis, System and Software Design, Implementation and Unit Testing, System Testing - this approach comprises iteration from design to formative evaluation back to design and so on. As iteration of all phases and tasks continues, it is recommended that authoring should not start until a comprehensive specification of the program has been produced (including screen 'shots', navigation structure, content design, graphic design etc.) . This can be done either on paper or electronically. This will improve the quality of the final product and will minimise the risks of the projects running over time and/or over budget.

CONCLUSION

Analysis, design and implementation of IMM learning environments require an understanding of learning theory, human factors and systems and software engineering. The diversity of opportunities provided by rapidly developing technologies makes important design issues more complex. So that implementations of NITs improve the effectiveness of educational environments, we suggest that an understanding of these diverse areas and adoption of sound software engineering practice are important.

Effectiveness of NITs is concerned with considerations of their cost effectiveness as well as their ability to deliver learning experiences of quality. It has been shown that development of IMM tutorials is costly although if student numbers are large they can be cost-effective. Quantifying the potential of NITs to produce better educational experiences for students is a little harder. This along with development of a taxonomy of design features is a crucial area for future research.

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DISTANCE EDUCATION: STANDARDS OF COMPUTER LITERACY

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The past three or four years have witnessed an avalanche-like growth of interest in the various kinds of distance training. And this is only natural: in our vast country with its backward infrastructure and significant concentration of scientific research and educational centers, an opportunity to get an education while continuing on one's main job is extremely valuable. It is also obvious that the operating system of correspondence education is failing to meet the growing demand.

This presentation deals with distance education on the basis of text computer conferences. In the West, where telecommunications are advancing at a faster pace than in Russia, on-line computer conferences have already become one of the distance education methods. A computer conference provides opportunities for organizing the students' collaboration and applying the methods of business role play and brainstorms. All this becomes possible by conducting virtual classes on the basis of computer conferences - a technology that is certain to find a vast number of applications in education in Russia.

There exist many types of computer conference differing in the mode of interaction with the computer or user interface, as well as in the arrangement of computer conference subjects. However, all of them have the same structure. A conference opens with a text that sets its subject. Each participant is then given a chance to add a comment of his/her own. The comments are arranged consecutively as they arrive and are accessible to all the participants, as is the primary text. Each participant works at the time that suits him/her best, but as the discussion progresses, the text incorporating the later comments begins to more closely resemble a stenographic report of any ordinary conference. The moderator has an opportunity to shape the primary text, to analyze the contribution of each participant, to amend a participant's text or to encourage a person to «say» more.

The participants may be divided into groups to develop some subject or another, their access to certain subject may be restricted. Generally speaking, the opportunities for organizing the educational process are broad. This is a good place to discuss the off-line conferences, which are more common in this country. The thing is that in this case, there exists a certain time lag (hours and even days) between the dispatch of a comment and its placement in the computer conference, as well as between getting information from the computer conference and actual access to this information on one's PC. This is why the dispatched comment may become obsolete, prove a repetition, be out of place because the discussion has taken a different turn, etc. Another fault of the off-line computer conference is that it is impossible to choose new material for read-off. In an on-line conference each of its participants has a chance to scan its contents and decide what he/she wants and get only the required information through his/her computer. The participants of an off-line conference do not know what new material is available and are obliged to order everything. The more intensive the work, the worse the off-line computer conferences are.

The success of computer conferences largely depends on the host, the moderator. The latter organizes and conducts the conference staying with the participants from beginning to end.

For all the merits of computer conferences as a means of distance training, there exists a number restrictions on the scope of their use. One of them is that the students' skills of work in telecommunication networks are not always up to the required standard. This happens mainly because the current school course of informatics does practically nothing to prepare the students for this form of work. The computer literacy level obtained through this course does not usually exceed the skills necessary to use an isolated computer, the students have very little idea of computer networks potential.

The concept of *computer literacy* was shaped when it became obvious that the. computer was ceasing to be a narrowly specialized appliance and was coming into mass-scale use. The substance of this concept changes with the expansion of the sphere of application of information technologies, and meets society's needs for their application at each development stage of this process. At the initial stages, the concept of computer literacy was based on Academician A.t. Yersnovs well-Known saying:

«Programming is alter ego of literacy». Later, computer literacy came to be interpreted as an «information technology» of problem-solving. Further development of information technologies as regards their impact not only on the technological aspects of civilization but also, increasingly, upon the cultural ones has produced a new interpretation of the concept of computer literacy. At present, its most apt definition is *information culture*. Apart from the other aspects of the use of information technologies, the concept of information culture implies having the skills required for work in telecommunication networks. This change has been reflected in *Information Culture,* the 11-year informatics secondary-school course edited by Yu.A.Pervin. Nevertheless, even this most recent course does not specifically expand the concept of computer literacy by including telecommunication components into it.

To work well in a computer conference, the following elements of computer literacy are required:

- skills in the use of a text editor;
- a good idea of global computer networks;
- ability to use a telecommunication program;
- ability to use the computer conference software;
- skills in the search for information in the networks;
- an idea of information protection and its legal status.

A COMPUTER CONFERENCE PARTICIPANT ALSO REQUIRES THESE SKILLS TO BE ABLE TO:

- read new messages and answers;
- read previously received messages and new comments on them;
- add comments to the existing messages or place new messages in the conference;
- send personal messages.

THESE ELEMENTS THE CONCEPT OF COMPUTER LITERACY AND AT THE SAME TIME CONSTITUTE A NECESSARY CONDITION OF WORK IN COMPUTER CONFERENCES

Computer literacy is acquired in informatics classes. On the other hand, according to the Russian general educational informatics standard, it is a general skill which can and should be developed in the process of learning any subject. This is why there are two ways of expanding the concept of computer literacy by including elements of network technologies into it:

- in informatics classes;
- while learning other subjects using the computer.

What is more, the network elements of computer literacy can be taught in the course of practical work in computer conferences regardless of the latter's subject. Needless to say, the formation of these elements does not happen automatically but should be directed by a moderator, who encourages further training and turns it into the proper channels. This approach was used as the basis of the methodology for the formation of new elements of computer literacy in the course of computer conferences.

The main principle underlying this methodology is that the required level of computer literacy is achieved by students teaching each other. This approach rests on the fact that a certain section of computer conference participants is better trained than the rest and can transfer knowledge and practical skills to the less advanced ones. The substance of the method is as follows:

- work begins a month before the conference is scheduled to open;
- the students get brief instructions on how to link to the computer conference and work in it;
- two parallel conferences open:
- the *first* is the training ground where the training conference on the preset subject, for example, PCs, takes place;
- the *second* is the so-called virtual cafe, where the students can discuss any subject not connected with the subject of the training conference. This is the place where they mix, consult each other, ask for help, get it, etc.

The purposes of these conferences are:

- to identify the students with a knowledge of telecommunications;
- to ascertain their readiness to share what they know with others;
- to organize mutual training and ensure the computer literacy level sufficient for beginning adequate training within the framework of the computer conference.

Here are a few possible questions:

- What do you know about FIDONET?
- Can a private message be sent to any participant without quitting the computer conference?
- Is it possible to send information from your computer to a friend's computer using the modem but bypassing the telecommunication network?
- Do you like to have people for a birthday party?
- Do you like giving presents?
- What do you find more interesting, to play chess with a computer or with a boy/girl your age in Great Britain?

Work in both conferences was monitored by the moderator. The experiment went on for three years in several Moscow schools; its results were measured and qualitatively evaluated.

The following measurement techniques were used:

- The statistical method

The computer conference automatically provided statistics on the users' work. In this way, the students' performance was analyzed throughout the entire conference: the ratio of the students' messages to teachers; identification of the key messages, which collected the largest number of comments and caused the highest number of chained interactions; the number of communications a day for a measured period, and many other things.

- The polling technique

The preliminary questionnaires distributed among the students before the outset of the training course assessed their expectations. The final questionnaires emphasized new knowledge and skills acquired as a result of the training.

- The interview method

A number of students accustomed to team work met in a certain place; the survey had the form of discussion.

- Contents analysis

For the purpose of this analysis, the following questions had to be answered:

- Do the students draw on the previous messages?
- Do they draw on their own experience?
- Do they use the conference training materials?
- Do they use suitable material outside the conference* framework?
- Do they generate new ideas for discussion?

An attempt was also made to measure the expansion of the content of computer literacy. After five – eight sessions, the students were offered three-level tests (V.P. Bespalko's method), e.g.:

- *Level one:* To work in a telecommunication network, one needs a computer, a modem, a telephone line, a telephone, special software, a network address (choose the requisite).
- *Level two:* Why does a telecommunication program request your name and code at entry? Can information be stolen? What does the moderator's starting message say in the *«Café»* conference? etc.
- *Level three:* Send a brief message to all the conference participants. What units can be used to evaluate the information?
- As a result of purposeful training directed by the moderator, the required level was achieved after eight - ten sessions; this level was later consolidated by work in a computer conference.
- On the whole, the results of the experiment confirmed that the developed method makes its possible to achieve an adequate level of computer literacy in a computer conference environment thus ensuring the students' subsequent efficient performance in computer conferences.

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SOME PROBLEMS OF DEVELOPMENT OF UNITED INFORMATION SPACES IN EDUCATION ON THE BASIS OF THE PRESENT AND FUTURE TELECOMMUNICATION TECHNOLOGIES

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1. STRATEGIC TARGET OF INFORMATION TECHNOLOGIES DEVELOPMENT IMPLEMENTATION

For improving efficiency of development and implementation of modem and perspective information technologies it is necessary to define more precisely a strategic objective for the society of this really revolutionary stage of our civilization history.

Beforehand it is reasonable to present more clearly what exactly in the most degree contributed to speedup developments of mankind as a whole, to raise the level in all spheres (spiritual, corporal, professional, cultural etc).

In the opinion of the author, the most efficient in the progress of any society it is expansion of the united information space, simplification of procedures to contact with this space, simplification of procedures to access to information for any society member.

In all those cases the creation of united information spaces has had and will have more important value for society progress than even the creation of united material spaces. For the development of the last one is sharply accelerated due to mutual knowledge exchange and effort concentration for further cognition of the universe, development of science, technologies and culture.

Therefore it is possible to consider, that strategic target of introducing the information technologies in all spheres of human activity still is the necessity of creation of united information spaces on the bases of principally new possibilities offered by these technologies.

It is known that these information spaces can be of three levels (each level falls into the next one as a sub domain):

- local information spaces (departments, institutions, enterprises, organizations and alike);
- regional information spaces (territory, country, group of countries and alike);
- united world information space.

Hens we come to the conclusion, that the main role belongs to telecommunication information technologies. For only they will allow any user to communicate with the united information space, in the interactive mode, rather than be a simple silent consumes of imposed information.

Hence also it appears that we have to use a united coding of the semantic features of information for ensuring to all users of its semantic adequacy on any national and ethnic level.

Accepting an idea of the united information spaces creation, as the main strategic target, will allow to plan more purposefully the processes of implementation of modern and perspective information technologies in all scopes of mankind activity, and with more optimum to take into account all national and international aspects of these important for terrestrial civilization of processes.

In the process of introducing new information technologies in different spheres of social activity it happens to face the same problems and difficulties, as for other new innovation means and technologies.

The history of our civilization development gives the evidence that new means and technologies, which are the results of scientific and technical progress, and they are primary for the further development of the society. Then follows investigation of ways of their use for the society. As a conclusion to this process are searching and implementation of the necessity organization forms.

The last two above mentioned parts, composing the progress, very little depend directly on creators of means and technologies. In general, they are defined by needs and possibilities of the society, in economic, ideological and political situations, by conditions of international co-operation.

It is natural, that a certain degree of conservatism (in some cases is, by the way, necessary and reasonable) in organization forms ways of using of old means and technologies, not only does not promote, but counteracts a process of implementation of new means and technologies.

All this is also lawful for information technologies especially in the case of telecommunications. There are given bellow three problems, which will really of optimal use of modern and perspective telecommunication and information technologies in sphere of education.

Therefore it is possible to suppose, that the decision of bellow given problems, in one or another degree will raise efficiency of using the information technologies in the first place and namely in the scope of education.

2.PROBLEM OF ARRANGEMENT OF UNITED, AND LOCAL CENTRES FOR FUNDAMENTAL KNOWLEDGE

The volume of current knowledge (particularly in the field of exact sciences) is international in itself. It is possible to speak about the contribution of scientists of different nationality or citizenship in the level of cognition of one or another field of science. Hut to speak about the national mathematics, physics, chemistry and so on, it is hardly legitimate.

Telecommunication and information technologies, unlike the so called "paper informatics", do not impose strict restrictions regarding the depository location, or information source, or access time to it.

Therefore for these technologies it is reasonable to start creating new methodologies of international and regional accumulation of current source of fundamental knowledge in various brunches of sciences for different education levels.

One of the possible directions of solving this problem is shown below.

a. United International Centre for Fundamental Knowledge (UICFK) is created for each chosen field of science (or subject of studying). The creation of UICFK must be done not so much by pedagogical but by scientific structures. Therefore information contents of UICPK (as a large standardized information base) must be formed by the international group of scientific institutions, authoritative in the given field of science.

Out of this group the main institute Is nominated, where UICFK is being formed as an international information-reference centre for collective (common) use with subscribers tele-access. As the cognition in the chosen branch of science is developing, the constant renewing and correction of the information contents in UICFK have being done.

Simultaneously the volume of knowledge in the certain branch of science can be indicated and recommended for each education level.

This Centre should have only accumulated by the mankind concrete knowledge of certain subjects. There should not be any method of teaching of the subject in UICFK.

b. In regions (continent, group of states, greater state) it is reasonable to form Regional Centres of Complex Fundamental Knowledge (RCCFK). These centres, as complex information bases, should contain fundamental knowledge of different branches of mankind knowledge. Necessary information for given centres will be obtained from the corresponding UICFK through tele-access.

As RCCFK will be oriented on problems of education in the given region, so besides fundamental knowledge of different subjects, there should be method and recommendations for teaching of given subjects.

In itself RCCFK will be centres of collective (common) use with tele-access for educational institutions, scholastic groups and independent learners of the given region. Therefore creation of RCCFK is reasonable to make under the aegis of the department, supervising education in the given region.

c. Right in educational institutes it is reasonable to create Local Centres of Fundamental Knowledge (LCFK). These centres, as information bases for concrete educational institutes of different levels, should ensure full information and methodological support of school plans of the given educational institute.

LCFK connected trough tele-access to RCCFK (and in some cases to UICFK) will have the possibility not only to track all the changes, but will provide quick possibilities for studying practically any new subject.

In itself LCFK will be centres of collective (common) use for students (or school-children) of the given institute (school), for all external students and self-training ones. It will be as well as object-translator for user entry to RCCFK and even to UICFK .

3.PROBLEM OF UNITED SEMANTIC CODING

As UICFK should satisfy the needs of the whole mankind and be available for all folk regardless of ones nationality, immediately the problem of semantic understanding for a carrier of any national language arises.

Every body knows out of ones own experience, that there are not appear problems in International communication, if the main subjects of communicated information are graphics or images. In these cases there are no needs of international transformations of information. More so, the volume of such sort of information is overwhelming (more than 96 % of the whole information, consuming by mankind). And there is also no problems of international music perception in the world communication.

And only in the written languages and speech, though forming rather small volume of the consuming information (but at the same time very important one), there appear all known complications in international language communication.

Of course, modern information technologies (but perspective - more so) allow to perform necessary direct translations from one national language to another, even in the dynamic mode, regardless of technical resources spent.

But there are two essential difficulties there.

Firstly, there must be very great amount of acting automatic translators there. For instance, if it is necessary to organize a direct communication between carriers of ***N*** different languages, the quantity of automatic translators ***T*** must be equal to ***N (N-1)***. For instance, if we put the limit, let us say, of 100 languages of the main countries (without small languages and dialects), it will be necessary to have about 10 thousand automatic translators.

Secondly, none of the speed and tricks used in information processing will allow to achieve the desired degree of adequacy in international language translation. This is counteracted by the essence of process of development and construction of any alive (or dead) natural national language. So a database (knowledge) on any national language can not be adequately transformed into the identical database (knowledge) on another national language.

If we take any language as a go-between for the international communication, there are possible two way here.

The First out of them is to consider this language as an auxiliary second language, and using it to realize all processes of cognition of nature, of technology development, education and for any professional communication. But, as a rule, without transition to the national languages (and if would means here will be no need for translations).

There are many examples of that kind. The most known example of similar approach is Latin, which has been used for almost 12 centuries as the common language for science, technologies and education. In medicine, up till now, physicians of the whole world are in the united information space by means of Latin.

The second way is to consider this auxiliary language as only an internal go-between language for technical systems and devices. Then communication of carriers of different national languages between them only through technical facilities, changes greatly a situation with the quantity of necessary automatic translators. By this for ***N*** languages there should be only ***2N*** of ***T***. Therefore in the example with 100 languages there would be needed only 200 translators.

However, for the last case, when using any natural national language as an auxiliary technical go-between language, there are completely saved difficulties with inadequacy of international language translations.

In the science and technologies similar difficulties are easily overcome by implementation of intermediate strictly determinate coding. This allows to produce a transition from one marking system to another without the loss of concrete essence of semantic system.

In this instance, when we speak about necessity of semantic adequacy while making the translation from one national system of writing to another, it is necessary to have an international, artificial, auxiliary, go-between language (which can be used also as the second language).

Consequently, it is required here participation of professional linguists and philologists rather than simple solving the task of semantic coding by technical specialists.

If this international, artificial, go-between language will possess such interlinguistical characteristics, as possibility to plan, aposteriority, autonomy and neutrality, then this language will be the most optimum one for using in technical systems, particularly in international telecommunication systems.

If it is possible adequately, according to semantics to perform a transition from any national language into information space of similar to the auxiliary, go-between language, then it will be possible to provide the same semantic adequacy to make a transition back into any other national language.

At present, there are rather many artificial languages in the world. For instance, specified above mentioned requirements, to a certain extent, are met by enough developed and already broadly used the international artificial language Esperanto.

Less than two dozens of grammar rules, not allowing any exclusions from them; monosemantic process of "how one writes, so one hears; how one hears, so one writes"; intelligibility and clearness of word formation (including new words) and many other merits make Esperanto sufficiently attractive for using it in technical systems of informatic while making the united information spaces.

However the last word should be after linguists and philologists.

4. PROBLEM OF CHANNELS AND DATA COMMUNICATION SYSTEM

There is only one side of great interest in this problem of education: cost of traffic and tariffs.

Implementation the telecommunication information technologies in the scope of education will, in the first place, depend on possibilities of getting the data communication system services. And this will depend not on technical facilities, but on pure financial ones.

The way of creation of special data communications systems and channel networks on any level hardly has real prospects. Cost of them will exceed all expenses of direct process of education. This equals to plan laying railway or telephone network specially for students or schoolchildren only, to the account of education.

Therefore social policy of any country (or group of countries) must stipulate the obligations that all data communications system owners and owners of telecommunications will concede part of their facilities for education purposes using very low tariffs, or free of charge at all, or on the account of states and international organizations.

5. CONCLUSIONS AND PROPOSALS

1. Experience of introducing the telecommunication information technologies in different areas of human activity shows that for getting appreciable efficiency from given technologies it is reasonable beforehand to begin from structural and methodological changes in the processes of accumulation and distribution of information.
2. Creation for the scope of education standardized information centres of common use, such as:
   a. United International Centres of Fundamental *Knowledges;*
   b. Regional Centres of Complex Fundamental Knowledges;
   c. Local Centres Fundamental Knowledges, that will allow using the telecommunication information technologies to start a process of shaping the united world information space for the scope of education.
3. Implementation the united auxiliary, artificial, go-between language will allow to use with maximum efficiency telecommunication technologies with the aim of creation of the united international information space for the scope of education.
4. The most favoured policy conducted by states and international organizations with regard to reducing the costs of data communications system services for education will make the implementation the telecommunication information technologies into the scope of education a more dynamic and available process.
5. The specified problems can be successfully and complex solved only under the general organizing and methodological aegis of UNESCO.

PROPOSAL FOR FINAL RECOMMENDATIONS OF CONGRESS

1. For development and organization of further constant work for solving the problem of the united international coding of semantic part of information (the problem of united, artificial, go-between language),

recommend:

- to create under the aegis of UNESCO international organization (commission, centre, etc.) with the financing by the main states-participants for realization of the Project "INTERSEMANTICS";
- to ask the Russia representatives, as initiators, for emerging co-ordinators of this Project.

2. Recommend to the states-members of UNESCO to reach agreement on legislative fastening their own countries the obligation to grant the facilities and the services of the state and commercial telecommunication networks for the scope of education on the free of charge or favourable bases.

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EDUCATIONAL NEW INFORMATION TECHNOLOGIES: ELIMINATION OF DEFECTS

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Today all new information technologies (NIT) have either telecommunication component or a sort of projection into computer communications. Therefore, a key point for our discussion is the ways for overcoming negative aspects of snowballing process of Internet service penetration into educational NIT applications.

First of all, here are some more or less fresh facts. On February 8, 1996, USA president W. Clinton signed the law, providing the penalty up to $250,000 and 2 years of the imprisonment for granting minors the possibility for telecommunication access to the materials, containing pornography and violence propagation. In March B. Gheits has published an article on the problem of censorship necessity in Internet. In April judicial bodies of German Baaden-Wurtemberg province started investigation on the fact of distribution of the ideas of neo-nazism and anti-Semitism through WWW by neo-nazis.

The above mentioned facts unequivocally testify the phenomenon of crisis of western civilization, designated yet by Heidegger who wrote about the conflict between civilization and culture. At present, the crisis begin to expand from purely theoretical sphere into a completely practical area of. NIT implementation.

Here, crisis phenomena result from the effect of technological pollution of thinking (ETPT). ETPT is such a negative consequence of the rapid technical progress, as more habitual «pollution of an environment by industrial wastes». ETPT is, in a way, a mental «analogue» of the environmental pollution.

ETPT is displayed as involuntary using of purely technological definitions, interpreting methods and problems solving approaches which are suitable practically for any kind of activity. The most evident example of ETPT symptoms is a mass culture of western type, all phenomena of which have hypertrophied technological character and in particular the computer games, created for training purposes can be considered as an example of ETPT through NIT in education. Loud design and various multimedia effects, fabulous plot grasp attention of the children providing them with a certain information, arranged in the appealing way. But a primitive principle of dual oppositions, which is a basis of scenario organization for any computer game, imposes on thinking of the children specific «machine» print. And very soon and quite distinctly this «machine» element is becoming a prevalent one in the intelligent tools arsenal of the children.

Another evident and forthcoming danger is an expansion of the virtual reality systems, with the numerous applications fallen within educational sphere. Here contact between the person and the computer has been greatly extended and the computer begins absorbing person, to merge with it and person does not always play a leading role in this new unprecedented phenomenon. It brings to the extreme mechanised way of thinking and total absence of moral settings, as the computers have not moral values (last film-festival in Toronto, occured under «sign of virtual reality» was rather significant in this sense).

ETPT is especially dangerous today's Russia going through the times of social and economic «tectonic» transformations. Borders between truth and delusion; useful and harmful, science and non-science are hardly noticeable under these conditions.

And yet situation in Russia originated from the compelled 80's hermetic isolation and preserving in a paradoxical way has certain positive sides. In particular, there is an opportunity of comparatively fresh and sober approach to things, which is free from «consumption society» prejudices which is natural for public consciousness for the countries with advanced market economy and its orientation on priorities of direct economic efficiency, the principles that already revealed negative moral and ecological consequences of their dominating. Besides we have an advantage (though, not long duration one) which is concluded in the absence of mass ETPT.

We may try to use temporary profits of our situation. The true is always banal, therefore we apply standard technique, which is usually called «creative re-consideration of the accumulated experience». In this case we shall take into account other's mistakes, i.e. we'll reconsider mainly not ours' but western negative experience, though not without our own approbation. The result of such procedures is an understanding of a place and role, which NIT may bring into education, with cutting out all the negative consequences of technological dominating.

It is supposed, that such understanding will supply methodological transition from non-systematic use of NIT for solving certain local problems at teaching to the complex «implantation» of NIT into the substance of educational process. That allows to use these technologies, on the one hand, accordingly to their potential, and on the other hand to place them inside «educational living structure», without breaking usual coordinations and functions of the «body» already being available. To realize this program it is first of all necessary to have a clear understanding of this «implanted» body function.

Though it may seem surprised but this idea is practically impossible to find among a great number of articles and sayings on the NIT subject which is probably connected with the extremely high rates of information technologies development and as a result of the fact specialists' thinking process is far behind dynamic reality.

So, NIT is first of all the computer. Computer is a machine. Machine, as is known is an amplifier of person's capabilities. This is the way of using computer facilities which is practised in the majority of cases. However computer is far from simple machine but machine with elements of self-organizing and rudiments of intelligence, though in most primitive form. Therefore in case of including it in the educational process as a simple amplifier of some ability like making calculations or for working a bulky, but not too complex problem (say, connected with processing of big information volumes with using vast resources of Inernet), computer starts «to push the teacher out» from the educational process, simultaneously imposing to the pupil its own, computer logic of defining and solving problems, which, despite computer quasi-intelligence, has purely machine character.

So we can make a conclusion that in the general educational applications intelligent complexity of the problem solved with using NIT should not only meet NIT capabilities, but to surpass them. That supplies a space for self-realization as of both the teacher and the pupil. Thus, function NIT in educational process can be defined as a help in solving of rather scale educational problems, «screening» a persuasive effect of technologies as such. The educational NIT should be a «transparent» and universal instrument, making its introduction in advanced educational procedures pertinent and expedient.

Thus we do not mean elementary utility of the application, for example, creating of big texts with the help of the computer is the operation as obvious as driving nails with a hammer.

Among the educational computer tools, bearing the mentioned above qualities, the teaching multimedia from a series «Computer EGO», in our opinion, should be noticed. The author uses these products at working with the students of younger school age for the last four years. Everyone knows the children's designers LEGO. Everyone knows children's programming language LOGO. In the middle of 80's professor Seymour Papert offered lucky idea to join these two products for children that are popular and differ by their nature with the purpose of creation of unified educational medium. This idea was implemented by the research group of the Massachusettes Technological Institute, which was personally leaded by professor Papert.

Practically the idea was realized as a kind of medium. «Computer LEGO» is a designer of LEGO company, extended by electronic components (various gauges and executive bodies) and software, allowing to create LEGO-objects controlled by the computors, capable to co-operate with external environment.

As an example of practical application of the «transparent NIT» concept we can mention the project on creating telecommunication language for LEGO-objects description.

A demand for such language was developed quite naturally. Following the publications devoted to the Computer LEGO the electronic mail started to bring to the author the responses from various countries of wide geographical range. Basically, these were teachers' requests to inform them of ideas of the projects. The question has immediately arisen of how to make it in use by means of the electronic communications. Verbal descriptions of LEGO-constructions are very bulky and, taking into account double language barriers, are fraught with the large distortions. The best way of the LEGO-constructions designing is three-dimension graphic images, but the graphic files have very large sizes, that makes their transfer through Internet and other computer networks unreliable and expensive. Hence, this regular topology of basic LEGO elements causes rather simple structure of such language. The above fact is an additional circumstance, allowing to involve the children of 9-10 years as quite competent developers. This is the language that is being developed now. The interpreter of the first, two-dimension LLL version is already created. (Our so called tele-philological product was named LLL). Computer technologies, which, one should think, make core of the given project, actually present only an opportunity to understand beauty of natural languages or their construction. The children have independently developed morphology and syntax LLL, mechanical and the programme modules of the interpreter LLL, check results of the work in network sessions of exchange by the LLL-offers. Thus, the mastered computer and telecommunication specificity (should be emphasised - at the most advanced level) is nothing more that background, «transparent» activity, but «normal» communication properties of language remain at the foreground. It was not just coincidence that this project has attracted the attention of young girls, who do not usually participate willingly enough in the activity of engineering mode.

It is obvious, that «transparent» NIT is a concept, directed not so much on purchase of a complex of knowledge, abilities and skills, but on development of the creative and intelligent approach as to a problem of application NIT, and to today's education as a whole.

What it is necessary for realization of the «transparent» NIT concept? First and foremost, it is the staff, which is the basis for all the success. The •programmes for training and professional level improvement for teachers of any speciality should include a «NIT» course, within the framework of which:

1. A contemporary situation in NIT field is the most dynamic and constantly updated part of a part of the programme representing current and promising development and tendencies, possessing educational significance.
2. The criteria are created with purpose of meeting educational challenges which can be settled through NIT. This section is a key one. The correct formulation of an educational problem is the basis for efficient NIT application and final success. The basic parameters are as follows: contents of a problem and its configuration that are adequate to features of NIT tools, attractiveness for the students.
3. The criteria are created in purpose of selection of specific tools from NIT arsenal with purpose of meeting educational challenges. The basic parameters are as follows: possibility for covering with the tools of wide range of concepts and subjects, easiness of comprehension by the students. These parameters

are usually strictly correlated. In most cases advanced NIT tools do not require mastering by the teachers. It seems to be a standard situation when the students during work are learning the tools much better than a teacher.

4. The practical skills are acquired by the students by means of the most universal NIT tools, allowing for the application to educational practice in any area.
5. NIT implementation into educational process is the imperative of these days. Natural difficulties of growth cannot be the reason for NIT rejecting. However, the practice of direct copying of someone's errors is also ridiculous. This practice is sometimes displayed in an unfounded implementation of high technology components in educational process. It is obvious, that NIT implementation into training should be considered in a context of dominating of classical, being improved through centuries pedagogic, which is based upon long living criteria. But the selection of new technological tools should be very verified, extremely careful and cautious, as it is meant by the concept of «transparent NIT».

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IMPLEMENTATION OF ACHIEVEMENTS IN INFORMATICS IN TEACHING TECHNOLOGY OF THE MODERN HUMANITARIAN UNIVERSITY

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The Modern Humanitarian University (MHU) uses original training technology, aimed at the stimulation student's *self-study work*, increase in efficiency (speed of new knowledge mastering), time saving for the students: number of class hours per week equals to 14-17. Principle of knowledge splitting and dozing is implemented. With this purpose, all the material studied is divided into primary educational cycles within each educational field.

Each cycle has standard structure (and technology of educational processes) and consists of several stages.

The first stage is *self-study* of information materials by the student from database of MHU.

The second stage comprises video-lecture in video classes up to 30 persons.

The third stage is an active practical class as business or operation games, roundtable, discussion and etc. Students' activity is accounted during certifying.

The fourth stage is computer classes as such.

The training computer programmes are developed by University specialists themselves. The programmes provide feedback with the students and represent new continuously updated information in dynamics as the contrast to the conventional textbooks. This results in significant increase of training speed. Educational training are conducted on accounting, finance, production arrangement, statistical data processing, editing, translating on the basis of professional programmes. In the course of stock market and finance studying, computer games with the robot, network team and individual games are practised by students.

The fifth stage comprises accomplishing ofcreative home tasks in the form of the logically organized knowledge database, its classification and professional dictionary creating. This is carried out by students separately for each cycle.

The sixth stage includes testing procedures. The original system for controlling students' learning progress practised in the University includes testing procedures for each part of educational field, evaluation of the creative home tasks, and course designs, written examinations and tests.

The educational centre was established at MHU with the purpose of educational materials development. The staff of the above centre consists of a number of experts, researchers and lecturers. The experts work not only in Moscow, but also abroad. MHU performs 4-year programme for bachelor training on the following directions: jurisprudence, economics, management, linguistics (foreign languages). Thus annually 24-30 cycles are carried out for each of direction. The system implementation required educational products development for almost four hundred cycles. Educational products are constantly updated and are adjusted.

The students are involved into the process of educational products elaboration in MHU. In the course of practical study the students take an opportunity of working at research laboratories and in expert groups elaborating educational materials and computer programmes. In the University, the cognitive psychology and methods for increase of educational processes efficiency are developed. New high technology and distance learning methods, educational materials and products are created in every direction. Social and psychological research is carried out.

Achievements of computer science in the field of educational technology allowed MHU to perform innovative educational process. First, this resulted in improvement of activity of the students and increase knowledge mastering. During business games and discussions the students not only receive the knowledge but also learn to use them in practice in real production situations. In the second place, distance learning allows to University to establish the branches in large and medium cities of Russia and CIS countries.

This gives an opportunity for organising of advanced, genuine high quality educational process in medium and small cities of Russia, where local lecturers staff can provide only practical training and consulting. In the third place, modern copying technology of educational products and standardised methods for learning result in reducing payment and makes chargeable higher education accessible for middle classes.

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LINGUISTIC PROBLEMS OF SHARED INFORMATION ENVIRONMENTS

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The question of possibility and necessity of creating a common subnational semantic code has quite a long history. The idea of an artificial language had a great appeal for prominent philosophers, logicians and mathematicians, on the one hand, and distinguished linguists, on the other. Of the former, it would be enough to name Gottfried Wilhelm Leibniz (1646-1716) and Ludwig Wittgenstein (1889-1951), and of the latter - Yuri Apresyan and Anna Verbitskaya. Our time has shifted the problem from the purely academic plane to a specifically practical plane. Moreover, its solution could be regarded as a vital requirement or - even - the dictate of the time.

There are several reasons to this, of which the two cardinal ones are determined by serious linguistic aspects. The first one is the problem of scope: the information environments are increasingly loaded by texts in various natural languages, and therefore their effective use is going beyond the domain of ordinary "human" technologies. No number of translators can cope with the floods of texts overflowing mankind. The computer solution is automated translation of textual information into a computer language. The second problem lies in the fact that the already existing computer information systems and those under way have reached the numbers that require an enormous effort specifically for their conjugation. It is a problem of *compatibility,* primarily of the local artificial computer languages, the number of which has several times exceeded that of the natural languages (which are estimated, as we know, at two to seven thousand). Thus, we have a great variety of natural languages combined with an extraordinary number of artificial languages.

The arising practical linguistic problems refer primarily to the competence of such explosively developing area as linguistic semantics. Viewed from this point, any artificial language should in the final count (or, maybe, initially) be approached as a specific semantic meta-language, in other words, as a structure secondary to the natural language designed to bring out the intrinsic meanings of the linguistic expressions, spoken or written (depending on a practical requirement, so to speak). From this it follows that the strategy of work to produce a semantic code should have the foundation of the semantic typology of the natural languages, presupposing their semantic comparison for the purpose of identifying the universal mechanisms of linguistic meaning, common to the national languages. It is noteworthy that the problem was approached from exactly this angle, as early as 1969, by B.Y. Gorodetsky (now professor of the Moscow State Linguistic University and Chair of Linguistic Semantics) in his book *To the Problem of Semantic Typology.*

The special part played by the science of language in the solution of these problems is not the result of the linguists' ambitions. The present stage in the advance of the computer revolution is based, in the first place, on the methodology of the artificial intelligence, which, in turn, builds its methodological basis of the ideas gleaned from those fundamental sciences which can 'give a constructive understanding of man's cognitive activity and its product, that is, knowledge.

The methodological role of linguistics follows from the experience of intellectual systems design accumulated at the world level, and, apart from that, from the fact that a natural language is an objectively existing cognitive system which is universal in relation to any artificial language. It is inseparable from human intellect, is the foundation of mankind's knowledge in all the areas of science and technology, a medium of intellectual interaction in space, and time. By its very nature, language is the most constructive phenomenon that has ever occurred in the intellectual and cultural world, and, in fact, all the artificial languages that people create for human or computer applications can be brought down to the natural language. It is logical, therefore, that other sciences within the *Artificial Intelligence* have been actively drawing on linguistic ideas and methods. All the more so, since, nowadays, language is understood as the mode of organisation, presentation and development of knowledge rather than the medium of expressing thoughts. A clear and expletive description of the linguistic ideas "growing into" the new information technologies is found, for example, in the series "New Trends in Foreign Linguistics", volumes XII and XXIV, edited by Gorodetsky, who is also the author of the introductory articles.

As realists, we should build the unity of informational systems upon the integration and development concepts, and not on the totalitarian principles. We can create the core of a universal semantic code and provide for building up upon it, its modernisation, etc., while this should not reject the presence in the informational networks of natioinal-specific components served by the automated translation systems. All this is possible subject to proper scientific examination. Thus, the main trends in the development of linguistic support of the shared informational environment should comprise:

- development of *semantic typology of* the natural and similar aimed at modelling the universal and specific components of the cognitive language systems;
- development of *computer resources of the European languages* (all world languages in future), with the accent placed on computer lexicography, aimed, in part, at building up and maintaining terminological data banks, which are, in a way computer sublanguages.

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REFERENCE BOOK FOR DESIGNERS OF COMPUTER TECHNOLOGIES OF TEACHING

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The «Reference book» is developed for maintenance of educational process at departments of teachers qualification increase and for the students of pedagogical higher schools on special course "Computer teaching technologies". The course is designed for 20 hours of lectures, 20 hours of practice in a computer class and development of course work concerning creation of a fragment of a training computer means for teaching. The reference book contains the necessary data for practical acquaintance with various parties of management process of trainee's cognition activity and gives a technique for the development of computer training technology. It automates management by training dialogue through the computer. In the creation process of the "Reference book" computer means of training had been developed by Moscow State Academy of Food Production during 1980-96 were used.

PART 1.
THEORY

CHAPTER 1.
BASIC REGULATIONS

1.1. Analysis of computer training means (CTM) created in different organizations has allowed making the following generalization.

The computer process of teaching is individualized, automatically adapted to each trainee, checking the quality of mastering of an educational material with given by the teacher frequency, including check of the given purpose of training on each step of training and bringing the necessary changes for this purpose in the course of teaching process.

Technology of teaching, management process by training dialogue does not depend on subject area, rate of education, the type of educational institution, the form of training and the other external parameters. The technology of teaching depends only on the didactic purpose of the given teaching step. Each didactic purpose requires management algorithm of trainee cognition activity.

Trainee's cognition activity can be described in various forms: activity breakdown turned to the list of activity, generalized (knowledge, competencies, skills).

Possession by logic methods of thinking, planning of the activity, skill to control the activity, skill to summarize an educational material may be included into new activity along with specific one, caused by the subject area.

Peculiarity of computer teaching process:

- in a mode of individual dialogue,
- adaptation to each trainee, on various parameters,
- discreteness of process, consisting of separate training steps, process control on each step,
- management script realization of the training process, described by teacher.

Computer teaching process does not replace the teacher, but it only carries out a part of his functions.

The requirements to management process of mastering at each training step:

- check of activity, included in the system of preliminary knowledge; if the given activity is not mastered, it is necessary to correct the model of trainee activity,

adding the necessary dozes or steps of training;
• control of fulfilment of the assignments on new activity; the control method must correspond to a stage and required level of teaching.

Levels of mastering.

Level of preliminary acquainting: motivation (the tasks are not solved); drawing up of a tentative activity basis (TAB).

Carrying out to an intellectual stage of mastering:

Formation of activity in embodied form with support on TAB,

Formation internal speech activity without a support on TAB,

Fulfilment of activity in external speech,

Fulfilment of activity in the form of internal speech.

Leading of competencies and skills up to a given level automatically.

The check of the achievement in specific mastering level requires the control method. The higher is level of mastering, the more difficult becomes its technical control. For example, control of "creative mastering level" requires standardless level of control, with using syntactic and semantic methods of the control. It requires input of the answers in strict entrance language of investigated subject area.

The management of mastering process can be actualised only in the presence of:

• model of activity,
• analysis of trainee's actual activity,
• definition of details and their divergence,
• definition of necessary correction for achievement of activity model and delivering of the appropriate instructions to trainee.

General requirements to the control:

• the time of activity fulfilment should not influence on estimation of activity (except for cases of training of some specific skills concerning certain trades);
• in order both advanced and lagging trainee should not lose interest to teaching, firstly it is necessary to check the correctness of final result realization and let answering correctly go to the following step. If mistake is found out, one ought to transfer to a lateral branch of teaching with bringing the necessary correction in a course of teaching.

In computer process of teaching *the computer carries out a following function:*

• under the given programme or at the choice of trainee gives out the next doze of the educational information;
• gives out the tasks and exercises for development of knowledge and skills and checks correctness of their fulfilment;
• distinguishes the type of errors have been made;
• carries out the analysis of teaching history and determines the most probable reasons of errors;
• checks the achievement of given mastering level;
• checks achievement of the local and global purposes;
• gives out texts and materials, necessary for correction and continuation of teaching process;
• conducts the protocol of teaching history.

CTP provides adaptation to:

• the rate of work,
• the level of initial preparation, including additional dozes,
• the level of general preparation (capabilities), giving out helpful texts,
• the character of thinking (by changing the form and methods of educational material's exposition),
• the current errors, giving out particular explanations on the basis of error type recognition,
• the reasons of errors (lack of knowledge in the previous sections) on the basis of a teaching history analysis.

CHAPTER 2.

TYPICAL COMPUTER TECHNOLOGIES AND MEANS OF TEACHING

For the basic purposes of teaching, which are used the most frequently in educational process, typical CTM are developed, the block diagrams of teaching dialogue management training with «dutchmen», which require only «adjustment» under author's computer technology of teaching and fillings of ready forms by the subject contents are constructed.

Conditional name of computer technology of teaching	Didactic purpose
DEMONSTRATIONAL	Intensification of good layout of material exposition
TESTING	Definition of a testee suitability for accomplishment of particular activity
MOTIVATIONAL	Belief the trainee that the study of the material is in his interests
SUPERVISING	Definition of educational material mastering level on the given grade stage
SELF CHECKING	Self-checking of mastering level according to trainee's will with a choice of sections or themes
TRAINING	Development of skills and competencies in specific activity with an automatically given level
TEACHING	Transfer of knowledge to trainee in certain subject area
MATHEMATICAL MODEL	Training of skills of mathematical description of the physical phenomena and complex systems and to decision methods of received equations systems
EDUCATIONAL Automatic Process Control System	Development of skills and competencies of complicated technological processes management
EDUCATIONAL Computer-Aided Design System	Training to ability of work with real Computer-aided Design Systems
PROBLEM	Training to search methods of decision in problematic situations
EXPERT	Training to methods of decision acceptance in conflict situations. Identification of complex objects or situations
TEACHING-SOLVING	Training to skills of the problems decision with using of ready software packages (SP)
INTELLECTUAL TRAINING	Purchase of creative decisions skills of sophisticated problems
ELECTRONIC TEXTBOOK	Organization of multi-target training at distance and correspondence education

CHAPTER 3.

A TECHNIQUE OF COMPUTER TECHNOLOGIES TRAINING DEVELOPMENT

Author work stages of computer training technology:

1. Choice of a theme (section).
2. Definition of global and local purposes of training.
3. Scheduling of handbook plan, collection of material, allocation of basic concepts, definition of the basic logic mental receptions, allocation of individual problems and invariant essence of learned material.

4. Definition of logic sequence of an exposition. Segregation of motivation stage.
5. Definition of exposition variants quantity. Allocation of stages.
6. Breakdown of an learning material on teaching dozes (steps): comprehending of the problem, drawing up of the TAB scheme (algorithms of activity), training to new kinds of activity, formation activity in embodied form with a support on TAB, formation of activity without a support on TAB, formation of required degree of automatically in trainee activity.
7. Logic scheme choice of management of teaching dialogue in dependence on the local training purposes.
8. Writing of the educational texts dozes.
9. Selection of typical problems and control tasks.
10. Definition of tasks quantity (depending on given level of mastering and necessary degree of automatically).
11. Control methods choice of trainee's answers depending on given level of mastering.
12. Writing of assistance texts and errors explanations, found out by trainee's work in a computer class.
13. Writing of helps texts and decision plans explanations of tasks for trainees, have already made some errors during decision of given problem etc.
14. Scenario description of management by teaching dialogue.
15. Development of printed distributed materials for providing of trainee's work in computer classes for given CTT.

PART 2.
PRACTICE

In the second part of "Reference book" fragments of computer teaching means (CTM) are contained, which are used as examples of typical Computer technologies of teaching (CTT) and CTM:

- Control CTM and self-checking of skill to solve problems on complete rate of physics for secondary school.
- Trainer of skill to solve problems on physics on secondary school complete rate (with a choice of section at trainee's will).
- Fragments of trained CTM on physics for the students of higher school on divisions "Mechanic" (kinematics, dynamics, work and energy, lows of preservation, harmonic motion, molecular physics and thermodynamics) and "Electricity".
- Fragments of trained CTM on strength of materials faculty, themes: "Bend" and "Complicated stress state".
- Educational computer-aided design (CAD) system fragments on machines designing course.
- Expert CTM "Determinant yeast cultures".
- Demonstrational CTM "Conveyor technology of CTM development".

The last CTM shows organization of work at creation CTM developed in Information technology of teaching department in Moscow State Academy of Food Production, which has allowed 1-1.5 orders reducing of the time needed for development and introduction of CTT and CTM in educational process.

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QUALITY ESTIMATION OF SYNTHESISED COMPUTER SPEECH: PSYCHOLOGICAL ASPECTS

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New technologies based upon Synthesised Computer Speech (SCS) are actively being developed for the last time. They are concerned with various fields of human activity as follows: communications and connection, training and services for blinds and persons with serious vision disorders, publishing (for example, edition "audio" books and newspapers) etc. In the process of SCS software and hardware development while defining the optimal variant, the psychological estimation of sound quality is just necessary. As far as we know, the methods of this kind are not yet developed either for Russian Synthesised Computer Speech (RSGS), or Lithuanian Synthesised Computer Speech (LSCS). That's why the major objective of this development is a consideration of some psychological problems, arising in the course of elaborating of these techniques and presentation of preliminary results of their implementation in the Laboratory of Special Psychology (Vilnius University).

In various laboratories of the world the quality SGS is usually estimated by two following parameters: legibility and acceptability. While the legibility can be measured both in the objective and subjective ways, the acceptability can be measured only in subjective ways. The term «legibility» usually means a possibility for perception and recognition of SCS, and "acceptability" means a subjective estimation, which student makes. The terms "subjective" and "objective" measurements are defined variously as well in various laboratories of the world. It is possible to indicate two basic attributes, which are characteristic for objective measurement of SCS quality. First one means, that the measurement is rather relative, than absolute, that assumes measurement in a situation of comparison. In our case, SCS is compared to the speech of a professional announcer (a referential comparison).

The second attribute of objective SCS quality measurement is the availability of the *objective* parameters. In our case this number of the correct, wrong and changed answers, reproduced by the student after listening the tasks of the test assignments on legibility. The term: «subjective measurement» usually means estimation based on the expressed opinion, physiological orientations or emotional impression connected with SCS. The given parameters are usually estimated with scores by means of the special questionnaires.

The SCS legibility depends first of all on quality of synthesis the sounds of speech (vowels and consonants). Sinusoidal waves (with or without overtones), acoustic equivalents of the letters, double phones and etc are normally used for evaluation of the quality. As a material for quality estimation of sound synthesis we used acoustic equivalents of Russian and Lithuanian letters (first sub-test of the whole legibility test). This selection is determined by fact that from the practical point of view SCS application in the communications is more substantial than measurement of the frequency and amplitude characteristics of transient processes. The second part of measurement technique of SCS legibility comprises the sub-test of the words. It includes 30 words, which are selected and mixed in a random mode from three parts of the frequency dictionary: ten words of high frequency, ten words of average frequency, and ten others of low frequency. Such selection of words is caused by the necessity for stabilising and smoothing of objective complexity of speech and possibility for creation of the parallel versions of the test. Availability of the parallel versions allows the balancing of dynamic the effects of testing (knowledge accumulation, exhaustion and etc.). All the words used were sensible because processing of senseless words (such words are used for an estimation of synthesis quality) are, apparently, made by more primitive brain nerves mechanisms as compared to those are sensible.

For example, as psychological researches show, the acoustic hearing apparatus aids with matrixes of microelectrodes implanted into the middle ear provide a good distinction by the person of complex sounds of a symphony orchestra, but are absolutely unsuitable for perception of verbal signals.

In other words, intelligent information (words, sentences, text fragments etc.) is more preferable for testing SCS quality, especially if the tested speech is used for communication, as it is in the case of our research. Thirty short sentences (consisted of 5-7 words) made up the third sub-test for objective measurement of SCS legibility. Each of these sentences included one word from the second sub-test.

These sentences were selected to represent communication speech. They were included with aim of covering prosody elements, influencing SCS legibility. This sub-test benefit is that it increases, for example, SCS capacity in the course of computer skills training for blinds, at editing of the so-called «audio books», and in the case of operating with large text files in publishing activity as well. This sub-test also takes into account the factor of a context and anticipation, which are the most important feature of the perception of any coherent legible speech.

SCS acceptability was measured, according to the questionnaire mentioned above which consists of the open and the closed question types. A part of these questions can be related to standard and easy-defined type (for example, age, sex, time-duration of work with SCS etc.). Another part of questionnaire demanded certain experience of self-supervision (this part was on five-grade scale estimation). In the beginning of the research the audimetry tests were made with the purpose of determination of the adaptation degree and probable hearing damages of the students. The procedures of calibration and training were also used. The SCS measurements were spent on 48 students (20 blind pupils and pupils with serious vision disorders who were trained to work with the computer, and 28 students of the second rate on a speciality psychology). A part of the students had certain experience of work with SCS, and other had not; the women add up to 52 % and the men add up to 48 %. The major part of the students possessed experience in calibration, and blind persons and persons with serious vision disorders had experience of training. All students spoke both Russian and Lithuanian. The original version of SCS was used that is implemented in the process of blind persons work with PC at LOGOS association.

Adapted "Apollo" LSCS version was used that was developed by "Dolphin" company and is implemented at the computer centre for training blind persons and persons with serious vision disorders in computer skills. The procedure of measurement consists of 4 series, and the measurements were carried out for each student individually. That is there was Russian announcer (RA) for RSCS and Lithuanian announcer (LA) for LSCS. A quality estimation of the synthesis according to acceptability parameter was carried out after legibility test procedure. The research, as a whole, was made with the maximum account of the psycho-diagnostics requirements. Forty-nine parameters of SCS legibility and acceptability were found for each student after measurements during primary data processing. Hereinafter these data were subjected to functional and statistical analysis. In addition for comparisons in pairs both correlation factor and *Student criterion* were determined with the purpose of estimation of the statistical reliability of distinctions between average values ($p < 0{,}05$).

Preliminary analysis of the experimental data revealed two effects that are of primary concern from the point of view of methodology are directly connected with validity of our test of SCS legibility.

The first effect is sometimes referred to a as «effect of a ceiling». The essence of the above effect is as follows. The value of the parameter is a maximal one or close to it and thus the two compared kinds of speech cannot be distinguished. In our case the percentage of the correct answers for the first sub-test for RSCS and RA equals to 36,09 % and 94,68 %. For LSCS and LA these numbers are, accordingly, 67,33 % and 96,83 %. Thus, legibility of speech for both announcers approaches to 100 % and almost does not differ. Hence, by means of the parameter of number of the correct answers we cannot distinguish the above types of speech of excellent qualities (RA and LA). This is just the above-mentioned "effect of a ceiling".

In a case of comparison in pairs RSCS - RA, LSCS - LA and RSCS - LSCS this parameter differs widely suggesting that the sub-test is valid for evaluation of SCS "of medium quality" (RSCS and LSCS). Basically, the same result is demonstrated in the other effect, "effect of floor", when numbers of the incorrectly reproduced answers for very good speech (RA and LA) do not differ and approach to zero. In the same time, in the case of referent pairs, such as announcer-SCS, this parameter is a revealing one.

These both effects, "effect of a ceiling" and "effect of floor", are found out and for the cases of the second and third sub-tests, that is also an indirect evidence of the sub-tests validity for estimation of the medium SCS quality.

It is necessary to note that there is no common estimation for our test of SCS, as well as in great majority of cases in other similar laboratories, i.e. we use the results of separated sub-tests separately. With the purpose of determination of a common score for these three sub-tests a standardization procedure is necessary which requires both special computations and large and diverse database. Such procedure is rather complex and expensive; therefore in the world there are only few standardized tests (for example, for English language). Thus, our test is not standardized yet, but, as we can see, it has all attributes of validity for estimation SCS of medium quality.

The second part of experiment comprises SCS acceptability measurements. It revealed the following fact. The RSCS score is 65 % lower as compared to RA. Accordingly, the LSCS score is 57 % lower as compared to LA. Comparison between RS and CS did not reveal any statistically plausible distinctions. Furthermore, RSCS score is estimated 10 % less acceptable in comparison with LSCS. Basically, the identical tendencies are presented by practical work experience with blind people who use SCS for dialogue with the computer. The above concurrence can also be considered as indirect confirmation of the validity of our technique of SCS acceptability estimation.

It is also possible to note, that preliminary results of estimation of RSCS and LSCS quality, for the first time received in our laboratory, are represented to be quite acceptable for comparison and selection of the developed SCS systems. Hereinafter, both database expansion and experience accumulation are necessary in the field of quality assessment of various SCS under various and for various students. In sight, it shall result in substantial increase of measurement accuracy and, eventually, in the development of standardization procedure for a test.

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The original is presented in Russian

INFORMATION TECHNOLOGY METHODS AND MEANS OF DIFFERENTIATED TEACHING OF SPECIALISTS AND PC USERS

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Modem status and directions of development of personal computers (PC) and information and communication technologies are characterized by increase of specific weight of use of these technologies in various areas of business, bank business, manufactures, military engineering, science and education.

There is a necessity for continuous outstripping training of various categories experts and users due to occurrence of a plenty new PC hardware-software means and networks and necessity their the prompt development and use in new information distance technologies.

Recently in various western countries a pronounced tendency towards removed offices' technology development has appeared which has a number of serious advantages in comparison with the traditional forms of company employers work organization. In the list of problems, which are carried out by the users of such offices, an important place is occupied by the question of software and technology teaching.

At the moment in educational institutions and centres for training of the experts is carried out in the frameworks of the curricula and programmes, which not always take into account individual qualities and level of learners' preparation.

At the same time in practice each teacher in his educational group always picks out three levels of learners as follows: very well advanced; advanced (basic staff on which the programme of training is designed and which are the basic object of teacher's attention); constantly lagging behind.

The curricula and the programmes of training are aimed to advances students, which make the majority in each educational group. For successful training in view of realities of the present period it is necessary to create or to use completely those methods and means of training differentiation and individualization, which were hitherto inaccessible for implementation in full measure. For the most part, these methods and means comprise information technologies for distance differentiated training.

Modern information technologies allow improving conventional and to develop new training technologies for differentiated distance teaching of the experts and the PC users.

Let's consider the fundamentals for development and design of such technology.

The integrated teaching system includes a number of local networks consistently connected by channels of internal and external communication with the help of which individual problems of training process are carried out at all stages. Depending on accepted model of training various technological circuits of training processes can be realized. As an example of management object at the basic stage a learner is considered possessing sophisticated dynamic characteristics, with the account of which the teacher carries out optimum control of the teaching process using accepted training methods and means.

Theoretical basis of differentiated approach is determination and subsequent use in the teaching process of individual distinctions, abilities, peculiarities of learners using new technologies of differentiated teaching. Realization of this approach on the basis of information and communication technologies is the most reasonable.

Each person as in individual can be characterized by a set of psycho-physiological characteristics, being common for all, and at the same time allowing to receive individual «portrait» of each person, to evaluate his psychological properties, abilities, features of character, inherent only to him. From the point of view of training and subsequent fulfilment of professional duties, connected with PC work. The most important are the following psycho-physiological characteristics of training objects: type of central nervous system, memory, thinking, attention, type of the person, sensomotoric reactions.

The difference of potential abilities of learners demands from the teacher an individual approach to each learner or the group of learners possessing approximately identical level. Three forms of differentiated teaching are possible: a grouping according to the teaching level on this or that course (division into flows); trainee structure modifying course depending on the level of knowledge achieved by them (temporary educational groups); individual training under the guidance of the teacher or using teaching programmes. During realization of the individual approach a standard three-profiled curriculum is constructed which is added by educational opportunities for the pupils with abilities lower average on one hand, and for talented - on the other hand. Depending on the results during teaching, transition of any learner is possible to the higher or lower «track», i.e. each trainee can study the course in his own rate.

Didactic «matrix» of the process of teaching is realized on micro- and macro levels. In the first case the training will be carried out within the framework of educational institutions of a certain type, specialized profile programme, flow, group. Macro level of educational process is interaction between the teacher and the certain students, individualized curricula or teaching programmes.

One of the forms of individual training realization is organization of groups with a various level of the educational tasks and individual rate of cognitive progress depending on the progress in the study of separate subjects, with «sliding transitions». «Sliding transitions» allow trainees to use all his opportunities for transition during training towards the higher level and educational programmes.

At such approach a role of the teacher significantly raises. He ought owes with the help of the various tests, experts in the field of the teaching contents and advisers to determine, which knowledge should get each student. Then he points out at and explains what tasks and materials shall be mastered by a student. He also indicates what ready for use training materials shall be used. The teacher plans and organizes the programme of training, manages the training process, acts as an adviser of the trainee and organizes teaching environment. His role is to promote the students in planning and estimation of educational work, to stimulate development of their experience, to help to them to realise alternatives at reception of the decision, to provide them by various educational materials for differentiated teaching.

The realization of individualized training is carried out in the frameworks of didactic system according to the beforehand planned programme, designed for the certain individual. This programme is acquired with inherent for each student rate; the learning process is constantly supervised and estimated. The programme consists of three phases: the entrance control, branching of training programme to the intermediate control on the important sections and the terminal control on the whole course.

During the entrance control each student passes preliminary testing, during which there shall be revealed trainee's reference as follows: individual «portrait», the level of knowledge, skills in this or that cognitive area. Each student approaches to new cognitive problem with unequal luggage of earlier acquired knowledge, and skills that are necessary for its overcoming. Therefore effective cognitive programme ought completely to take into account already is able to operate and what has not yet reached. The teacher determines what necessary for further cognitive progress knowledge the student has already mastered. According to the results of the entrance control each student is previously allocated to one of the three levels.

On the second phase the teacher selects the programme of teaching in conformity with a level of the student and offers to the plan of training.

On the third phase the testing is carried out that results in determination of the achieved level of knowledge and skills as compared to the objectives of teaching. Then the teacher makes a decision on the estimation of results of comparison. The teaching programme for individualized training is formed according to a principle of «blocks» or «educational packages», which are intended to give the student an opportunity to take possession by certain skill or representations, or to advance in interesting for cognitive area in conformity with his own rate. Educational packages or blocks have the form of printed materials, which open certain aspect of the contents of education or the area of cognitive interest. In these materials the specific objectives of teaching are formulated, instructions for the students are presented, the references information sources on a theme and all kinds of educational activity of students in this area are specified.

The quality of teaching depends on quality of particular development and teaching methodical materials, which is possible to consider as engineering part of teaching process Essence of individualized training comes to splitting of educational contents on separate conceptual-informational fragments (blocks, educational packages), connected among themselves by structure, contents, and complexity. Each student receives a set of educational materials for passing in his/her own rate. It allows revealing the typology of the individual cognitive peculiarities in teaching process.

Some students master an educational material in the best way, if they have an opportunity «to open» basic laws and fundamental integration. Other students prefer the situation when the educational material is structured deductively, and not inductively, in other words, they pass from the general to the particular, instead of vice versa. Some students are trained better during direct and specific experience accustoming to various things, other prefer mediated experience or verbal method, when they simply hear. Some students are trained better when their cognitive experience is divided into short blocks, acquired for certain interval of time. Others prefer the conditions of complete submergence into cognitive experience without any short-term interruption. Some students are trained better, being under a direct management and control on the part of the teacher, others prefer being completely independent. Some students make progress better at presence of stimulus, others - when they can really feel it; thirds prefer to perceive the information in an oral presentation. There is no universal given optimum approach to the process of teaching since the students differ from each other.

Theoretical basis of process of teaching is didactic, one of the branches of which, connected with use the personal computer, is cybernetic didactic. It was shown, that during mastering of the student educational material he consistently advances among various levels of memory: direct, short-term, long term. These levels of memory are characterized by throughput duration of presence in memory. Quantitative parameters of memory of the students of various age groups enable to estimate approximately the speed of mastering of the given educational material and cycles of repeated training for maintenance of a necessary level in system of individualize training. Cybernetic didactic also considers psychological aspects of training, allocating six most general purposes of student: knowledge, understanding, application, analysis, synthesis, and estimation.

In a teaching system the ultimate objectives shall be achieved for fixed term with the use of appropriate methods and means. For the successful decision of this problem the students, as an object of teaching, shall have, depending on the purposes of training, both individual psycho-physiological properties, determined by initial level of basic training and necessary professional work experience.

Each group of entrants ought to pass the entrance control. Initial level of basic training and necessary professional work experience is determined with the help of supervising rates. The list of questions with variants of answers is previously developed by the author of a course for each training programme and then it is made out as supervising course. The algorithm of processing of the results is defined by the author of the training programme according to the requirements to the basic training, experience of practical work and individual properties of an applicant.

Before the beginning of the differential training the teacher ought to take into account three factors for each trainee: a level of abilities; basic training; professional experience on the theme of teaching. Testing procedure is carried out with the help of special supervising courses and diagnostic tests with the purpose of data obtaining for each entrant. During the testing each answer to proposed question, in dependence on its contents, is estimated in numbers, and according to the appropriate algorithm total quantity of numbers is defined for each tested person. Then results of an applicant's testing are processed on accepted algorithm as to three groups of the tests, and with the account to weight factors of separate factors of influence. Total numbers and appropriate level of a student are calculated. According to results of testing and of a subsequent interview the teacher defines the structure of differentiated teaching and accepts that or other decision about including an applicant into the staff.

The level of abilities is estimated with use of a package of psycho-diagnostic tests, which allow to allocate basic psycho-physiological, psychological and behaviour parameters of an applicant (type of nervous system, memory, level of thinking, attention, type of the person).

Under each test an applicant collects the appropriate quantity of members, which is compared to control (base) for each of three levels and then his level is determined. Then after testing on all tests of the package through appropriate algorithm the level of abilities of an applicant is determined.

The base training is defined using specially made questionnaire. Determination of the level of basic training is done with the purpose of receiving of the information on the previous applicant's preparation in the high or secondary school, and also retraining and increase qualifications on information technology and computing engineering for the subsequent estimation of an opportunity of his successful passage and finishing of the programme of forthcoming training.

Quantity structure and the contents of questions is determined by the programme of forthcoming training and by the requirements to trained, listed in this programme. The questionnaire is realized as supervising system on PC. Basing of the results of interrogation the quantity of numbers is determined and is compared to control sums on first, second and third levels. Depending on collected numbers appropriate (1-3) level of the applicant is defined.

The necessary level of professional experience is determined by a teacher with the account of the final level of training, which a student shall reach after the end of training. Estimation according to this factor is the least formalised way and it may include three stages:

- answers to theoretical questions on hardware-software maintenance of PC;
- fulfilment of the control tasks for check of skill of the applicant to work with PC software in normal modes;
- fulfilment of the control tasks for check of skill of the applicant to work with PC software in failing situations and at malfunctions.

After realization of the assessment on each of the listed factors each of applicants receives the appropriate quantity of marks, which is compared to control sums for each level and, depending upon collected scores, an applicant is allocated to the first, second or third levels of professional standards (experience).

After realization of applicant's assessment according to three listed factors and using appropriate algorithm his initial level is previously defined as to the beginning of training (the level is specified after an interview). Then the probability and ability of an applicant is defined during the given term of training to reach the purposes of training and after fulfilment of terminal control tasks to receive appropriate certificate.

After realization of the above mentioned control the whole quota of applicant is divided on three groups:

1. Group of the students with an initial level above the average.
2. Group of the students with an average initial level.
3. The group of the students with an initial level lower average.

As practice and experience of the authors shows basic structure of the students concerns to 2-th groups with an average initial level and makes on the average from 70 % up to 90 %. The first and the second groups make from 5 % up to 15 % of the whole quota.

Considered approaches towards realization of information technology methods and means of differentiated teaching can be put into the basis of remote training in the presence of appropriate hardware-software means of remote access between centre training or a teacher and a student, since the a major factor in this case is the presence of methodical and programme support of the differentiated teaching technology. At distance training the determining factor is the speed of the information exchange by removed users and choice of the possible interaction circuits between a teacher and a student for various ranges of actual rates of the information transfer.

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NEW INFORMATION TECHNOLOGY OF TEACHING: THE CONCEPTUAL ANALYSIS

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In the range of scientific problems, the decision of which is necessary for informatization of education, the leading place belongs to psycho-pedagogical problems of development and application of new information technologies of teaching (NITT). Currently the conceptual analysis, designing and psycho-pedagogical examination of NITT efficiency are the most prioritise. Any of these problems can not be solved in divorce from others, and the research of each of them should come true in a context of others. So, for example, we consider unproductive conceptual analysis of NITT without account, that they should be projected; it is impossible to carry out effective NITT designing without a support on their conceptual analysis and etc.

Mentioning about NITT we mean a lot of technologies, which use information media in educational process and in the first rate a computer, while using it as a means of teaching.

Teaching is a dialogue process. The method of dialogue interaction organization between students and teacher (computer) means, to our mind, carried out technology characteristic of training. We mean either external or internal dialogue, its symmetry, application sphere, pedagogical set level etc. For the NITT characteristic essential is such management parameter as modality of information exchange (we mean modality of presentation it by computer and modality of students messages).

Taking into account the fact, that recently diverse training organizations have been used with computer help, and along with individual form, more and more frequently various group forms of work have been used, essential characteristic of teaching technology is the form of its organization (note, that these forms are rather distinguished on structure, ways of students interaction among themselves and between them and computer).

The important NITT characteristic is the indication of those managing functions and ways of their realization, which computer carries out. This parameter we have titled «organizational aspect of management» (for example, adaptive, individualized, reflexive management etc.).

At last, very essential characteristic of teaching technology, especially the newest technologies, is distribution of management functions between computer and learner. We mean the question, what functions of management are delegated to student. This characteristic reflects organization level of educational activity, dynamics of transforming to self-training.

The conceptual analysis of teaching technology as a system of knowledge, concerning training process, assumes first of all specification of its status, association of teaching technology with its theory. While definition of technology teaching status we start from a rule, that neither psycho-pedagogical theory can be directly introduced in process (mentioned idea concerns not only the theory of educational activity, but the training theory). It resembles, for example, how the laws of physics cannot be directly used in manufacture. The necessary condition, thus, is application of theory to technology i.e. creation on its basis the appropriate technology.

The technology of teaching acts as some intermediary between the theory and practice of teaching. We can not agree with those authors, how consider as equal the technology of teaching and its designing. And we think that the latter can come true not only on technological teaching level, but also on the level of its theory and practice. Its peculiarity lies in the ways of the project description.

One of the most vulnerable points of the modern theories of teaching is the difficulty of their application to technology. This comes through the following reasons. Firstly, their principles are formulated in such a way, that they hardly can be practically applied. Secondly, no theory is able to cover all aspects of teaching process, while technology should take into account all aspects without exception. Taking into consideration mentioned factors, the main requirement to the teaching theory is possible to formulate as following. It should be appropriate to technology, i.e. should ensure an opportunity to describe the operations as a system of elementary ones.

We should indicate the following requirement. The theory of teaching and educational activity should be interconnected. Only in this case they can be the theoretical basis of teaching technology. Unfortunately, today the learning theories (theories of educational activity) and teaching theories develop independently from each other, though the elements of their association take place in all theories. Necessity of complementation of the theories of educational activity and teaching ones is caused by the fact that any teaching theory always proceeds from definite representation about educational activity. Similar situation takes place at development of the theory of educational activity. It proceeds from definite idea concerning teaching. Even in the case when there has been put a mark of equality between the learning theories and teaching in class, it is not possible to completely disengage from teaching in any learning theory.

At last, the third requirement to the theory of teaching is that it should base on psychological mechanisms of training, describing interaction between its subsystems. In teaching, considered as system .education, teaching and educational activities act as subsystems. Psychological mechanisms in teaching describe interaction between them.

Along with well-known mechanism of teaching, common to arbitrary control system (feedback), we underline also the following two psychological mechanism of teaching.

1. Complete determination of educational objectives: this mechanism opens transition from training influence to an educational objective under the influence of a set of factors, including situational ones. Just this mechanism allows to prove regulations, that in the system of teaching the student acts not only as object of management (teaching activity), but also as the subject of educational activity. Complete determination of managing influence takes place in all kinds of management, object of which is the person. Peculiarities of this mechanism functioning in the system of teaching are connected with the fact, that in this case the decision of the problem acts not as the purpose, rather as means of its achievement.
2. Consider the psychological mechanism of dynamic

distribution of managing functions between learner and trainer (computer). This mechanism is inherent only for teaching. A role of this mechanism significantly grows in NITT conditions, since there is real opportunity of dose transfer of management functions to students. The offered approach allows:

a) to reveal one of the basic reasons of experimental research results inconsistency, concerning various teaching technologies comparative efficiency; this reason consist in the fact, that not all technological parameters were taken into account in the research process;
b) to plan new lines of the theoretical designs analysis, beginning from teaching level, called «an explanation of new material», up to new paradigms of educational process («learning without teachings, «learning by way ofteaching»);
c) to allocate the basic components of the teacher and students activity, which should be discounted at NITT designing.

The information technologies of teaching introduce modifications to all aspects of educational process. They render essential influence on the activity both of the teacher, and students, while comparison between them and «traditional» technologies is not quite pertinent. It is necessary to take into account new opportunities of educational process construction.

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THE CONCEPT OF THE ELECTRONIC TEXTBOOK AND NEW INFORMATION TECHNOLOGIES

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The information technologies in education are the key point of successful development of information technologies for a society, being linked with expansion of a role and extent of influence of intellectual activity modes diversified over human life.

The computerization of education and, in particular, methods of distance teaching are heading at the moment in humanitarian areas of education mainly. Technical branches of science because of their complexity and large volumes of information are not practically considered at the creation of systems of distance teaching. At the same time the necessity of distance teaching in technical branches of science, especially in the field of mechanical engineering, even more important, than in humanitarian areas. It is confirmed by the fact that designing and technological designing is a creative process, caused by the complex inter-disciplinary links and requires a plenty of references and graphic materials. A support of interdisciplinary links and the creation of systems, ensuring a feedback between these and the persons under training, can be provided only by essentially new approach to a process of teaching and establishing of electronic teaching systems - electronic textbooks forming teaching as a course combined with various spheres of knowledge.

The main reason of obstructions at creation of new technologies of. teaching is a serious contradiction between an essence of traditional contents of educational subjects and inter-disciplinary character of computer medium used.

The further development of computer technologies of teaching should follow the way of content reforming on the basis of non-standard ideas and creations of new integrated educational courses.

Currently the main purpose of teaching becomes not only mastering ready knowledge, but also the assimilation of information, tracing the ways of information interchange and use as the means for accumulation of new knowledge.

In the present work the new approach to formation of a computer base of knowledge and a methodology of establishing of the teaching courses within the available knowledge spheres is proposed.

At traditional approach to the process of teaching all students must get knowledge within one tempo. The use of a computer will allow to each student to choose an optimum for him speed of reception and mastering of material, to supervise oneself, to review the earlier studied material etc. The computer provides and active feedback with a learner, analyzing the results of training and changing a tempo and technique of teaching depending on the results of mastering the educational material.

Electronic textbook is an electronic image of an information all over the educational material (books, lecture, subjects and etc.), elaborated on a computer and complemented by the functional opportunities for the realization of teaching process: by reflection of mutual findings of subject sections and interdisciplinary coupling; by the explanatory means, demonstration, practising and control. The listed opportunities are given to learners by means of the user interface. The electronic textbook similarly to book has a table of contents accompanied by a specialized index of subjects, ensuring the contextual references to any objects, among them the graphic, audio- and video-objects. In addition to this, the electronic textbook presents the associative linkages, and also pictorial representations of an educational material can be realised. The electronic textbook, except the content and technical software, includes also methodical support, which ensures the realization of training with the problems in hand.

The electronic textbook is formed on the basis of a specialized catalogue, organized as a graph. This graph sets thematic or any other user's partition of the information of a textbook (sections of the book) into groups, probably, partially intersected. A user has an access to the information of a textbook by two ways: one - through the structure of a catalogue (graph), the other - through the coupling references in textbook sections. As fractional unit, from which an electronic textbook content, is constituted concept of a generalized paragraph is used.

The paragraph includes all elements of information, contained in the textbook. Among these elements are textual (indent-sentence), graphic and tabulated (table) information. The generalized paragraph includes one more additional element - a binding unit. This element allows to set information binding between the paragraphs and their elements.

The offered structure of the paragraph allows to proceed to the representation of the textbook as oriented hyper-graph. This hyper-graph ensures a thematic or any other user's partition of documentation base into groups. The paragraphs act in a way of graph nodes while the element of paragraph «binding» defines the structural links of graph. The hyper-graph's modes were named a document. Thus, hyper-graph will consist of the documents, connected with each other. The representation of the document structure in a way of graph opportunity to create systems of interconnected documents. The proposed information structure of data storage allows solving several problems simultaneously:

a. to arrange a simple and handy structure of information;
b. to ensure a purposeful or a random processing of this information;
c. to modify a structure of information, not changing its content.

From the standpoint of the chosen information structure capability any document, the book etc., being in hyper-graph structure can be represented in their natural form. At same time the book is represented as a two-level (multilevel) document. The first level of the description defines the structure of the document, i.e. contains the titles of sections, included in the document, and references to appropriate sections. On the second (subsequent) level of description there are the sections, that include essence of the document. Depending on requirements to the quality of sections the chapters, the paragraphs, indents, drawings and other structural items of a document can be accepted. Thus, an electronic pattern of the book has usual and habitual for user structure and does not require a special preparation for its formation. The hyper-graph structure provides also a support of data structure through a checking block of system. The catalogue of cyclic checks control series, the frame and the elements of frame the control question, variants of answers drawings, helps and repetitive cycle are referred to is the elements of frame.

The main feature of a hyper-graph information structure is the fact, that by means of it the database is transformed to the base of knowledge. The hyper-graph structure allows to impose on existing information the additional links and to create the new information structures. Upon description the necessary structure of links between data sections, it is possible to set up specialized training courses. In this case the content of a course is no limited by one document, but uses the information forma the whole database.

The proposed principle of data structure formation and the methodical approach to structure of an electronic textbook as a hyper-graph, binding various documents, enables to form various training courses on the basis of the same information. The educational courses are divided into following types: first viewing base; auxiliary and facultative.

The courses of the first viewing level enables to receive only contemplate representation about the subject to be studied. They briefly outline the statements, facts and some explanations of the basic paragraphs of a book.

The base level of educational courses gives a significantly required minimum of information, which is necessary for a subject to deal with. The auxiliary and the base courses include a profound study of the material. In conformity with this division the elaboration of a cyclic control of appropriate severity is possible.

Thus:

1. The information structure of the electronic textbook should be organized in a way of the hierarchical hyper-graph.
2. The basic structural unit of a hyper-graph is the paragraph (hyper-document).
3. A hyper-document can comprise a text, drawing, table, formula, field of input, area of dialogue, electronic settlement tables, the structured images, bodies of control (including sound effects), demonstration animated and videocassette, synthetic objects (having the external representation, behaviour, responses to influence), points of an input in the field of a virtual reality and special elements or the points of connections for transition to other hyper-documents.
4. The elements «connection» should address the references to other hyper-documents (textual and graphic).
5. For the textual hyper-documents the elements «connection» should address the references to textual allocation of textual documents, graphic objects and their elements, objects of demonstration and any external programs.
6. For graphic hyper-documents the elements «connection» should address the references to the textual explanations and to the objects of demonstration.
7. The hyper-document containing a group of element «connection» should describe a chain of hyper-documents, specifying a cycle of training.
8. The selection of hyper-documents connections should be performed step by step in accordance with the description or under the conditions.
9. The electronic textbook is integrity of three components: the content, techniques of teaching and a software-technical provision.

New information technologies connected with combining of information within the framework of global networks of computers, enable new opportunities of •structuring and mastering the information, and in a way of a remote access to the data, localised in nodes of this network. These networks assume making use of hypertext structure organization, access and data processing.

The opportunities of hypertext systems are really fantastic, they are the ideal means for electronic textbooks, since they enable the realization of main advantages, which are necessary for elaboration of the changeable and diverse structures of textual sample and graphic information as well as various methods of access and etc. The hypertext systems represent a new class of systems for information management. These systems enable the users to establish, to distribute, to make links and to use files of the most diverse information in a form of text, diagrams, the images, audio-video information, programs and etc.

In general the hypertext system can be taken as a database system, which provides the completely different methods of access and management of information. However, distinct from the traditional systems a database, which have regular, ordered structure, the hypertext systems of database have no strict structure, and the user is free to operate with the information by various accessible to him methods.

The basic idea of hypertext systems consists of a concept of automatically supported connections both inside one document and between various documents. The support of such connections permits to organize the non-linear textual structures. Advantages of nonlinear documents is obvious: distinct from the linear document, for example, the article in a magazine, which is a single-level, unchangeable and having a limited set of references, the hypertext document represents a flexible structure, that can be oriented to a specific user. A learner can, at his will, be limited by the superficial one-level information, not spending time for looking for the necessary documents according to references.

The teacher, while executing the hypertext document, can supplement it by new references, to update separate parts of the document, not changing the content of separate parts. The hypertext was determined as an approach to information management, when information is stored in the nodes of a network, connected by links. The information, stored in the nodes can have the textual, graphic or any other type of data. The findings refer to the relations between elements of the information. They can be two-directional, allowing coming back from a subsequent element to previous.

Thus, the proposed concept of structuring of electronic textbook and the new information technologies of data processing are merged together. As a basis for execution of hypertext electronic textbooks it is offered to use the capabilities of language, intended for the description of screen pages on servers. Such approach will allow to make the description of electronic courses in a simple, from a point of view of a developer manner and to use the results obtained for teaching at separate working places, at local networks, and, also, that is even more important, to organize training in global computer networks, such as Internet. Established on this basis, a teaching complex of electronic textbooks allows organizing a uniform information space for methodical work of a teacher and student teaching and will ensure the performance of educational process for the group and, also, the performance of personal and remote modes of teaching.

The complex is intended to be used along with lecture and laboratory studies for groups of the students associated with special disciplines in display classes under a teacher's control and management and for independent processing at personal working places.

The complex and its information support is used in the methodical work of the teachers on establishing, updating and development of educational plans and execution of complex curricula, ascertaining the interrelations between separate disciplines and joint use of monographs and similar teaching material.

The expected effect of educational process and quality of specialist teaching is defined by a raise of information saturation of teaching, intensification of cognitive activity without an increase of loading and moreover the realization of the concepts of individual and distance education.

The developed concept of the electronic textbook allows preparing the automated educational courses various disciplines and can especially meet the realisation of training courses, concerning subjects. The offered technique of execution of the electronic textbook was sampled at elaboration of educational courses on technical and humanitarian disciplines: «The automatic control in mechanical engineering», «The basis of inter-changeability», "Russian history", «Culturology» and the others. The results obtained have confirmed the efficiency of application of given approach at creation of electronic courses of teaching. As a basic means of a software package mapping was used.

The presented technique and practical results of the development of structure, composition, information and methodical provision of teaching complexes of electronic textbooks can be proposed in a way of a typical sample at creation such complexes along with a number of special technical disciplines for technical universities.

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DEVELOPMENT OF PRACTICAL SKILLS IS THE WAY TO COMPUTERIZATION OF TEACHING

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The history of teaching process computerization in a higher school is rather rich. With the first occurrence of computers at higher school the problem arose of its use in course of training of the experts on-various specialities. The programming was the first subject, which the students had to master during their work with computers. First of all, such approach was based upon the fact that high school was supplied with computers, which were perfectly equipped with software aimed at decision of various calculation problems. On the other hand, programming skills, mastered by the students, could be used in various special courses investigated in higher schools. Such approach brought positive results. In various spheres of activity a lot of higher school graduated experts mastered programming in addition to the knowledge in the field of basic speciality appeared. It is precisely these experts began to implement computer information technologies in various spheres of activity.

However, the fact that in present informatics and mathematics are considered as very close disciplines resulted form both well known conservatism of high school and backlog of the development of training technology for students in the field of informatics as compared to the development of the technical means and software. This is also evident from educational standards on many specialities, authorised State Committee for Higher Education of the Russian Federation. In these standards, in particular, such specialities, as jurisprudence, economics and management, marketing, mathematics and informatics are incorporated in common section. At the same time, the share of informatics is insignificant yet in the total scale of experts training. It is no wonder, that in the overwhelming majority of educational programmes on informatics for a higher school give till now basic attention to study that or other algorithmic language for programming. In conditions of the advanced software modern computers, which widely take root into all spheres, this knowledge of programming hardly will be demanded. Moreover as practice shows 80 % of computer use is connected with textual information storage and processing. Especially it is typical for such areas as economics, management, and jurisprudence. Such situation is hardly possible to consider satisfactory.

At the same time, in a number of higher schools of the country there was produced other approach to computerization of teaching. For example, in computer preparation of students of faculty of economics, management and information technologies in the Moscow State Industrial University the teaching begins with formation of initial practical skills in the work with computers. The acquaintance with the computer the students of the first rate start from the work with files, using minimum opportunities of operating system. At the same time they master the practice of work with the editors of the texts. Teaching is carried out by the blind method of computer typewriting. In parallel in a lecture course the students get minimum knowledge about structure the computer functional devices, operating system.

Thus the students from the first day of learning begin intelligently work with the computer, using for formation, storage and running of various kinds of documentation, the rules of drawing up of which are studied by them in parallel course «Office-Work». The students overcome psychological barrier in using by the computer. It immediately becomes for them the assistant in study. The students begin actively use the computer in the decision of learning problems: for preparation of the abstracts, home tasks, course works.

There are decided not only learning problems, but a certain level of professionalism is also reached by use of the computer as of the tool for the decision of professional problems. For example in the first semester the «blind» method of typewriting and basis of office-work are mastering. In the second semester -professional mastering of computer editors, DOS superstructure, target professional practice. About 30 % of the students after this preparation reach a level of professional typists according to the literacy and correctness of the documents registration. About 70 % of the students have a level of professional skills, quite satisfying the inquiries of organizations, which don't have large volumes of the documentary information.

In university the problem of professional step preparation and certification in the field of use the computer is put and realized. The first rate -certification on the assistant of the manager; after second rate - on engineering of the statistics-programmer.

All students of University aspire to an overall performance with the computer by changing structure, introducing in a practical work development of networks, electronic mail and other modern programme and technical means within the framework of the same teaching hours.

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THE CONTRIBUTION OF MULTIMEDIA TECHNOLOGIES TO COGNITIVE DISTANCE LEARNING

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«Cognitive Distance Learning» is a concrete term for the twin programmes of UNESCO, «Lifelong Learning for All» and «Learning Without Frontiers». It unites today's concept of man, well-founded by natural and human sciences, as a living being that is distinguished from all other biological species through its cognitive abilities of uninterrupted lifelong learning from experience, with today's technological methods of disseminating human knowledge without losing any time all over the world. But the problem is how to combine both areas of

- cognitive information processing in man and
- the documentation and technical transfer of human knowledge
- into a general theory of cognitive learning that is more fundamental and basic as a theory of pedagogical practice and strategies.

For the pedagogical process of learning by means of an explicit teaching process is only one among many alternatives, besides other forms of learning from experience by means of trial and error. The general meaning of the concept of «learning» as an active, or in most cases even creative, behavioural adaptation based on previous experience plays a crucial role in various areas of cognitive information processing: for example in biological ethology, in neurobiology, in learning psychology and in the theory of self-learning machines and of course also in the area of global information and communication technology, that is nowadays the physical basis of distance learning.

This new form of learning that emerged from these developments, that reduces spatial distances and that *turns the so-called «information society» into a «global* village», is more than just the technological implementation of information highways, but it must in particular take into account the abilities of the learning individual or the user of these new technologies.

These abilities and the limits of cognitive information processing in humans are based in biology in two ways: learning as a biological phenomenon can be explicated, on the one hand as genetic information transmission and on the other hand as neural information processing.

Any kind of human cognitive information processing, like the processing of direct sensory information or perception or the transmission of «pre-fabricated» information in spoken or written language, is based on this foundation.

Based on our present knowledge about genetic information transmission we can be sure that the human mind is not a «tabula rasa», but that it contains a lot of structural information right from the start, i.e. both genetic and neural information that is determined by the structure of the brain. This structural information is the prerequisite for the brain to be capable of acquiring the new type of fluctuating information.

Unlike genetic and neural information, this new type of information is called «cognitive information», when we focus on the material-physical basis, or as «mental» or *«rational» information, when it is related to human* cognitive information processing that presupposes consciousness.

Human cognitive information processing was originally limited in its natural representation and communication to direct sensory contact with the objects concerned or to oral speech contact to the communication partner. The invention of writing was the first step in a technological revolution of language and has made human communication largely independent of space and time. On the other hand the material carrier of writing means several limitations to communication, in particular the linear access to written text.

The second technological revolution in modern information technologies replaced the slow and inflexible medium with digital electronic storage and transmission, but it continues to be linked to the user or the learning individual, without whom these *information processes carry* no meaning, i.e. do not represent any knowledge. In this sense the basically useful heuristic metaphor of a global information and communication network as a «global brain» is totally misleading.

While every real living brain or central nervous system has a uniting function in relation to its own carrier organism, the body, with this function manifesting itself prior to any kind of consciousness or self-consciousness in the strictly localizable representation of the body in the cerebral cortex (as a so-called homunculus), this holistic function totally misses in a technical communication network. It is thus neither a global brain, nor an overwhelming global intelligence in the sense of old phantasies of AI-research, but rather a termite intelligence, resulting from action and interaction of large populations of individuals who are not tied to this system, but who can log into this system or off any time.

The real user of such a distributed system of knowledge who wants to learn something, can only access a certain part of this global knowledge, based on his/her individual knowledge and abilities, although this knowledge is basically available as a whole without limitations.

The reason is that the learning individual only knows a certain subject field, speaks mostly only one language, understands only part of the symbols and needs time to acquire and process knowledge that is offered in different forms and in several languages.

Although it has been clear for a long time that multimedia systems that link to each other pictures, sound and text in non-linear ways are an adequate means of knowledge representation, because it corresponds to the multimedial sensorial acquisition of information in humans who process the modal information input in inter-, supra- and metamodal ways by means of the uniform language of his neural network, and that every hypertext system has already overcome the limitation of linearity of static written and printed text by direct non-linear access to every part of the text, we are still missing a clear answer to the question of the fundamental unity of knowledge, that is represented in distributed form in different ways as symbols, pictures and sound.

Neither the digital units of machine language nor the isolated data of traditional data processing can be this unit that we look for, but it is the complex structure that has already a high degree of condensation of elementary, isolated information (data) that we traditionally call «concept». Knowledge-based systems are thus always concept-based systems. The missing link between a theory of cognitive information processing and a theory of documentation and of knowledge transfer is, therefore, ***concept theory.***

This theory is also the core of a general theory of learning that links cognitive information processing to documentation and knowledge transfer. For the concept is both, a complex condensation of information in the form of a reaction schema of living organisms, and a fundamental unit of human knowledge that is presented in descriptive concept systems and in causally explaining and prognostic systems of propositions, where the concept appears in its logical function as the predicate of possible propositions.

In this sense we will have to focus ***on basic terminology research*** in the future, in particular on the different possibilities of expressing concepts that are not necessarily expressed by linguistic means alone or that sometimes are presented mainly by non-linguistic means, as it is the case in multimedia systems.

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MARKETING KNOWLEDGE AND MARKETING SKILLS TRANSFER IN THE FIELD OF STEEL PRODUCTS MANUFACTURING OF PROFILE AND BRAND PRODUCT RANGE

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For the first time in Russia a unique database developed in the field of ferrous and non-ferrous metals and alloys by the team of the experts of Moscow Institute of Steel and Alloys. The priority feature of the above base is as follows. It constitutes a wealth of various information on metals in CIS countries. The database can replace hundreds of reference books, standards on metals and alloys products, and factory catalogues, including the complete schedule of manufactured products. At present, the size of the above database is as much as 1500 Mb.

The database is intended for fast and automatic search of the manufacturers of any kind of production (rolled flat and structural shapes, pipes, wire, bars, semi-products, ferroalloys, powders etc.) in CIS countries (address and telephone numbers of the managers are included).The database provides information on chemical composition of 6700 domestic and 16000 foreign brands of ferrous and non-ferrous metals and alloys, on correlation in chemical composition for foreign and domestic brands of metals and alloys, on physical and mechanical properties of metals and alloys, on 8000 Russian and foreign standards, on equipment performance at various enterprises, and on production being manufactured more than 600000 positions).

The above systematised database is used for training of students on the following specialities: "Research, development and thermal processing of metals», «Processing of metals by pressure», «Designing of technical and technological complexes». For future experts it provides possibility for quick search of interesting information which can be obtained as a hard copy. The work with the base not only improves the quality of knowledge mastered by the students, but also considerably simplifies and accelerates search for information, increases the skills in the field of information technologies implementation. Future users of the above database are as follows: experts of departments of provision, of marketing, of factory laboratories, as well as managers of selling-purchasing commercial companies, specialised on metal.

The first part of the programme complex comprises a block of the programmes for updating. It is intended for information amplifying and eliminating defects of the above database. The stored information to be updated is as follows: and corrections of the stored information: the list of materials, the list standards, the list of shape product range, graphic representation of the shapes, addresses and payment essential elements of the enterprises, the list of production being manufactured and telephone reference book. The corrected information can be sorted according to on various attributes. The process of information input and the editing is improved through menu application within all textual positions.

The second part enables to execute search, to extract from the above database any bit of information according to user's wish, to output necessary information as a hard copy or as a file for checking, editing and subsequent printing. The user has an opportunity for modify the list of information output and its sequence according to his requirements. When the modifying process is completed, the tables are automatically organized according to paper sizes, the list itself and the schedule of information output. The information can be classified according to various parameters. The list of materials contains definitions and the names of the materials and their groups, codes as to qualifier, material functions, products made of it, and also chemical composition, mechanical and physical properties. Any block of the base allows .search for the suppliers of the material, for information on its properties, on standard requirements and on the list of products under this standard, the list of the major standards. Besides, it is possible to get systematised selected data on product quality requirements. The user has opportunity for carrying out of comparison between foreign and domestic steel brands as to its chemical composition and for selection of a required analogues according to its mechanical characteristics. Shape product range contains the list of shapes supported by the data on materials, standards, modes of manufacturing and sizes. The shapes can be represented as technical drawings on PC display. The list of the information on enterprises includes addresses and banking data. Production of the metallurgical enterprises can be obtained in two modes: brief mode and detailed mode. The database also includes reference book of telephone and fax numbers of the chief managers for enterprises-manufacturers and English-Russian dictionary containing 22000 words.

The third part of the programmes package contains service programmes for creation of convenient work environment. These programmes provide possibilities as follows:

- colour scale and symbol sizes modification on a PC display,
- direct editing and information output of the database contents,
- direct editing and output of file structure.

The programmes are developed in the FOXPRO language for a database control system supplemented by C language.

Centre for Information and Marketing under Moscow Institute of Steels and Alloys delivers consultations and information services by means of the above database.

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THE PERSPECTIVE DIRECTIONS OF APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION

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Exponential evolution of information and communication technologies determines the urgency of investigation of their use in educational systems at various standards and profiles. The education requirements for efficient utilization of information and communication means led up to new non-traditional developments and techniques for teaching of various subjects. Therewith the problems of pedagogical efficiency inevitably faces confront such innovations, since a use in teaching process even the latest scientific achievements did not bring the training upgrading. The radical solution of a task of educational efficiency advancement is connected not precisely with an expansion of capabilities of modern information technologies, but with elaboration and application of didactic and methodological principles in education. Let up put forward the most promising directions of information and communication technologies introduced in a teaching process.

The creation of subject-oriented multifunctional teaching media permits to use multimedia technology, "virtual reality" method and hypermedia system, as well as electronic textbooks and "micro-world" medium. The subject-oriented multifunctional training media are the combination of previously known pedagogical software, which can realize a new idea of creation and application of information technologies in an educational process.

Multifunctional thinning media include the following components:

- extensive databases, required for storage of various information (textual, graphic, reference), involving video material and animation rollers with audio background;
- knowledge bases of educational purpose, involving a model of definite field of a subject, knowledge about the formation of learner's skills and experiences for their use;
- systems of artificial intelligence, realizing the abilities of data accumulation, concerning the teaching results of each learner for selection of individual effects and regulation of skills and habits formation;
- laboratory practical work with a capability of assignment of mathematical model for phenomena and processes studied, with creation of computer model of a laboratory testing unit or an assembly, made out of existing in catalogue ready elements, as well as operation modelling of this testing unit and assembly at monitor screen;
- expert-training systems, forming a learner's model with a diagnostic of learner's knowledge on the basis of experts' knowledge from a subject field on the level of tutor [1,5], and providing the possibility to analyse user's actions, to realize a wide range of teaching effects, to put questions, arrange control and training, to use communications between learners and a teacher, to promote a computer control and so on.

Multifunctional training media permit the following:

- to organize various forms of learners' activity on independent knowledge absorption and presentation;
- to use the whole range of modern information technology abilities in the process of training of various types of training activity, including such as registration, collection, storage, data processing, interactive dialogue; modelling of objects, phenomena, processes; automation of teaching results control, testing and practising;
- to ensure the control over information flows;
- to manipulate with information, to deform the presented information over different parameters, to choose the needed trend of the relevant topic (text, video-topic, graphic, animation, the control of various devices, laboratory testing units and soon);
- to increase the level of emotional perception of learning information;
- to form the ability of self-study knowledge acquisition;
- to increase the learning motivation at the cost of possibility of self-control, personal and differentiated approach to each learner;
- to develop an intellectual capacity of learners.

Multimedia in combination with hypertext constitutes the hypermedia systems. The hypertexts can be provisioned with not only textual, but with graphic and visual information. The practical realization of those systems brought into existence the-electronic books, designated mainly to independent training. The electronic books conditionally can be classed into four sections: encyclopaedic, informational, training and examining [1, 4]. The difficulty of practical realization of elaborated till now hypermedia systems, intellectual training systems, medium "micro-world", electronic books, etc., is caused, first of all, by the fact, that this software is designated mainly for independent training and contain a number of supplementary information and hardly compatible with a real educational process. The programs for self-study teaching are surely needed, but in definite proportion with the rest training program means. Frequently, the essential reduction of didactic capabilities is induced by the fact that most of them are developed by programmers without participation of pedagogues.

Most of those drawbacks can be eliminated through elaboration of subject-oriented teaching media by a team of high-qualified pedagogues, scientists, engineers, programmer and so on. Their creation is one of the promising trends of education development.

The practice of application of teaching-information media, realising the multimedia technology in educational process, allows to make a conclusion on teaching efficiency raise in the expense of stimulation of the greatest number of learner's perceptions; of utilization of various forms of learner's computer operation; of formation of learner's habits, which can't be formed in other computer media; of application of modern means for audio- video information processing. In spite of difficulty of elaboration and realization in educational process of those media a more wide propagation gains the new technology of non-contact information effect - virtual reality, delivering by means of complex multimedia - operational media the illusion of direct entrance and presence in real time in stereoscopically presented «screen world» [5]. The realization of technology of virtual reality in educational process promotes the following:

- formation of skills and habits for activity of designing and modelling of objective world;
- development of image-visual theoretical thinking, that allows to study not only objects and phenomena of our surroundings, but those phenomena and processed, which can not be reproduced in a reality (space flights in time and space, surgical operations, observations for events, taking place at super high and super low temperatures and so on).

The application of communication means, involving the computer networks, telephone, satellite links for various information exchanges between a user and central information database or between users [1, 2, 3]. Therewith the possibility appears to realise the following didactic functions of telecommunications [3]:

- to fulfil the joint investigations together with learners from different educational institutions and different regions and countries;
- to render a consulting assistance to learners and teachers from scientific-methodical centres;
- to arrange the networks of distance education and qualification upgrading of pedagogical staff, to perform an exchange of top-level pedagogical technologies;
- to interchange the information of interest, themes, to use the information obtained for educational and scientific purposes, to analyse and study the foreign experience;
- to form a learner's culture of contact, the ability to formulate briefly and legibly his own thoughts, to sustain a discussion, to prove his point of view, to respect a partner's judgement;
- to form experience of research activity;
- to form an ability to obtain information, to storage, to transit and to process it;
- to promote the mental development of learners.

On utilization of communication a new approach to teaching and education is used, which permits to stimulate an independent learners' work; to develop their intellectual and creative capacities; to operate with various sources of information; to involve them to designing of their own presentation about environment, to form their own world outlook instead of plain ready knowledge absorption.

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ON THE HIERARCHICAL MULTIENVIRONMENTAL APPROACH TO THE WORK WITH KNOWLEDGE

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When working with computer technologies, the diversity of existing spheres of application of computers and, respectively, of information-language environments, to which operation in these branches is oriented, presents a great problem. The efficiency of work with computer facilities is directly connected with the fact, to what extent language aids of man-computer interaction are adequate to class of objects, dealt with in the specific branch. The problem of selecting approaches and corresponding computer environments in education is more aggravated in connection with a reasonable wish to give pupils certain relatively long-living knowledge and skills.

Problem of co-ordinating branches of application of computer technologies with specific programme environments is usually solved by one of two methods. The first method consists in studying and using some universal aid and reducing all really arising objects to it. Teaching courses, based on this approach, contain two sections: studying of some universal paradigm (for example, algorithmic logic or functional) with corresponding computer environment (for example, Pascal-system) and studying methods for reducing problems from different branches to this paradigm («programming»). The another approach consists in studying and using some aids, containing a variety of capabilities for work in any particular branch, for example, systems for work with databases. This approach requires studying a relatively great number of sufficiently great specific systems, which comparatively quickly become obsolete. In so doing, a situation of balancing between tendency to a wealth of capabilities of used and studied systems and their simplicity, flexibility and universality arises. On our opinion, the only way to solve the noticed discrepancy is to use a hierarchical micro-context approach.

In compliance with this approach we propose to extract different compact principles of forming composite objects from simple ones, sets of basic composition (decomposition) aids, for example,

- algorithmic aids, allowing to represent some action as a time sequence of simpler actions;
- functional («formula») aids, allowing to build more complex conversions from elementary functional conversions (for example, arithmetical operations);
- logical («predicate») aids;
- «geometrical» aids, allowing to construct graphic elements from the other elements; composition rules, allowing to create complex types of data from simple ones (for example, as in Khoar language in Pascal);
- syntactic rules, allowing to describe composite objects through simpler ones.

Each of these methods can correspond to its micro-language (note, that in such approach the algorithmic language will not contain formula, operators of assignment, descriptions of data). It is proposed to consider any informational description as a structure of elementary descriptions, i.e. the common description language will be formed as a structure of their micro-languages, arising during solution of specific problem.

Note, that such an approach in the «anatomy» form can be applied to already existing languages by selecting micro-languages in them. The described approach permits us during training to independently consider typical paradigms of composition/decomposition for different approaches and different branches (including different sciences). In considering specific object one should skillfully carry out the stage-by-stage decomposition of description with selection of most suitable, paradigm at every phase of embedding. In the presence of special programme aids for supporting this technology it is sufficient for its successful work. For working with traditional environments one should be able to- reduce descriptions in paradigms of the hierarchical approach to descriptions in terms of aids of these environments.

Merits of using the hierarchical micro-context technology are as follows:

- every element of complicated information work is performed in microenvironment, most suitable for work both according to language and to interface equipment;
- every one from sub-environments is very simple in studying owing to its compactness;
- common approach to different information concepts (i.e. in sphere of programming the difference between «algorithmic», «functional», «logic» languages, between «programming» and «employment of complete programmes» is removed);
- ensuring the maximum opportunity to use the obtained knowledge owing to skill in carrying out division of any language into micro-levels, extracting known elements in arbitrary systems;
- even slight set of different sub-environments creates considerable diversity and power of specific environments, hierarchically formed by this set.

Thus, the use of this technology permits, in particular, to settle the problem of discrepancy between simplicity of information environment and a wealth of graphic aids, provided by it.

For some years the author lectures the special course «Models and Languages» at the Ural State Technical University, based on studying basic micro-aids and also used this approach in lectures for school pupils.

Programme complex PIFAGOR for IBM PC-compatible computers is an example of realization of the programme environment on the basis of micro-language hierarchical approach. The complex contained algorithmic, formula, syntactic micro-language layers (aids for their edition, compiling and execution). Used as operators of algorithms can be arbitrary external environments (for example, graphic, text, music editors, environments of logic or functional programming, aids for work with external devices, for carrying out physical experiments, etc.). The specific feature of the complex is employment of graphic languages, visual descriptions.

The complex can be used for realization of the main principle of hierarchical technology: each type of information should be represented in the most convenient form; preparation of programme should be made by most suitable means; processing should be accomplished by most suitable equipment.

The complex can be used in training process as «world», in which the trained person works and also as an environment, in which training environment can be developed. In this case, one may employ already existing (in arbitrary computer representations) text, graphic, music materials, existing already-done works in the form of programmes on arbitrary languages and maximum use of accumulated-by-used experience in operating any computer systems, and also arbitrary auxiliary equipment (scanner, sound input, tele-camera, power-driven models, etc.) with the simplest procedure of its connection. It allows us to quickly develop programme systems, multi-language systems, having a minimum level of familiarity with computer and with complex PIFAGOR.

During operation in the algorithmic environment a triad concept «developer-manager-executor» is realized. Works connected with each of these elements look differently, «manager» and «executor» correspond to different windows on the screen, activity of «developer» is based on its own window of icon menu.

To increase the interest of work diagrams of algorithms in the system are represented with the use of various showing metaphors. During edition and performance of instructions sounds and animation are widely employed. This has done, activity on developing and debugging the programme outwardly reminds a game. The accumulated experience of work with complex PIFAGOR of children, beginning from 5-6 years old, shows, that they really perceive this work, as an interesting game. In the same environment the development of the other sufficiently complicated programme environments is implemented.

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TV-COMPUTES INFORMATION TECHNOLOGIES AND DISTANCE EDUCATION

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Permanent improvement of information technologies results in the growing number of higher educational establishments using these technologies in the process of teaching. Alongside the computer technologies, TV-computer information technologies are being increasingly applied of late, using extensively TV means of data transformation and transmission.

In this communication the findings and experience of Tomsk Academy of Computer-Based Management Systems and Radioelectronics (TASUR, Russia) in this area, as applied essentially to distance education, are set out.

The technical facilities for distance education at TASUR include:

- Corporate Computer Network of the Academy «CCN-TASUR» [information and communication units in three academic buildings, local computer networks (LCN) in these buildings, local computer networks and distant terminals of the academy branches];
- TV-computer system with equipment for putting together and transmission of «Tele-text» programmes and of computer data via TV communication channels;
- transceiver complex of satellite television.

The primary component of «CCN-TASUR» are information-communication units, providing for integration of the local network subdivisions into a universal information space and serving as a gate to «CCN-TASUR» and global networks. Every unit has a file server managed by OS Novell Netware 3.12; a communication UNIX-system managed by OS UNIXFreeBSD 2.0.5; teaching UNIX-systems managed by SCO UNIX.

A communication UNIX-system provides for interaction of «CCN-TASUR» units among themselves and with the units of other networks, and functions as a gate between LCN of each building and other networks having access to Internet.

In addition to the listed functions, one of the information-communication units secures the functions of external interaction with other networks. The unit has a modem for remote access through switched communication lines; marked channels of ucban information medium; IP-channel for Novosibirsk and Moscow; «Iceberg» equipment of «Inmarsat» system with a telephone satellite communication channel; a unit of international non-commercial network FIDO. Communication between information-communication units is arranged in three options that duplicate one another: via a marked telephone communication channel through short modems based on a family of TCP/IP protocols; via a radio channel, at a speed of 10 MB/s; via switched telephone communication channels, using standard Hays-modems on the basis of the UUCP protocol.

The internal LCN network infrastructure comprises two levels: inter-server segments of the local network connect the servers of subdivisions and of the departments network class-rooms. All local networks of an academic building are based on Internet and support IPX/SPX and TCP/IP protocols.

At present, there are 25 local sub-networks of «CCN-TASUR», the operating stations being equal to around 320.

Now that a platform of technical programmes for a multitude of information resources to back the teaching process is created these can be used effectively on a large scale to meet the requirements of the teaching process, in particular, to organize distance education. The following facilities are available, among other things, to the user of local networks (providing access is properly authorised):

- access to all file- and UNIX-servers in LCN;
- work with electronic mail (local, within an academic building, and global);
- operation through Internet and FIDO gates;
- using ETELNET protocol to connect a distant terminal with any UNIX system within the local network or in Internet;
- operation in FTP mode: to be able to exchange information (data files) with subscribers having access to Internet;
- operating NET BBS as a convenient means of organising a paper-free training process technology;
- using a multimedia distributed reference system based on a WWW-server.

If the end users have an adequate supply of hardware and software resources, WWW-technology is an excellent structural nucleus of the distance education system as it exceeds quantitative and qualitative characteristics of BBS.

External (relative to LCN) electronic communications available to remote subscribers in the distance education system may be divided into three categories:

- those using Internet capability and protocols (telnet, ftp, WWW, Net BBS);
- those using FIDO-NET network mail;
- those using direct modem connections via switched telecom lines (backing of the UUCP protocol).

The choice of one of the options of an electronic communication channel is made by the student, depending on his technical capability, while the potential of TASUR communication units make it possible to maintain all the aforesaid categories of communication on the basis of equipment available. In terms of the diversity of capabilities and accessibility of all protocols and communication technologies (including WWW), work to IP protocols is preferable. Once a subscriber has an access to the presumably free FIDO network, he can use FIDO E-mail facility to exchange information with the teaching institution over any distance. Using a direct modem connection, the user is free to work with a network training BBS, engaging its modem input, and has a reference system at his disposal, along with a possibility of dual transmission of data files.

Transmission and reception of educational information in the system of distance education, using air and cable television, constitutes a relatively independent use of this technology. In this case, a student may have access to information on teaching programmes when it is broadcast via telephone networks in a desired mode, via air television in the form of particular tele-text programmes transmitted together with ordinary tele-programmes or in the form of video films. The use of a conventional TV-set connected with a source of information being part of an information-communication unit, makes it possible to produce an interactive mode enabling a student to communicate with data and knowledge bases, which become optionally accessible through a feedback in the system.

System configuration comprises equipment for putting together and transmitting a tele-text programme and computer data, a local computer network, an editing video studio, a computer graphics studio to produce and broadcast multimedia programmes in the «Invision» mode, TV cameras for recording and archiving fragments of training courses, and a network of TV-sets with a system capable of receiving additional textual information of tele-text type. Information may be transmitted to subscribers' TV-sets either via a cable network or in an air broadcasting mode (with feedback via telephone channels).

The system integrates the strong aspects of television, computer engineering and up-to-date methods of teaching, and provides for the following functions of distance education:

- regular educational TV broadcasts for schoolchildren, students and for self-education, using the bank of video materials available in Russia;
- holding preparatory extra-mural video course for those willing to enter institutions of higher education;
- holding discussion, advertising-information and other TV programmes on scientific and educational issues;
- putting together and broadcasting reference, methodological and scientific-educational information blocs for population and organisations over the «Tele-text» channel.

At present, in Tomsk, TASUR specialists, in association with an independent TV company «TV-2» have launched an UHF-band TV channel (22nd channel). On the basis of this channel, an equipment-and-software complex has been developed to transmit additional information (tele-text programmes and computer data) via television communication channels. Since early 1995, transmitting equipment has been operated on two Tomsk TV channels. The complex in question transmits the data at a speed of up to 100 kb/s.

The transceiver satellite TV station provides for reception and transmission of a television signal from satellites with geo-stationary orbits. It comprises a very sensitive receiver, a 1.5 kW radio transmitter and a parabolic antenna of 4.5 m in diameter.

The system of distance education combines the basic principles and approaches of extra-mural education with elements of day-time education. Emphasis is placed on independent study of subjects by the trainees. However, for all the apparent similarity, the proposed training technology is fundamentally different from extra-mural education. This is manifest in that the user is in a position to maintain permanent contact with an institution of higher learning, to consult a lecturer quickly should a problem develop, whereas the lecturer can, anytime, monitor the results of trainee's independent study.

Here, two major problems of organizing the training process should be distinguished: institutional and methodological.

Institutional problems consist in synthesis of the specific system of following up the performance of trainees, in synthesis of the structure and algorithms of distance education functioning, providing the most optimum conditions for the trainees as well as for the lecturers. Of crucial importance here are matters of administration which stipulate the performance of functions aimed at reliable and efficient distance education.

The methodological problems of distance education organizing comprise the development of information technologies, performance of teaching process and creation of corresponding information resources. For these purposes, TASUR has developed a workbench system [hereinafter referred to as FEYA ('Fairy')], intended to produce all kinds of teaching software (TS): computer text-books, practical courses, tests, examiners, etc.

The system's functional structure includes:

- vector-type graphics editor for entering and editing graphic teaching information with a possibility to include pictures of PIC and PCX formats;
- paragraph text editor, working in a graphic mode, with a possibility to change paragraph position and size, line space, word font and colour, to format a paragraph, to import text files produced by other editors;
- menu editor;
- editor for producing questions and entering benchmarks;
- editor for management entities designed to organize all kinds of cycles and transitions, depending on trainee responses or a choice in the menu;
- music editor;
- configuration programme;
- executing model.

In terms of methods of teaching, TS in the «FEYA» system is a combination of interrelated frames. Each frame consists of a fixed set of entities: graphic, musical, management, etc. (in all, nearly 80 types of entities).

The aforesaid technology of TS development has been adopted at TASUR and has been transferred for adoption to a number of institutions of higher learning in Tomsk, Novosibirsk, Krasnoyarsk, Abakan.

The results presented in the article determine only the initial stage of adopting TV-computer technologies in support of distance education. In our view, the following are priority areas of further research: adoption and adaptation of WWW and BBS technologies for distant access to information resources and programmed systems in support of the teaching process; increasing the rate of «Tele-text» programmes transmission; development of institutional-and-methodological aspects of organizing RE, of building up information resources in particular areas of training, trades, subjects.

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VIRTUAL REALITY SYSTEM IN EDUCATION: DIDACTIC PROBLEMS, PROSPECTS OF APPLICATION

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The virtual reality is a new technology non-contact informative interaction, realizing by means of a complex multimedia-operational media the illusion of a direct entering in real time and presence, concerning with stereoscopic «screen world». The non-contact technology of information interaction, realized by the system «virtual reality», makes it possible for computer to reflect in digital form the pulses from «information globe» («interface-globe») and «information suit». A user can, figuratively speaking, make «a step» directly to virtual world, if «information suit», «information gloves» and «informative spectacles» with firmware spectroscopic screen (spectacles-telemonitors) are available.

Just now the capability of «virtual reality» systems are used for training of sportsmen, for preparation of future specialists in airspace, architecture, medical diagnostics, for arranging the entertainment and a rest, and, also, in areas, using a scientific visualization (for formation of illusion of actually conducted medical operation).

The basic components of a typical system «virtual reality» are follows:

- the enumeration's or lists of objects, forming a virtual world, in a subsystem of creation and management of objects of virtual world;
- a subsystem, recognizing and estimating the state of objects and creating permanently the picture of user's «location» relatively to virtual world objects;
- head-installation display (glasses-terminators) with continuously shagging pictures of virtual world «events»;
- a device with manual control, arranged in a form of an «informative globe» or a «space ball», indicating the direction of user's «isplacement» regarding to virtual world objects;
- a device for sound formation and transmission.

The contact of user with a system «virtual reality» can be realized by voice or with a special device-joystick, providing a feedback as well as with the glasses-terminators. Separately, let us observe the last devices, since an audio communication is not new, in principle, and is used for a long period of time. This should be noted, that the reaction in the system «virtual reality», to audio signal, received from user, is reduced in accordance with prescribed program.

The device joystick causes the effect of force-feedback communication, and «interface-glove» enables gesture contacts, converting each movement of hand into an electric signal, which are perceived and decoded by means of a computer. For example, while manipulating by fingers in «informational glove» in front of a screen, one can move the objects on screen. Moreover, it is possible to «enter» into virtual world of screen, removing, replacing and touching the objects, depicted on a screen. Thus, for instance, one can feel sphericity of a globe, an illusion of grasping an object, depicted on a screen, «sense a weight» of this object. The glasses tele-monitors provide a stereoscopic vision of screen representation of virtual world. The modern system «Virtual reality» usually ensures the creation of various «pictures» for each eye. Under some displacement the user is able to «overview» by all means of tele-monitor the whole stereoscopically presented «picture» of virtual world.

The special «informative suit» is used for a perfect, polyhedral and multifunctional, non-contact interaction of user with the virtual world. It should be noted, that software realization of «Virtual reality» has different variants. Schematically, the presented above description is a one of possible.

At present time, three approaches can be singled out for a realization of user's interaction with the objects of virtual world formed by a system «Virtual reality».

The first approach realizes the idea of «immersion» into virtual world. Therefore; figuratively speaking, a user, dressed in informative «space suit», «enters» in digital universe. Manipulating with a «informative glove», he directly interacts of virtual world, represented on a screen, «moves» or vflies» in side it, in fact, with synchronous audio background.

The second approach provides a window presentation of three-dimensional space of virtual world on a computer screen. Therewith as a means of control the devices of a type of «space-ball» or «flying mouse» are used a significant degree of freedom.

The third approach realises an interaction with the objects of virtual world through the «third person», presented by a moving image on a screen (for example, in a form of some drawing), and identified with a user himself. Therewith the actions of a third person are controlled by a user, as if finding his image on a screen. All these approaches realize the main idea of informative interaction, enabled by a system «Virtual reality». This idea consists of providing, firstly, of a direct user's participation in the events, taking place in virtual world, but acquiring in real time, and, secondly, with maximum distance of interface between user and a computer.

The realization of mentioned above possibilities allows to create a principally new level of informative-subject medium of «immersion» into three-dimensional, stereoscopically presented «Virtual reality», providing the following:

- modelling the senses of direct user's contact with objects virtual reality (to see, to hear, to touch by hand);
- non-contact user's control with objects or processes virtual reality;
- imitation of reality - the effect of a direct participation in processes, taking place on a screen, or influence of their modification and functioning;
- interaction with objects or processes, having their image on the screen, the realisation of which is impossible in actuality.

The capabilities of a system «Virtual reality» through realization and introduction of special methods of «imbedding» of training technologies into subject-oriented training media allows to realize a teaching affect of longitudinal character, providing the following:

- the development of visual-mapped, visual-active, inductive, creative, theoretical thinking;
- the formation of aesthetic tasks, evaluations, promoting to aesthetic education.

The use of system «Virtual reality» opens new methodical possibilities along with formation process:

- skills and habits of subject world projection;
- skills and habits of artistic activity - «activity», along which an artistic composition is originated and accepted;
- abstract images and meaning, presenting to a learner an instrument of modelling of studied objects, phenomena as environment, and of those, which are unproduceable in reality.

The realization of capabilities of «Virtual reality» system is combined by the level of software development, created for functioning of «virtual worlds», and capabilities of instruments.

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NEW INFORMATION TECHNOLOGIES IN TEACHING: A PSYCHO-PHYSIOLOGICAL APPROACH

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The main directions of a psycho-physiological approach to application of new information technologies (NIT) during teaching are:

1. Improving the efficiency of training owing to creation of optimal functional states, enhancing the faculty of brain for mastering information - i.e. a psycho-physiologically-oriented teaching. It is based on employment of known neuro-physiological mechanisms, being the foundation of processing the information by brain, thus providing the more complete realisation of brain potentialities for training. Just the computer technologies create the basis for introduction of similar training methods due to opportunity of using a computer during a session of interactive training besides implementation of the main training task in the background mode for solving the problem of controlling the functional state of a trained person and for individual physiologically-substantiated measuring of information load depending on this state.

This work cover the following two methods of psycho-physiologically-oriented training:

a. formation of artificial sensitive periods (ASP) for improving the efficiency of mastering information during training of adults, juveniles and children of older age groups (using the phenomenon of hypermnesia, creating the motivation for mastering knowledge);

b. controlling the formation of mental strategies for accelerating the intellectual development (developing training), when training children of younger age groups (using the laws of age maturing of the functional asymmetry of cerebral hemispheres).

2. Neutralization of the adverse affect of NIT on the trained person. In particular, when using NIT during training of children - preventing of their possible adverse affect on formation of the functional asymmetry of cerebral hemispheres and mental development of a child.

Owing to their purposeful effect on dynamics of inter-hemisphere relations the described training methods (a, b) help also in solving this problem.

I. FORMATION OF ARTIFICIAL SENSITIVE PERIODS ON THE BASIS OF VIRTUAL REALITY TECHNOLOGIES

On of proposed methods for improving the efficiency of training with NIT applied is modelling of natural functional states, appearing in definite age periods and connected with improved ability for perception and storage of information - so called sensitive periods or periods of increased sensitivity for development of certain mental functions.

In earlier work (Sandomirsky M.E., Belogorodsky L.S., 1996) we shown connection of age dynamics of sensitive periods with stages of ontogenesis of the functional asymmetry of hemispheres, allowing to form NIT with the aid of physiological age regression, i.e. to recreate the inter-hemisphere relations peculiar to younger age periods, in particular, with activation of the subdominant hemisphere. In this case, reproduction of the functional state, returning the brain to previous stages of its ontogenesis, i. e. to physiological age regression, improves the efficiency of mastering information, activating «early setting for training» (M. Erikson, E. Rossi, 1995), formed in childhood. In similar state the incoming information is assessed by brain as a statistically rare and high-information one, being of great importance for organism, and the efficiency of its storage is, respectively, increased. Temporary change of brain to the functional state, peculiar to younger age period is considered, on one hand, as an artificially crated period of sensitivity and, on the other hand, as the changed state of consciousness (CSC). Passing through the similar state is the obligatory condition of efficient training [it is considered that in principal any mastering of material during training is implemented in short-time periods of CSC (S.Heller, T.h. Steele, 1987)].

State close to described aoove can be formed spontaneously in the course of the man-computer dialog, *creating the background state of readiness for transition* to CSC or the superficial CSC. Correspondingly, on the basis of these states the «utilitarian» CSC can be formed for improving the mastering of training material. To prove this thesis, first list the basic factors of CSC induction:

- concentration of attention;
- *artificial organization of a sensor environment, breaking* usual stereotypes of perception (including sensor deprivation and sensor overload);
- paradoxical content of incoming information, bringing to forced refusal from thinking stereotypes, when during search of problem solution the logical way does not lead to the proper results; thinking procedure, going on the sub-consciousness level, are respectively activated.

What factors from those, favouring the cause of CSC, take place in using computer information technologies during training? When discussing this problem, it is necessary to select two classes of problems, occurring during operation on a computer, which require either (I) standardized activity - mainly of operator type, connected with working-out of senso-motor operator skills (keeping of attention, rate of response) or storage of routine information; or (II) original activity - analytic work as well as solving of creative problems.

It is clear, that all three factors of CSC induction arise naturally in the course of man operation with computer. First, it is the factor of concentration of attention and also artificial organization of sensor environment - either elements of sensor deprivation (motionless pose, fixation of sight, sensor monotony), or (more often) sensor overload. In so doing, in problems of I type continuous concentration of attention is achieved owing to continuous change of situation, while in problems of II type concentration of attention in linked with the third factor of CSC induction. In this case, the latter occurs in the form of stressed intellectual activity, especially in case of troubleshooting or available discrepancies (cognitive dissonance according to L.Festinger).

The above-described data results in the fact, that in case of using NIT during training we can often observe during man-computer dialog the spontaneous development of CSC, in a number of cases sufficiently deep and intensively felt. In this case, User may not interrupt his work on computer for many hours. If we consider the extreme displays then lovers of computer games can be a well-known example for problems of I type and programmers-«hackers» - example of problems of II type. On one hand, arising of such states visually demonstrates the possibility of intensive effect of NIT on the functional state of man, including the state of consciousness; on the other hand, practical employment of similar spontaneous non-controlled CSC for intensification of training seems impossible.

At the same time it is obvious, that, using technical potentialities of computer (especially multimedia) in the course of interaction of man with computer, one can organize the information flow, acting on man in such a way, that to maximise the specified factors of GSC induction. Thus, controlled CSC can be formed and used during training for improving its efficiency. For this purpose, it is expedient to use, parallel to feed of training materials, the technology of programmable rhythmic audio-visual stimulation on the basis of multimedia facilities, presenting a variety of virtual reality technologies. The essence of method consists in synchronization of endogenic biorhythms with rhythmic variation of an external input signal, thereby implementing their modulation. It enables to carry out the purposeful formation of both frequency and space pattern of brain bio-electric activity, thus allowing reproducing specific functional states - ASP, required during training and optimal from the point of view of its efficiency. It is advisable to perform the diagnostics of these states and the physiological inspection of their running either by monitoring the EEG or by carrying out the statistical analysis of heart rhythm and, firstly, its spectral characteristics (N.N. Danilova, 1992). According to monitoring data this procedure includes not only inspection of CSC depth, but also operative •measuring of information load in the on-line mode. The indicator of the depth of created CSC and corresponding ASP in monitoring the bio-electric activity of brain is dynamics of the functional asymmetry of hemispheres, undergoing a number of stage changes in order, inverse to order of its formation in ontogenesis:

1. Offset of activity focus within the hemisphere, accompanied by change of the leading perception modality or the representative system, including transition to rarely used «displaced» systems.
2. Inversion of the functional asymmetry with activation of the subdominant hemisphere.
3. Levelling of the functional asymmetry with smoothing of inter-hemisphere differences.

II. STIMULATION OF INTELLECTUAL DEVELOPMENT BY INDUCTION OF MENTAL STRATEGIES

From positions of a psycho-physiological approach individual differences in methods of processing and mastering information during training are based on preferable mental strategies, formed in the course of ontogenesis (M.E. Sandomirsky, L.S. Belogorodsky, 1996). The mental strategy can be considered as a system of priorities of activating different brain zones, characterised by a specific information processing method, determining the priority of including them into procedure of its processing (Sandomirsky M.E., 1995). Application of NIT during training for children of young school age can, on one hand, allow us to accelerate the maturing of strategies and, on the other hand, enhance the intellectual potential in subsequent age period. The latter is possible owing to mastering of related strategies together with a basic individual-typological strategy. In case of usual running of the age development process the individual-typological strategy, formed in the school age, is often a single one, while the related (alternative) strategies are simply inaccessible. In some sense, the leading formation of mental strategies is equivalent to solving the problem «how to teach learning». Accelerating the formation of strategies can be provided by employing the method of purposeful working-out of mechanisms for random inspection of cerebral activity patterns with the aid of adaptive bio-control (ABC).

At the initial stage the method proposes to conduct procedures ABC, first employing the visual channel on the basis of showing pictures of spatial distribution of electric activity of brain. Working-out of strategies includes several stages.

1. Creation of basic functional states considered as strategy elements. For this purpose, a habit of arbitrary bio-control for electric activity of brain (static mode) is elaborated for a trained person with creation of a stationary activity in the specified cortical zone. Every basic state should be connected with definite stimuli - «armatures» of different modality, poly-sensor ones being desired (which activate the right-hemisphere mechanisms of perception). At first, an external stimulus is used, then - with the automation of habit - transition to endogenic stimuli (visual, audial, kinaesthetic) takes place. One can say about generation of sensor-neuro-dynamic associations, deflecting connection of certain signals with internal states of brain (according to N.N. Vasilevsky, 1970). As practice shows, the adaptive bio-control helps to achieve stable reorganization of EEG-activity patterns and, respectively, the random inspection of definite functional states, the similar training of children running quicker and bringing to more stable results.
2. Creation of complex functional states on the basis of 4-element combinations of a set of basic states - movement of a focus of maximal cortical activity in the specified sequence. Teaching the habit of arbitrary switching, alternation of a definite combination of basic functional states - first, in 2-step, and then in 4-step sequence - practically presents the mastering of the mental strategy, corresponding to the given combination of them (at all 16 alternatives of individual-typological strategies are considered).
3. Interiorization of habit, elaborated in item 2, i.e. formation of ability for independent reproduction of the complex functional state (strategy) in different situations, not based on hardware components, ensuring ABC.
4. Practical development of habits for using strategy during mastering of training material and solution of training tasks.

III. NEUTRALISATION OF ADVERSE AFFECT OF NIT ON DEVELOPMENT OF TRAINED PERSON

When we say about negative moments of applying NIT during training, especially during work with children, it is necessary to mention about potentially adverse affect of computerized training not only on the current functional state of a child (action of electromagnetic fields, visual fatigue, monotony, hypo-dynamics), but also on its mental development.

It is known, that intensive and long-term studies of child with computer, connected with predominance of logic left-hemisphere method of information processing, are thus linked with preferential formation of habits of left hemisphere. The latter can lead to unbalanced formation of the functional asymmetry of hemispheres owing to one-sided development of habits of the left hemisphere to the detriment of right-hemisphere ones, and consequently to one-sided and non-harmonious development of child psychics, to deformation of its development, appearing, in particular, as a deficiency of commutative habits, auticity. On our opinion, application of specified methods for controlling the functional state of a trained person in the course of training procedure with NIT employed, in particular creation of states, connected with activation of right hemisphere (ASP), can not only provide the improvement of the training efficiency, but help to overcome possible negative psychological aspects of training computerisation. The latter is the subject of further investigations.

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THE TEACHER AND NEW INFORMATION TECHNOLOGIES. NATIONAL AND REGIONAL ASPECTS

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The approach to the information technologies (IT) use in Moscow region schools is described in the report, meaning precisely that teachers are the key factor for educational changes, and which should realize all advantages of information technologies.

At present time Russian regions are responsible for financing of educational system and for some extent, for basis curricula. The Moscow city stays in favourable position owing to persistence and sequence of its authority. The Moscow Committee of Education supports the wide variety of educational systems in scope of the fact that schools have to adhere to a number of federal and regional limitations and norms. Moscow standards of education are under elaboration now: they are structured like hyper-structure of knowledge and minimal requirements. To recent days the Moscow region occupied the leading position in Russia regarding not to the extent of schools fitting out with technological means, but to a real involvement of teachers into educational process.

Ten years ago the mandatory training subject «Informatics and computing» was introduced (with participation of the reporter) to all Soviet schools. At the time the basic concepts were embedded for next decade. And also from the beginning it was declared on the existing of three branches of school informatics. These are the mathematical informatics, the study of information technologies and application of information technologies in educational activity for other school disciplines.

In Moscow standards of education, which are now under elaboration, the theoretical informatics is being combined with mathematics, and information technologies enter in educational area «Technology», filling more than 50 % of its training time (2 hours per week for 1- 9 forms, 3 hours/ week for 10-th form) and can be introduced additionally in regional, school and personal component.

The educational area «Technology» is organized by module principle. As a rule, each module shows to pupils the range of practical use of the studied content in terms of modem and future actuality, considering it as a part of cultural inheritance and also the ways of its utilization in study of other school subjects, fulfilment of training projects and, at last, as an educational technology (compositions and text editing, arranging and filling the data bases, creation and presentation of hyper-textual structures, scientific observations, data collection, conducting experiments, communication and mass-media). At the same time many of modules were oriented on formation of general concepts (such as, for example, tool, friction, assembling - dismantling, classification, understanding of main types of formation and its search; activity planning and cooperation; aesthetic, ecological and economical aspects of technology). As for information technologies, they especially readily enter in such new Russian school-training subjects as *«Citizenship Studing»* and *«Moscow Studing»*. According to the projected approach the children interview the members of .their families, old residents, chiefs and then decode, edit and resume texts, thus, it easy to understand, what is the difference between such kind of educational activity and standard dictations and presentations.

Today Moscow schools are equipped not only with computers (on the basis of INTEL and Apple plus the obsolete old Soviet machines), but the information medium is created there, integrating all types of information: digital data, text, graphic, audio, video, system input devices (cameras, microphones, scanners, sensors, transducers and so on) and system output devices (monitors, copy-mashies, printers, head phones, synthesisers and so on); designers sets (LEGO), modems. The unique computerized apparatus are used for operative observation after pupils' health. To raise its technological instrumentation, a school makes a substantiated application, which, in fact, helps a staff to understand better their own aims and the ways to them. The application is inspected by the Expert Council on new technologies under the Committee of Education.

Now computers are not locked beyond iron doors being in power of only one teacher of informatics. They are used by teachers of other subjects, school administrators, and librarians. A teacher needs to know that in this case the main necessary skill is to master the blind method of printing. The important organizational scheme of information technology introduction into the net of various subjects is based on co-operation of the two teachers: of definite subject and technology. Working together they present to pupils the opportunity to master the technology as a subject and to apply it right on-the-spot.

The intellectual potential of former soviet academic, applied, military and industrial sciences is Russian tradition of direct participation of famous scientists in school development (well-known example of A. Kolmogorov). The Institute of New Technologies for Education (INT) established by Moscow Committee of Education, is an organization, co-ordinating this process. The examples of other structures, representing the same potential, are the magazine «Chemistry and Life», Interdisciplinary correspondence School, Moscow Institute of qualification upgrading of educational workers, responsible for retraining of teachers and providing the technological support.

The various combinations of instrumental and software means permit to form the training and developing media of most different destination. Thus, the universal design, introducing a child into a sphere of material design, is a LEGO, while into a computer design is a LOGO. The most mass in the world training software, adapted by INT to Russian school, is product - LOGO that is most popular in Russia. Among most recent LOGO-versions the Russian schools use *LogoMiry*. Recently INT had completed the elaboration of FirstLogo - *Logo* without words. This Logo version, connected directly with *LogoMiry*, shows an excellent property - one can use it, being unable to read and to write, even knowing no alphabet. On the contrary children, when using it, master an alphabet, digital and algorithmic competence. Among other INT that are developments in theoretic informatics are the following: «Algorithmics» is a textbook and problem book for 5-8 forms, approved by Minister of Education of RF; «Mathematics and Language» is a faculty course for junior school and kindergarten. The software now in school use also includes the general applied packs of common use, such as «computer designer sets» («Live Geometry», «Live Physics»), mighty combinations of two those families - Logo (*LogoMiry* and FirstLogo), hyper-encyclopaedia on CD-ROM and the access to Internet sources. We treat Internet, first of all, as a form of alternative and non-formal training. At the same time Internet can become an instrument, assisting the pupils to collect research data for international training projects; to participate in routine teleconferences for students and instructors, devoted to one or another school subjects and delivered by world-wide known scientists. Along with such course of events some students can act as expert - consultant on one or another theme in their school. The strategy of information technologies introduction into education uses also the meaning of «zone of nearest evolution» for school (Vygodskie's metaphor) and building up a community of teachers and instructors, exemplified by the Moscow Club of teachers «Technology».

In such educational situation the importance of the teacher significantly increases and his role changes. Now during the curricula he can play the role not only of a person who knows how to answer the questions and who evaluates students' knowledge but also the role of a scientist - this role we offer to the students -the person who is like a baby always ready to investigate surrounding World.

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OPEN «EDUCATIONAL ARCHITECTURE» FOR THE INFORMATION-AGE SCHOOL

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As in many. other countries, schools in Russia are in the process of deep transformation caused by intensive informatization of the economy and society's life generally. The continuing informatization of education implies serious changes in the substance of the methods and organizational forms of general secondary education at a stage when the school is learning to live in an information society. Giving an outline of the situation, one may say that there has begun practical transition from education against the background of limited access to information to education against the background of unlimited access to information.

In the context of advancing information society, global control over access to information is unfeasible. Free access to the entire wealth of information amassed by mankind is an inalienable right of every citizen. This right is not merely declared but is practically supported by the modern electronic information means, computers, the Internet global infrastructure. To teach the children to live and work with confidence in this ever-changing environment is a new challenge to the secondary school. And this means that the teaching methods and forms should be constantly changing to the extent to which they contain the elements of the new substance of education.

The updated substance of education with the computer equipment supporting this process is becoming the foundation of all «new-generation school curricula» which should be offered to the modem schoolchildren, these future citizens of information society. However, it is not always realized that the principal brake on this process is the long-established organization of secondary education, the traditionally rigid «architecture of teaching».

Obviously, the school has no other alternative than to radically revise the substance, methods and organizational forms of teaching, to introduce new information technologies as the chief instrument of the change of the information environment inside the school itself, to adopt an open «teaching architecture», and to gain an awareness of itself as a participant in the global educational process. These tasks have already acquired a practical aspect. It is necessary to show the ways of creating an open «teaching architecture» which would naturally integrate all the information technologies applicable in secondary education; of helping schoolteachers to discard the methods typical of the closed «teaching architecture» and purposefully learn to employ the whole range of the methodological and information means offered by an open «teaching architecture».

Such an attempt was made within the framework of the research project «*The World Around Us*» [3]. Developed as a result of a three-year teaching experiment, the course «Natural Sciences-5» (NS-5) is an example of how a subject long-established on the school curricula was adapted with a view to preparing schoolchildren for life in information society. NS-5 was to replace the «Nature Studies» course, which forms part of the fifth-graders' general secondary school curriculum [4]. The new course is based on:

- the experience of teaching the natural scientific disciplines and using the «research» approach in education accumulated in Russian schools;
- international experience in drafting curricula for the 21st-century school;
- original programs for the use of computers, training programs and telecommunication means in secondary education.

The overall purpose of the course is to introduce schoolchildren to the natural scientific research methods. Laboratory and computer classes, homework and participation in conferences familiarize the students with the basics of the practical work of a natural scientist who uses the relevant methodology, has mastered the techniques of observation and of analysis and presentation of its results, and who is a productive member of the scientific community.

NS-5 was conceived as an integrated course, which is why the traditional narrow, subject-related approach is unproductive here. The integrating basis of the course is constituted by the natural scientific approach to the study of the phenomena of the outside world. Observations (including instrumental ones) of natural phenomena, their description, comparison of the obtained results and their discussion and summarization, as well as setting the tasks for the next series of observations constitute the methodological carcass of the repeated procedure performed by schoolchildren using a variety of materials. Analytical skills, practical skills in the use of different instruments and appliances (including the computer), and the habit of group work implying the members' positive interdependence are some of the expected results of this educational effort.

Over 85 % of the time is allocated to the students' independent laboratory and computer work. Each student builds his own idea and knowledge of the examined subject through personal work experience. «Collective» knowledge is generated and formalized as a result of «personal collectivization experience» stemming from communication (joint activity) with the other participants of this process.

The course is structured as a sequence of «research projects», with each following naturally out of the previous one. The materials' electronic format makes it possible to compare notes on the results through a computer network and incorporation of these results into databases. The computer network is used as a «storage facility», a source of training materials, and as an environment for organizing the collaboration of students and teachers. There is no textbook for the NS-5 course in the traditional sense. Whenever necessary, the students search for information in the «network encyclopaedia» which contains a superfluous volume of relevant information.

Training videos are used as a source of information and a means of supporting the students' independent thinking and the teachers' exchange of experience (video filming during classes).

The main forms of the work are as follows: laboratory sessions; individual/collective observations and studies; drafting reports on the results of the observations and analysis performled at school and at home; work with information sources (above all, the network database); preparing and conducting student conferences. The computer is used very extensively for processing materials, preparing reports and for writing and dispatching electronic correspondence; for interacting with the partners in training telecommunications projects; for work with the network version of training materials (selection, reading, printout); for publishing purposes (materials of student conferences, wall newspapers, final collections of the students' works).

The predominant orientation toward practical work, the students intensive group work and the electronic format of the used information (both offered to the students and independently prepared by them) combined with access to information through the global computer network and collaboration with peers in other schools and cities determine a radical revision of the «teaching architecture». The students get the bulk of facts as texts for reading (computer training database), training videos shown during classes, or the teacher's suggestions and recommendations in the course of independent laboratory work.

The teacher's level of qualifications is the crucial factor of the secondary school system in conditions of superfluity of information resources. Experience shows that the key to an efficient use of the open teaching architecture is the substance, methods and organization of teacher training. One cannot expect a teacher to create and maintain conditions conducive to student research if he himself does not enjoy such work conditions. An open teaching architecture should also be used in the training of teachers and in the methodological support of their subsequent practical work. NS-5 makes provisions for retraining and operative support of teachers. The computer network is used as an instrument supporting the teacher in his/her workplace. The teachers' methodological support includes:

- detailed familiarization with the NS-5 course before it commences;
- operative methodological support of the teachers in their workplaces with the help of the computer network;
- regular (twice yearly) seminars during the first two or three years of work;
- changes and amendments in the course.

We see that NS-5 includes means of operative methodological support of the teachers, which enables them to make an efficient practical use of the new skills and methods of work learnt during the specially organized training that precedes the introduction of the new course at schools.

Built into the methodological system of NS-5 are student joint telecommunication projects and network monitoring of the teachers' performance, which is executed by the specialists who provided the primary training. Computer communication makes it possible to set up an «invisible club» of like-minded teachers, who solve similar tasks and keep in touch without leaving their workplaces.

Retraining and subsequent teaching of the NS-5 course implies that the teacher has a PC and an opportunity of distance access to the school computer network and Internet. Retraining uses such a form as collaboration groups; there comes into being a community of like-minded professionals, a favorable 'environment for an exchange of experience and methodological discoveries and for solution of practical problems that arise as the course is taught. This community is the foundation of a future association of teachers who use the NS-5 course in their work. Setting up courses with an open teaching architecture helps form a professional community of teachers who deal with professional issues openly and responsibly. Such an association could become an effective intermediary between teachers and the public education administrative bodies, and help secondary school make the transition to work in the conditions of information society.

Today as never before it is clear that the time has come for serious international projects for developing methodological support for and standard modules of global education in the emerging global information society.

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TO TEACH AND TO LEARN AT A DISTANCE: EVOLUTION OF SERVICES AND RENEWAL OF TECHNOLOGIES

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There are important changes in distance education, connected with rapid evolution of technological means, available to both the learners and teachers. CNED strives to provide the pedagogical services, which should meet the demands of different society strata with due regard for educational level (from primary education through uninterrupted professional background and to University), geographical distribution and for cultural context.

Those services are developing according to tempo of technological transformations and technique equipment of social and cultural spheres. At present time CNED advocates the combination of technological and pedagogical means, depending:

- *on the services offered: information, tutorial guidance, estimation, control;*
- *on definite society strata: localization; cultural, social, economical aspects; educational standard;*
- *on a number of people, involved in the same mode of background (from several dozens to several thousands, depending on the mode).*

Although the «Electronic Campus» Project of CNED corresponds, even partially, to harmonization of pedagogical services in the framework of Programme Turnpikes of information», now there is no the universal technical mechanism, identifying the features of different languages and technologies (technical mechanisms - the vectors of multimedia language, based on the appropriate symbolic representations), with possibility for interchangeable use, various rules of permutations. In this sense the two large spheres of pedagogical services in CNED are mentioned below, complemented with appropriate, will elaborated or under experimental test, technical habits: communication area, independent work area.

1. COMMUNICATION MEANS FOR TEACHERS

Presently there are several technologies, which are supposed to be used for pedagogical tasks:

On-line regime: interactive tele-transmissions and modes of communication, some modes of video-graphic communication (in a broad sense of a word), ensuring the collective work, create at distance the effect of presence. On this technique the communication between a teacher and a learner (or participants) become, more or less, individualized, more or less, personified. As the demands were determined the number of learners, their localization (the groups in special places, separate persons, combination of the direct and remote education, etc.) the technical equipment and its function may be varied.

For example:

- For large groups of learners: interactive tele-transmissions (VTI), that is the TV on general themes, during which the learners put questions directly from the place of TV course reception, that enhances a definite sense to the discussions, which are of interest to TV viewers. In this case the dialogue run on the type of «miracle»: in spite of the fact, that mass audience can't put questions to speakers, the evident questions, prepared beforehand, may arise all along a run of tele-transmission.
- For small groups of learners, located at different places: video-graphic communication is an actual remote course of lectures, in which a dialogue takes a significant room.
- Also a telephone..., in particular, for personal contacts.

But the use of on-line transmission, ensuring at some extent the "visual presence" of the participants, shall not result in coming back to restrictions, that are peculiar to our education. It is relatively easy to arrange a teleconference inside the educational institution when all learners and students are concentrated there. The difficulties can rise on attempt to arrange it in the framework of remote training, when the learners and participants are situated at different places with noticeable difficulties, but not only.

Off-line regime: the means of video-graphic communication (Minitel, Internet etc.) and all appropriate services, e-mail, forums, dialogue courses, meet excellently the requirements of requirements of distance training. They allow to arrange a learner's training with a speed, which suits him; to ensure the interpersonal communication, to present the "peripheral pedagogical" services: the discussions at distance between learners from the same background process or between teachers, while applying both the direct forums on experience exchange and virtual "professor" training. CNED disposes with a significant experience in this area, using the possibility of Minitel: now this means of video-graphic communication is gaining acceptance among users more widely, than Internet. Some aspects of human nature, tied with this mode of communication, are well known and are useful for the transmission of Minitel services to other types of network.

2. MEANS OF OPERATION IN LOCAL REGIME AND MIXED DEVICES

CNED produces some means of EAO (Education Assistant Ordinary) on diskette or CD-ROM, inside its system or in combination. But it cares of external production. Special CD-ROM, inside its system or in combination. But it cares of external production. Special CD-ROM for training or for mass users: can be applied for remote training, similar to direct training. But the medium of application can influence on conditions of pedagogical service utilization.

As to user, the area of knowledge generation and acquisition does not always prevail in significance for software, created by teachers. In fact the latter possess of a complete independence to fulfil other works by orders, for example, in the field of encyclopaedic topics. A context, within which the remote training is accomplished, can make less flexible organization of additional types of activity at distance and avoid a preliminary programming.

The Mixed devices combining the operation in local regime on the basis of special CD-ROM and ensuring direct and indirect communication with teacher, seems to be especially suitable for distance training. Thus, CNED tests the experimental arrangement of this type for language learning, when the learner operates in ordinary tempo, but under the control of interactive system, programmed in local regime, during which the multimedia link is added (audio recording of learner's product and remote leading of this product to teacher's receiver though ISDN network, while through Internet later).

Making experiment, generalization: ensure accessibility. CNED tests multimedia means and medium of their application for distance training. It also engaged with technological succession (from forums Minitel to Internet) and co-existence of the technical means, which can become necessary because of variety of audiences, equipment and cultural traditions.

The significant enlargement of a number of experimental arrangements is one of directions of CNED activity.

This work is closely bounded with a care to enable for learners an easy access to new means of information and communication technologies, to convert that, which is perceived sometimes as restriction, - the necessity of distance training - to a trump: that is to say that the training is realised at distance and should be conceived in a way to allow a learner mastering new technologies and to make his room in information society.

This care is expressed in thoughts, concerning to multimedia languages (compatible interfaces, transparency of information technologies, an attention to cultural aspect of multimedia system presentation: text, sound, image), and in search and development of access centres to pedagogical services CNED, based on utilization of technical means, where this access have also geographical, economical and cultural aspects.

New Technologies Department of General Directorate CNED

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MULTIKNOWLEDGE THROUGH MULTIMEDIA

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Fast changes of the market labour structure in Bulgaria that as a rule is difficult to predict make necessary the preparation of the experts, which on the one hand have high qualification, and on the other - ability for fast reorientation to some of the next areas. Experience of western countries shows, that it can be reached through interdisciplinary training in so-called virtual universities with participation of the highly skilled teachers from maximum educational institution with various structure - technical, economic and other. And in practice it is possible only with using the new, more effective methods and means for training, that now offers multimedia. Multimedia can and should be a subject of interdiscipline education, as, being the group of computer - integrated Media - text, diagrams, pictures, video, audio and other, it requires the group of knowledge - on computer engineering and technology, economy, pedagogic, psychology, art and etc. These sights are incorporated and in accepted Ministry of Education, Science and Technologies in beginning of 1996 Programme for introduction interactive multimedia at the system of education. The programme provides, that all this occurred stage by stage, and on THE FIRST STAGE multimedia will be basically OBJECT of STUDY, and on SECOND - MEANS FOR TRAINING.

The realization of this program began from study and critical analysis of another experience (see table 1). It was made the connection with German Union on Multimedia, uniting the majority from organizations engaged in this area was established. Through this Union contacts with the firms, that were busy with the preparation of the experts on multimedia and development multimedia products were carried out. The following large firms in Berlin were visited: Media Design GmbH; SAE Tehnologie Institute GmbH; Comhard GmbH; Pixelpark Multimedia Agentur GmbH; LuRaTech and Multimedia GmbH, from which first three are busy educational, and other industrial activity. Four kinds of the experts on multimedia are prepared: on informatics, managers, scenarists and producers; the duration of training depends on preliminary preparation of the candidates and proceeds from 3 till 12 months at average monthly rate about 1500 DM. There are developed multimedia products for education, for presentation, for entertainment and other, and their theme and quantity are determined from the market needs. There was ascertained, that in these firms as platform is used basically PENTIUM PC and only in rare cases - POWER MAC.

Except for the companies some high schools were visited in Berlin. They are as follows: Technische Fachhochschule; Fachhochschiile fur Technik und Wirtschaft; Technische Universitat; Freie Universitat; Humbold Universitat. The multi-media technology, in itself, is commonly studied at the first university of the above mentioned, and at the three others it is used only as a teaching mean. Such hardware, as PC and work-stations, meets these objectives.

The familiarization with the analogous methods and means was carried out in England at University of Plimouth and in Belgium at Interactive Multimedia Company in Brussels.

It resulted in the following conclusion. In those cases, when multi-media technology is considered as an object, PCs are used as a hardware, and on the contrary, when multi-media technology is considered as a subject, work-stations are used. The corresponding information can be found both in [3] and in great majority of special magazines on multi-media which are edited in Germany, UK and other countries of the West.

At the first stage of the above programme the work was continued according to the plan in the following directions:

- development of the plan and curricula on interactive multi-media technologies specialization,
- development of the curricula on interactive multi-media technologies for post-graduate training,
- discussion on the above the curricula and its approval,
- development of the course of lectures for the above curricula,
- development of the project on establishment of the training interactive multi-media laboratory,
- discussion of the above project and its approval,
- establishment of the laboratories (one lab for one university),
- development of the cycle of training exercises,
- the start of interactive multi-media training,
- analysis of the results and curricula improvement.

Now the interactive multi-media curriculum is being discussed which contains the issues as follows:

- scenario development,
- text objects development and editing,
- raster graphic objects development and editing,
- vector graphic objects development and editing,
- video-information recording and editing,
- audio-information recording and editing,
- production of multi-media product circulation,
- multi-media product recording and distribution,
- multi-media and PC-network technologies integration.

The project on multi-media training laboratory is also being discussed. Such a laboratory comprises development work places supplied by PCs, and, in doing so, each place is aimed at the development and editing of the only one multi-media mean. All PCs shall be both integrated in a local networks supplied by file-server and connected with global Internet. Such design of connections will significantly improve file exchange with other nets. According to the preliminary assessment, the cost of hardware and software for such a laboratory will not exceed $ 50,000. This sum can be almost halved in the case when the possibility for simplification of the network design is used. During the first work period Internet connection is not obligatory factor, the possibility for future connection with Internet shall be considered. The other way to reduce the cost is use the printers that are cheaper than laser one.

According to Ministry plan training curricula shall be aproved and two pilot laboratories shall be established in the technical universities of Sophia and Ruse up to the end this year, and in 1997 the training of the specialists and lecturers shall begin. The specialists shall master the methods for multi-media product development and the lecturers shall master the skills of implementation of the above products for teaching process. So, objective prepositions shall be gradually created for multi-media use as a teaching mean and later for virtual universities establishment.

Table 1

Multimedia authorizing systems	Company	Cost in DM	File format				
			Text	Graphics	Animation	Video	Audio
Authoware 3.0	Macromedia	10500	ASCII, RTF	BMP, DIB, EPS, PICT, PCX, RLE,TIF,WMF	CEL, FLC, Director 4.x-Filme, PICS	AVI, QT, MPEG	AIFF,PCM, WAV, IDI and CD-Audio
Book One 4.0	Paralax BV	5000	über Windows-Zwischenablage	PCX, TIF, MP	nein	AVI	WAV
Course Builder 4.2	Discovery Systems	4500	ASCII	PICT	nein	QT	SND
Director 4.04	Macromedia	2900	als Qrafik	BMP, DIB.WMF, EPS, PIC, PCT, PNT, GIF, TIF, Photo CD	FLC,FLI	AVI, QT	WAV, AIF
Eckermann	Octopus New Media Factory	900	ASCII, ANSI, Business-Version: HTML	BMP, DIB, PCX.TIF, GIF, PCD	FLI, FLC	AVI, MOV, Business - Version: MPEG	WAV, MID
Guide Author 4.0	InfoAccess	1380	ASCII, RTF, Word, Word Perfect, AmiPro	BMP, CGM, DXF, EPS, GIF, HPGL, JPEG.MSP, PCC, PCX,TIF,WMF	FLI, FLC, AAS	AVI	WAV
HyperCard 2.3	Apple Computer	220	k.A.	PICT	k. A.	QT	k.A.
Icon Author 6.01	AinnTech	9200	ASCII, RTF, FTT	BMP, CAL, CLP. ATT, CUT, DLX, DIB, EPS, FIF, GIF,GX, , ICA, ICO, IFF, IMG, JPEG,KFX, LV, MAC, MSP,PCD,PCX, PDS, PICT, RAS, RLE. WMF, TGA, TIF	FLC, FLI, AAS, AWM, AWA	AVI, AVS, MOV, PPG	CD-Audio, WAV, Midi
Media Objects	Oracle	1100	ASCII, RTF	BMP, PICT, PCX, TIF	nein	QT, MPEG I auf Set-Top-Boxen	AIFF, WAV
Media Shop 1.0	Motion Works	500	ASCII	BMP, DIB	Corel Move, FLC, FLI, MWF	AVI	WAV
Media Styler	APE Ptacek Engineering	800	TXT	BMP, TGA, PCX, WPG, TIF, GIF.JPG, EPSu.a.	FLI, FLC	QT, AVI, DVI, MPEG,M-JPEG	WAV, MID, VOC
Media Tool 1.2	Apple Computer	800	k. A.	PICT .	k.A.	QT	SND, AIFF, WAV
Multimedia ToolBook 3.0	Asymetrix	2100	TXT,RTF, ASCII	BMP, DIB, DXF, CGM, GIF, CDR, EPS, PIC.AI.JPG, TGA, PCT, PCX, TIF, DRW, CHT, CH3, SYM,	FLI, FLC, MMM	AVI, MOV, JPQ, MPG, PIC	WAV, MID, RMI
Optix Media Base 2.8	Computer Media Design	800	ASCII	BMP, TGA, PCX, GIF	FLI, FLC	AVI, MVI	WAV, VOC, SND, BYT
RSE-Author 1.0	Reitz Software Entwicklung	100	ANSI	BMP, TIF, GIF, PCX, JPEG	FLI, FLC	AVI, MPEG	WAV, MID. MOD
Supercard 2.5	Allegiant	800	k.A.	Pict, TIF, Mac Paint	k. A.	PICS	QT
TX Authoring	BYQ-Systems	9800	alle gängigen Formate	PCX, BMP, TIF, DIB	Director 4.0, FLI, FLC	AVI, MPEG	WAV, AIF

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HIGHER EDUCATION AND INFORMATION TECHNOLOGIES IN COURSE AND DIPLOMA DESIGNING

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The course and diploma designing is an important part in engineering education in high technical institutions.

The designing comprises concentrated expression of theoretical knowledge and practical skills, which students master during the education process. The significant sections of special disciplines are essentially devoted to various aspects of technical objects designing. Almost on each discipline design works are carried out during all training on almost all disciplines.

In great majority of the curricula on technical specialities during each semester the students carry out one or two course projects or course works, spending a lot of study hours on it. Thus each project not only serve for mastering of the studied material, but also for preparation to a following, more difficult, project. So, on younger grades of some technical specialities the designing is devoted to separate the elements of those systems, which are, as a whole, projected on senior grades. A final stage of the training process of an engineer comprises the development of graduate diploma project.

Designing of technical objects, as a rule, includes mechanical, thermal, air- and hydrodynamic, electromagnetic and the number of other calculations and it is terminated with technology development and construction design. Thus, the modern designing is so difficult and laborious that it is hardly possible to realise it without using of the means and the methods of automation.

Now the fulfilment of educational designing should be based not only upon deep knowledge of natural, general technical and special sciences, but also upon implementation of the information technologies. It is assumed the knowledge of the programming languages, skills of work with modem hardware, skill of applied software use.

The higher electromechanical education comprises studying of modern methods of automated designing of power systems and electromechanical converters (EC) included in their structure.

In Moscow State Aircraft Engineering Institute (Technical University) the works are conducted in the field of technologies for optimum designing EC of independent power systems. Thus, that the most promising direction of automated designing is a systematic detaied research of project variants before the development of design and production forms and records consideration for difficult non-linear and dynamic operation modes.

The authors have developed the technology for automation of EC optimal designing, including the development of a programme complex of preliminary automated designing and applications of NASTRAN and EMAS powerful software packages for profound studying of the project. This technology was developed with the purpose of implementation in the course and diploma designing.

The technology of EC designing automation includes the following stages:

- development of the technical assignment for project on designing;
- adoption of the constructive layout, computational model and optimization criteria;
- determination of the sizes and winding data, unequivocally describing geometry of the converter;
- development of the files for optimization parameters and varying parameters according to a priory chosen criterion and restrictions accepted in model;
- algorthmization of the optimized model;
- development of the programme for optimization calculation;
- preparation of the basic drawings of EC longitudinal and cross sections in AutoCad system;
- determination of initial data for the programme of automated designing;
- development of a software package for the AutoCad system aimed at construction of an active zone;
- development of the programme of automated designing;
- development of a programme complex for automated designing;
- choice of a calculation method, accuracy, mechanical and thermal loads for finite-element analysis of mechanical strength and heating;
- development of a typical file of the initial data for NASTRAN programme;
- choice of a type of calculation method, of accuracy level and setting up the problems of electromagnetic calculation for electrical and magnetic circuits;
- development of a typical file of the initial data for EMAS programme;
- development of the methods for course and the diploma projects execution.

Such the languages of a higher and low level, as Fortran, Pascal, C++, C etc., can be used in the process of development of the optimization programmes for calculation and designing. With the of object-oriented methods, the implementation of the C++ language gives possibility for determination of the basic physical parities and for creation of the universal classes, making easy transition to new constructive circuits and development of new models EC.

During the process of automated designing the interactive methods are applied for designing in the AutoCad system which is actually an industrial standard nowadays.

Optimization computation and designing are a base for detailed automated computation, which includes mechanical, thermal and electromagnetic calculations. The mechanical strength and heating are analysed by the method of finite elements on the base of modern NASTRAN software package. The electromagnetic analysis will be carried out on the basis of EMAS package. These packages give possibility to carry out the finite element analysis of designs with practically unlimited complexity, but also to carry out both linear, and non-linear electromagnetic computation of electrical power systems and their elements. These packages comprise extensive database on constructive and electromagnetic materials, including constant magnets. The NASTRAN and EMAS programmes are developed by the McNeal - Schwendler Corp. Company. They are used in an educational process on the base of educational-scientific centre established by the Digital Equipment Corp. Company and Moscow State Aircraft Engineering Institute.

On the basis of the above technology the authors have developed - the programme complexes for designing automation of the air trunk synchronous generator and asynchronous engine of increased frequency, and also manifold engine and independent synchronous generator with PC constant magnets. Thus the main generator is designed as a unit, consisting of three EC: pilot exciter, activator and of the synchronous generator as such. Optimization computations of the above converters are carried out on the basis of industrially tested methods with the use of modern optimization methods. The result model of each EC includes electromagnetic computation but also thermal and mechanical computations, which are of primary importance as functional restrictions. The designing is conducted according to individual criteria with rather small (up to ten) quantity of optimisation parameters and varying.

In the process of designing, the most advanced constructions of modern EC are accepted as the basic ones with the use of promising electromagnetic and constructional materials, including composite materials and high-energy constant magnets. In these constructive circuits effective cooling systems are used to increase permissible mechanical and thermal loads and to improve mass and energetic parameters of the converters.

On the base of stated technology a number of the manuals is developed for automated EC designing.

The developed technology of designing automation has required the change of methods for students' knowledge control.

Now the authors carry out the development of algorithms of multy-criteria designing optimization (according to the criteria of material and energy saving and generalized criteria of an economic efficiency).

Implementation of the developed technologies, which includes the development not only in modern applied software, but also general methods of computer science, permits to reduce time expenditures, to increase a level of EC designing and thus to improve the quality of the engineers training on a number of electromechanical specialities.

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Theme 4

SOCIAL, ECONOMIC and CULTURAL ISSUES

INTEGRATIVE MODEL OF INFORMATION ACTIVITY AND VIRTUAL REALITY

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Since the end of 70-th different simulating-modelling complexes became to actively employ the computer aids of visualization. The technology of virtual reality (VR) arised on this base; it presents a simplified system for visualization of real-time processes and is realized on personal computers. At the present stage of technology development the VR aids can not only visualize scenaria, but also provoke physiological sensations and feelings during simulation of reality.

The VR technology finds wide application in different branches of activity: simulating-modelling complexes (direct purpose of the VR technology), communication aids, entertainments (virtual world).

For the last time the public health and psychological services become anxious in connection with rapid development and spread of VR throughout the world. They apprehend the complete going-away of the entire Humanity into the virtual world and, consequently, its degradation and downfall [1].

At the same time, if look attentively at the history of development of modem civilization, the Humanity repeatedly stood before a choice: live in the real world or in the world of illusions (remember ideas in the world of maya). Time suggested only various ways for going away to the world of pleasures and enjoinments: drugs, hypnotic and suggestive effects, creation of mythes (including mythical ideas of life in the ideal society). The scientific and technical progress considerably expanded the capabilities of going away from realities of everyday life by means of technical facilities, among which phone, radio, television are spreaded most of all. It seems to be not great exaggeration to say, that the Humanity tries to use practically everything, what surrounds it (it is not important whether it is created by itself or by nature) not only for direct purpose, but as an aid for going away to the «parallel world» of fantasy. That is why, it is no wonder that such new advanced communication aid, as a computer, did not avoid the same fate.

Together with development of the scientific thought the visualization technologies are improved and evidently transition from a helmet and dress to bioimpulse simulators will be the next step of VR development. The usual time the Humanity will stand before choice.

It seems, that people have really made their choice long ago: they live in several dimensions, including both world of realities and world of fantasy. And the problem consists in depth, in relation of these worlds in Man itself.

Problems of relation and measure should be considered from the point of view of the system approach, models of development and organization of the Humanity.

An integrative model [2] was earlier proposed on the basis of using cybernetic principles of constructing models of self-organizing systems, which offers to consider the Humanity as a system in its dualism, in interaction of opposite qualities in Man. The Humanity as an information system is represented by a combination of set of diagrams of interaction (DI) of opposite principles in the Humanity. Its bipolarity is traced in all spheres of existence: spiritual (good-evil), social (altruist-egoist), psycho-physiological (Yan'-In'), physiological (right-hander - left-hander). Combination of DI in all qualities and fields of Humanity display present a qualitative characteristic of the system.

Processes of interaction in the self-developing and self-organizing system «Humanity» conform to the normal distribution law (NDL). The NDL graph, plotted for any DI, gives us the quantitative idea about processes taking place in the Humanity. Boundaries of graph are determined by a number of people with clearly expressed either quality from opposite qualities, but it amounts to only some percents from the total number. The most part of the Humanity has polar qualities coexistent in a certain relation.

This model can be also applied to considering the problem about adequate perception of the VR technology by the society.

Going-away to the virtual world, created by a machine, is accompanied by several motives, based on the dominating role of one of opposite qualities, tendencies of a person: leader-outsider, strong-willed -weak-willed, optimist-pessimist, realist-idealist. Graph of distribution for every diagram of interaction of qualities, leading to motivation of using the virtual reality on the basis of model premises, has the form of normal distribution. Considering a set of constructed graphs of distribution for known DI, we may forecast the distribution for diagram of interaction of the tendency to go away into VR and its denial. The graphic representation of people distribution by «workshipper» and «antagonist» of VR will also have the form of a graph of the normal distribution law.

Consequently, for request about fanatical «workshipping» to VR we may answer, that the main mass of people, as it seems to us, will use systems of virtual reality, keeping sober mind («all time - to work, an hour - to fun»), a small part of the Humanity will really be absorbed in illusive world and a number of people will actively oppose the VR, as an aid for solving the vital problems.

Conclusions:

1. In the history of the Humanity development it more than once stood before a choice: to live in the real world or in the illusive world and in this aspect a question about the virtual reality is not a new one.
2. A research apparatus for system approach and system analysis allows us to assess the relation between world of realities and world of fantasies in Man.
3. From the point of view of the integrative model of information activity of the Humanity the development and introduction of VR technologies don't result in fatal change of external and internal activity of the Humanity.

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THE CONCEPT OF ECOLOGY «MATHEMATIZATION» OR CONSTRUCTIVE ECOLOGY

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At present the term «ecology» is widely used both in science and in its practical applications. Meanwhile the interpretation of the term is ambiguous and at times inconsistent. An attribute of an extreme social actuality of ecology is a treatment of its subject in compliance with this or that scientific discipline. The negative side of this process is a subject borders breaking while the ecology is an independent scientific direction, representing methods, theory, set of methods, notations, means, problems of researches goals. In view of that, we made an attempt to define ecology as a subject of scientific activity with maximum using of modem mathematics methods and computer technologies at the analysis of problems, problems situations, putting and solving of problems, researches of the descriptions, explanation and prediction of various ecological situations.

According to the generally accepted definition the ecology is a science dealing with the relations between vegetative and animals organisms and their environment. Another definition of ecology is known as «geographic», a subject of which are dynamic processes, occurring in lithosphere, hydrosphere, atmosphere and influencing life in all aspects. Since seventieth of the twentieth century human being and social ecology is being formed. This branch of ecology studies laws of human society and environment interaction and includes various philosophical, social, economic and other aspects. At present the majority of researchers consider ecology as interdisciplinary field of knowledge covering all aspects of nature, society and human being interaction.

Protection of environment is taken as the most actual applied problem of the ecology. The ecological situation caused by society development has generated a number of political movements («Roman club», «green» parties, rescue committees etc.). These movements activity makes an accent on wide publicity, state and political authorities attention to the negative tendencies of the anthropogenic factors impact on live nature. The world community attention focuses now on effective approaches to setting up and solving the ecological problems which demands promoting new ways for operative and resulting application of both system analysis and management methods in ecology.

The researches we have conducted in a view of the described objective let us define ecology as scientific and practical sphere of activity, studying the relations between an inorganic and alive nature with the purpose of an explanation and prediction of system behaviour (i.e. inorganic + alive nature) with space and time.

A main, determining essence of the ecology, in our opinion, is relation treated as follows:

- the relation characterises interdependence of system elements;
- the relation can display as a property and attribute of things;
- a thing, taken in different relations, reveals various properties.

The relations and interdependence of things are diverse: space and time, cause and effect, part and whole relations, form and contents, external and internal relations etc. It should be emphasised, that the revealing of the relations in ecology can be of various character: on the one hand. sense of interrelations between objects is defined, on the other hand the peculiarities of the relations properties are investigated.

According to above-stated the general features of the ecosystem structure can be exposed as follows.

1. The environmental world within the framework of which the relations between live and lifeless substance are investigated. The accent on the environmental world is based on that it can be in certain relations both with separate objects (live or lifeless) and with the whole as such.
2. All the living [human beings (society, manufacturer, functioning etc.), group, community, trophic circuit etc.] Living (as well as any other subsystem), certainly, includes in itself internal connections and relations.
3. Lifeless (inorganic nature).
4. The relation between live and lifeless, describing live and lifeless interaction with space and time.

The central moment in our understanding of ecology is the research of the relation between live and lifeless, i.e. the onsideration of the following aspects: what internal properties characterize the relations, ensuring stability (instability) of the ecosystem; what properties of living and lifeless predetermine properties of the relation; what properties characterize the environmental world, ensuring the opportunity of ecosystem existence through these relations.

The objects of an inorganic nature can be characterized by the space-time, physical and chemical, biological and other properties. The most different objects, such as ground, elements of ground, water, objects, containing water, climatic space and many others can be considered as inorganic ones. Depending on the purposes of research an inorganic nature model based on space-time and other laws (known or hypothesised) is formed. These representations can base on material and/or power balance, opening or isolation of system, its stability/instability, properties, ensuring stability of the system (for example, at the expense of redistribution of substance or energy) etc.

For example, vegetative world as a whole, its separate elements or sets of elements; the animal world, the relations between elements of the animal world; the micro-world; human being in various aspects; trophic circuit and between its elements etc. - are all the objects of Live nature. The formation of live nature model is based on the concept substantial, energy, psychological and physiological, social, political and other types of balance, as well as on the system opening and isolation, its stability, properties ensuring stability etc. A main object in ecology is the human being (group or society), which is in the certain relations (known and unknown) with other objects (techno-sphere, animal and vegetative world etc.).

Depending on purposes and problems of research the model concepts, including above-mentioned ecosystem components, should met certain requirements, such, for example, as space - time correlation, completeness and independence of system description space as well as its elements, possibility of the characteristics observance etc. Structured as mentioned above the variety of concepts on constituents ecology and on possible inter-dependencies allows to determine the approach to the relations study by scheme which is relevant to mathematical researches and the exposed account of the ecology research object allows, as we believe, for efficient applying of system analysis, complex computer modelling, computer statement, solving and interpretation of the results of the appropriate problems.

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PSYCHOLOGICAL CONSEQUENCES OF A CHILD'S INTERACTION WITH COMPUTER

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The investigation and analysis of psychological consequences of information technologies more often processed for children of overage and senior school age. Preschool and junior school age was out of intense attention. The market of information services submitted by computer and its software producers is characterized by large variety of service opportunities of information technologies being more grown for children older than 11 years, than for children from 5 to 11 years old. The representatives of education system and manufactures of information technologies first of all assuming it as a tool to solve the problems of information education are introduced mainly to those didactic branches and subjects that are characterized by presence of sequential and strict system of rules and logic of arguments and solutions. These are mathematics, physics, Russian language and other educational subjects concerning to natural sciences.

Thus, the information technologies are introduced for creation of knowledge's, skills, experiences which are typical in case of evolution of verbal intellect. The researches, oriented at junior children age (5-11 years), testify to significant potential opportunities for information technologies to affect mot only an intellectual spheres of children, but the individual and the emotion-motivation component. According to analysis of information technologies application the age of 5-11 years is a most demonstrative from the point of view of revealing and estimation of affect level that renders this tool to the whole sphere of child mental evolution. To detect a spectrum of this information technologies effects the precise representation and understanding of an sense of this new intellectual tool is necessary. Traditionally, this tool is used for intellect evolution, however, a computer and its servicing opportunities 'provide new ways for new knowledge's and experiences to be acquired and they differ form traditionally formed by decades in pedagogical practice. The information technologies are characterized with such properties that provide to bring in the teaching of new material colourfully, dynamically, flexibly, thus rendering strong influence and switching on the emotion-motivation mechanisms of educational process. The investigation of psychological consequences requires also a clear understanding of what place and role the information technologies take in educational process. The scientific researches concerning to the investigation of peculiarities of children cognitive evolution and creative capacity under influence of computer can be divided between two trends.

Within the framework of the first trend the information technologies are a complementary link to the traditional educational process. Inside this trend the informational function promoting the development of verbal intellect can be assigned to this tool. Its mastering by children is carried out by a spontaneous and natural way and without special selection of psychological features of formation - the transformation of a computer in a tool of activity.

Within the framework of the second trend the information technologies are attached to a special activity status which takes into account a psychological essence that means such a tool that strongly affects not only an intellectual activity but the personality of a child and his self-evaluation and understanding himself while interacting with a computer. The extraction of psychological features of information technologies according to both world and native research practice gives the basis for general description of influences conveyed by a computer to a child.

If at the moment of mastering a computer we conditionally allocate three levels of mental evolution of a child as high, average and low, then from stand-point of conditional evaluation of current knowledge, skill, experience, maturity of emotional realms, cognitive standard and self-evaluation of a child we can come to the following conclusions:

1. Children with high level of current development as a result of «dialogue» with a computer receive an additional stimulus extending their creative abilities, raising cognitive motivation, forming durable interest to activity and arbitrariness of actions, in which the technologies are involved.

2. Children with average or low level of current development don't receive a positive psychological influence while adjoining with it. Subject to their personal features and, first of all, to their self-evaluation one can expect a negative effect of ambivalent reaction. Children try to avoid the following contacts with a computer or the interaction, which becomes formalized, mechanistic, «key-button» type. Sometimes children exhibit their interest to information technologies but this interest has been shifting from cognitive, educational realms to leisure games on a computer. The gained knowledge and skills are limited with a restricted utilitarian part of information technologies employment.

3. Psycho-physiological aspect of consequences, accompanying a «dialogue» of children with a computer, appears rather brightly and manifests itself both in positive and negative influences. Not touching the sanitary-hygienic features of the effects we can allocate the psychological manifestations of those influences. A «dialogue» is known to be characterized with high level of intellectual and emotional stress. Children, of junior age especially, can be exited or, vice versa, tired after studies depending on their temperament peculiarities. The interaction with a computer creates the conditions for psychological tension. The faulty actions of a child can provoke the appearance of stress, thus rendering his self-evaluation, emotions and motivation. Depending on a level of current development (high, average, low) one can expect the appropriate effect of influences. The psychological complexity of «dialogue» situation for a child with high level of development is overcome without psychological consequences. Children with average and low level of motivation correspond more often to those with unsuitable level of psycho-physiological formation of morpho-functional structures having arbitrariness off their memory, attention and thinking. Being in a stage of formation, such instability of psycho-physiological structures created a strong loading on mental evolution. This instability had required from physicians and hygienists to produce the rules and norms preventing the nervous system from provoking overload.

Thus, the selected psychological features were studies to illustrate the employment of information technologies in conditions of spontaneous - natural mastering of a computer by a child as activity means. Besides the psychological consequences of these new means of activity for 5 -11 years age the psychological essence of it was investigated. There were made the following conclusions.

1. During the transition of children from pre-school age to school age the information technologies can promote more effective formation of cognitive activity, i.e. its operational and emotional components. The intensified influence and protection from negative consequences require a specially arranged «dialogue» according to studies, taking into account the psychological essence of a computer, which, we consider, is a tool for development and correction of current evolution of a child.

2. The information technologies can provide the premises for generation of new forms of creative activity unlike the traditional ones. At a stage of transition from pre-school to school age these new forms can by best to prepare a child to school time mentally. The computerized cognition is an intermediate form between them, since their structural characteristics are similar to games and education. This, for example, may be a necessity to realise mentally the external goal and experience while mastering a computer.

3. A computer mastering results in positive consequences only after the specific skills and motivations inside the operation structure had been formed.

4. The lattice-ordered mastering with a computer needs the application of special pedagogical methods to modify a computer step by step into a tool for operation. Otherwise (spontaneous-natural formation of operation) one observes most commonly the superficial forms of computerized operations being a part of «key-button» work. The psychological-pedagogical «dialogue» techniques based on information technologies influence on children, contacting with a computer, were worked up along with a choice of software permitting to set in motion all service potentials of information technologies. To test the congruence between the research conclusions and the practical use of information technologies in education the investigation of proposed psychological-pedagogical technique has been accomplished for banishing the negative consequences. The investigations were performed with children of preschool and junior average school age.

We had been analyzing the following generalized factors: efficiency of operation; independence; mental complexity; affective-emotional trace in memory (3-5 months after studies).

The following results were obtained:

1. All children, cognising the information technologies in the conditions of «lattice-ordered» interaction, had not shown the negative consequences.

2. In the conditions of spontaneous-natural cognizing of the information technologies the affective-emotional trace (memory) of computer programmes was saved with one child (out of 17) having initially a high level of current

development. In the conditions of purposeful formation of operational structure only 20 % of children in 5 months have recollected no one computer programme, whereas 46 % of children have recollected 1 computer programme, 33 % - 2 programmes, 13.3 % - 3 programmes and 6.6 % - 4 programme (out of 5).

3. Towards the end of a year and under duration of «dialogue» between 10 and 15 minutes once a week the operational efficiency of children increased from 48 % to 73.2 %, cognitive activity - form 35 % to 78.3 %, independence - from 17.4 % to 69.6 %, whereas mental complexity reduced from 43.5 % to 13 %. The amount of errors at operation with a computer has decreased for 80 % of children (out of 25) with positive (joyful) response to errors for majority of children. For a half number of children the initiative has increased while for the others it remained the same - high, average or low. The independence at studies has raised for 68 % of children (24 % of children worked independently all the time). The expansion of necessities, that is the exit of interests out of an educational programme, took place for 44 % of children. The majority of children did not feel tired when running a computer. Also, the majority of children demonstrated an interest to a computer (basically, steady strong interest or dimple curiosity).

The efficiency like this, connected with purposeful formation of structural operation with a computer and eliminating the Therefore, the exposure of information technologies and their consequences depend on their essence as a tool for children operation and on the method of mastering this tool by a child and on mental content of those experiences, that are applied by a teacher.

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HEALTH PROTECTION SYSTEM FOR STUDENTS EMPLOYING NEW INFORMATION TECHNOLOGIES IN RUSSIA

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Traditionally Russia sustains a system of health care for various groups of population over many years.

The following interconnected parts can be distinguished in this system. The first component of this system is a study of influence of people surroundings on health condition indexes, capacity for work, psycho-physiological and physiological responses, as well as on reserve ability of human organism under variety of environment intensities, which must be evaluated.

The outcomes of scientific researches are exploited for evolving of norms and rules, state standards, specifications and other documents. Thus, the second important component of population health care is the availability of state regulations as an integral part of the legislative system.

The extremely important manifestation of the state legislation is the compulsion of its execution. This precept is fixed in a number of acts and first of all in Russian Constitution, in Law of Sanitary Epidemiological Well-being. Therefore, the following link of the system lies in a control for fulfilment of existing laws, sub-law acts, and in particular, in hygienic regulations, norms and rules.

The present system set a mission to ensure well-being of people in all orbs of vital activity, among them the children's pre-school institutions, schools, high and middle special educational institutions, enterprises and organizations, performing upbringing, education and professional training.

The current information technologies are certain to open to various groups of pupils the access to untraditional sources of information, raise the efficiency of independent operation, bring completely new capability of assuming and fixing of various professional skills, provide more sophisticated assimilation of educational material and enable to realise radically new forms and methods of learning.

However, all these obvious advantages of new information technologies (NIT) for teaching can be successfully realized, as the investigation have shown in that case, if the optimal ambient medium for obtaining knowledge and skills will bring into existence and if there will be no negative influence of a complex of factors, which can be formed as a result of NIT use.

The findings obtained in Russian leading scientific institutes of hygienic profile have shown NIT both enhance the intellectual capability of man and substantially rearrange cognitive structure itself formed historically.

The training by means of personal computers (PC) and video display terminals (VDT) causes the loading of various parts of human organism. Pupils can be exposed to effect of the following harmful factors: electromagnetic fields (fields of radio frequencies), static electricity, noise, not fully adequate meteorological conditions, light deficiency and psycho-emotional tension.

Features of a character and mode training, significant for mental and other strains with new information technologies can cause to change the functional state of central nervous system, nervous-muscles apparatus of arms. Non-rational design and layout of workplace units require the maintenance of fixed poses. Under the conditions of hypo-kinetics, the durable discomfort brings about the muscles' tension growth, the development of tiredness and pupils' capacity for work decay. The negative consequences are attributable to the fact that along with durable run a computer, particularly, if the quality display is not good, pupils can suffer from distinct tension of visual perception, and complaints appear on dissatisfaction by operation, headache, violation of dream, tiredness, irritability, pain feelings with eyes, pain in a small of pupils' back, pain in neck, hands, etc.

The tiredness of users is characterized with some peculiarities, first of all by the complaints on sight organs, including sight disorders - sight obscure, troubles, while fixing an eye from short - distance objects to long-distance objects and on the contrary. Sometimes there appears both illusory change of colour of objects, their bifurcating, and unpleasant feelings in eyes, such as turning red in the eyelids, burning, conjunctivitis, pain in choroid. Most commonly the complaints are imposed from the persons with sight defaults.

The analysis resulted in finding that the foremost reason of «display asthenia» is a peculiarity of screen image in comparison with paper recording medium. The long-term combined study of functional state of central nervous system, heart-vessels system and sight organs let us to describe the main regular trends in changes of capacity for work of various ages pupils under the influence of computerized studies. In this connection it was cleared that a character and extend of favourable or negative influence over running a computer depend on duration of operating time at a screen, content, volume and set up of whole work. And also, the younger the pupils' age, the greater number of negative reactions from involved human organisms has been registered after studies.

Among a majority of factors, effecting on functional state of human organism, the great significance has, as were observed, the starting level of pupils' capacity for work and their interest to operation with VDT.

It was pointed out, that high and average starting level of capacity for work registers lower number of complaints on sight discomfort, lower range of indexes changes, which characterize the tension of sight analyser and which are not stable. In this case it is important to underline, that positive motivation of pupils toward the studies running a computer promotes the stabilization of functional organism systems, concerned to training activity.

As can be seen from the research, the pupils, along with growth of their age, are adapted to mastering of a computer. However, the period of time of its development differs from age to age. Thus, the lesser adapting feasibility was noticed for pupils of 7-11 age, that indicates that the largest number of unfavourable

lies in a capacity for work and functional states of nervous and sight systems.

The reserve capabilities under development make them more stable to influence of computerized training for pupils of middle school age, there more so as for students of colleges, high schools, resulting in decrease of tiredness.

The data obtained served as a basis for hygienic Regulations of VDT operation duration on lessons and out of lessons training for pupils of different ages and for students of high and middle special educational institutions. For this, there were determined the conditions and modes of computer operation and developed the special physical exercises to take off tiredness from various parts of human organism.

The variety of training models, like playing problems and business games, being most efficient, are provided as additional didactic possibilities. The educational information technologies makes it available for teacher to achieve the didactic goals and to use both the separate kinds of training work and any other set, that is to project the educational medium. From this point of view it is necessary to take into account that the extent of pupils' tiredness of different ages depend mainly on features and content of computerized lessons.

The computerized lessons are connected with protracted retaining of posture. The sight work is accomplished with three operational planes alternately: keyboard, copy-back and display, which are oriented at different angles. In this connection, the tiredness of operating at VDT users significantly depends on working place design, its illumination, pupils muscle state (strength, endurance, elasticity, lithe of spinal cord and joints) and ergonomic specifications of furniture. The special studies allowed to develop the basic hygiene requirements to the design of computerized working place.

These requirements are used as a basis for furniture design for computer classrooms.

As a part of hygienic exploration the optimal conditions of illumination medium were determined for users at displays. They are met along with north and north-east orientations of rooms, if common level of illumination reaches 300-500 lux for working place and 100-250 lux at the screen.

These conditions provide the favourable and stable indexes of sight functions. Under the natural illumination the display classrooms shall be provisioned with light protection and light control, since some sacrifice of image quality appears as a result of specks produced by light opening. In this case the formation of the whole operational zone is of great importance and it should be located at possibly longest distance from light openings, that is in the canter or deep inside the room. On the basis of researches accomplished in Russia, the measures of preventive maintenance are permanently under development and improvement with the aim to provide both the absence of harmful influence on pupil organism over all stages of training process and the optimal conditions of knowledge mastering. To our opinion, the preventive maintenance, concerning to effect of unfavourable factors accompanying PC training and the provision of optimal educational medium, can be distinguished as follows: hygienic, ergonomic, technological and medical. Hygienic measures comprise the recommendations of display location and room illumination, as well as of sustain of micro-climate conditions, etc. Ergonomic measures mean a correct arrangement of working place and modes of training and relaxation. Technological measures hold the improvement of display itself and short closing its properties to that of paper information carriages. Medical measures include the requirements to sight-organs of PC users, the recommendations of rational optical correction along with this operation, as will as of special gymnastics and massages during the breaks.

The developed measures constitute the basis of a number of regulations. At a time the results of this work found the reflection in Federal Sanitary Rules and Norms «Hygienic specifications of VDT, PC and operational arrangements».

Thus, the existing pupils' health care system in Russia for employing new information technologies in education includes the following elements:

1. The accumulation, generalization and analysis of information on potential impact of mode and type of operation with PC and VDT and of influence of surroundings educational Medium on pupils of different ages.

2. The study of terms of formation of such negative factors, accompanying VDT and PC operation, as noise, static electricity, soft X-radiation, electromagnetic waves, air ionization.

3. The development, expert appraisal and approval of normative documents, methodical recommendations and other regulating documents concerning to prevention of negative effects on human organism from a number of harmful factors and establishment of optimal conditions for mastering the training material.

4. The monitoring of pupils health, state of environment, following the hygienic regulations, arranging the training process.

The interaction between those elements is not simple. Thus, shortages of regulations can depend on a number of factors, including more likely the deficiency of theoretical knowledge of some processes of NIT use; the imperfection of methodical research approaches; insufficiency of combined effects accounting. Only under combined approach and cooperation experts of various knowledge orbs one can guarantee the functional efficiency of the system and, therefore the efficiency of preventing measures for pupils health care in terms of permanently improving educational system utilising new information technologies.

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*UP-TO-DATE INFORMATION TECHNOLOGIES AND EDUCATION: PHYSICAL AND AESTHETIC EVALUATION OF VIRTUAL ENVIRONMENT **

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As new information technologies become increasingly widespread, which applies, in particular, to the development and accessibility of Internet, the traditional problems of education, ethic and aesthetic upbringing have lately come to be regarded literally «in a different light», featuring a new, non-traditional twist in their development. Traditional, aesthetic upbringing was based on the use and interpretation of images obtained in a reflected light. Now that computer technologies have made a considerable advance, images that themselves are a source of light are in common use. Images visualized with the aid of a computer monitor, unlike their historic precursors, i.e. stained-glass windows, are characterized by a more varied colour palette (different by orders of magnitude) and, besides, exhibit a much stronger pronounced interactivity with the observer.

The nature of the original itself has changed fundamentally: a work of art produced on the screen of a display has no copies. All the copies recorded on a magnetic disk and subsequently reproduced on a monitor are originals, regardless of the distance, in the case of Internet facilities application. Thus, the concept of objects identity acquires a new sense.

The development of means to produce computer «virtual reality» broadens the potentials of the process of education and also stipulates new problems: from purely philosophic to pedagogical and medical-and-psychological aspects of trainee security. While considering the broad spectre of using the concept of virtuality, we should dwell on two marginal areas of possible worlds. On the one hand, purely mental possible worlds represented by systems of views, memory of a cognising subject, including, in a broad sense, the spaces of the works of literature, myths, theories. This category of possible worlds is essentially subjective even though the subject may be both an individual and a social organism. Another extreme case is associated with virtual processes in contemporary particle physics, where particles cannot be observed due to the uncertainties relationship, however, just like in the case of physical vacuum, this virtuality is objective.

Both aspects of the virtuality concept prove closely related to that of observation, and observer. In mental spaces, the observer is a prerequisite of virtual world existence, because any information recorded, for example, in a book or with the aid of some other medium needs a perceiving, observing, cognising system that makes it possible to perceive it. Objective physical virtuality acquires the quality of «virtuality» as long as there exist tough restrictions on observing such a reality. In other words, virtual processes of this nature cannot be followed by an observer of a particular structure with particular levels of structural organization.

Computer virtual worlds hold a special position. On the one hand, they are relatively independent, on the other, just like anything else created by humans, their descriptions are in the designer's mind and cannot function without his, albeit indirect, influence. Computer virtual worlds erode, expand the observer's boundary, both physically and mentally, by connecting manipulators and increasing memory.

As hardware and technology advance further, there may arrive a situation where it will be rather difficult to determine in what space the observer functions: objective physical or computer virtual. Today, already appropriate outfits and headsets are available, used in a virtual reality technology which, in fact, make it possible to lock human sensor receptors in a computer, programmed reality. In this context, there again an acute question arises as to whether or not human sleep or function in reality.

As we know, one of the criteria making it possible to differentiate between sleep and being awake is coherence, recurrence over protracted time intervals of the subjects of reality, unlike sleep, which, normally, has an interrupted structure. In the case of computer virtual reality, this criterion should be generalized considerably.

We feel that a concept of coherence in the sense of being harmonious, consistent, aesthetically keen on something. The concept of coherence treated in physics as capacity of light, particle to be engaged in interference generally indicates identity, a common origin or interfering particles. Virtual worlds are also characterized by a certain degree of coherence in terms of their events and structures being consistent and harmonious. At the same time, the worlds existing in the works of literature, in areas, where figurativeness is achieved through rigid logic, are characterized by virtually absolute coherence whereas objective worlds are never that coherent, considering their evolution, transformation, development.

An observer has two methods to determine that the world in which he functions is, in fact, a virtual-computer world. The first method has to do with a possibility of locating one's own receptor not locked by computer sensor transducers and, using Godel's theorem, «exiting» to an expanded system where a computer functions as a subsystem. The second method is to try and make an analysis from the inside. To do this, an observer must analyse the coherence of reality scenarios in which he functions. Simulating observations in computer reality, as G.Patty pointed out, is no easy matter: the problem consists in making a kind of additional measurements and computations. The process of observation becomes a comparison of the limitation imposed by the system with components of system description, while the process of computation is associated with implementing a particular stage of the programme. It remains to be seen whether or not the process of observation using programme interface may be used to simulate adequately the process of observation. However, in our view, solving this problem constitutes a crucial phase of computer virtual worlds development.

In addition to philosophic and theoretical aspects of possible worlds, there are specific problems of improving methods of teaching the trainees to creating images using computer technologies. At the present stage of education development it seems premature to renounce the use of traditional methods of teaching fine arts. Yet, we do not find it expedient to ignore new technical means and computer technologies as a novel powerful tool of technical upbringing and education. Visualization of information technologies touches upon the questions of the need for selection and, consequently, aesthetic evaluation of the images perceived. However, in the conditions of the growing visualization, this is not the case for virtually every user because as far as the incoming information is concerned man is most interested in the plot to such an extent that even if he develops aesthetic attitude to virtual environment, it remains at the level of visual perceptions.

Physical appraisals of the system of reflected light and artificial electronic environment are only of significance to a narrow circle of specialists: psychologists, computer scientists, physicians, artists, etc. We have to admit that aesthetic perception of different colour media introduces elements of creativity at the level of observations, then statements and transformations; moreover, the judgements passed are the subject-matter of fundamental and applied research. As far as artistic observations in incident light are concerned, there exist historically probated procedures of nurturing visual culture of perceiving and reproducing the observed light, which occurs as a result of permanent aesthetic judgements assisting in proper evaluation of the observed natural phenomena and real life subjects. Shaping up the depth of aesthetic artistic evaluation is further encouraged by the perception of the works of fine arts, which, in turn, is a specific visual medium associated with preserving the traditions of applying regularities existing in the harmonies of reflected light.

It would be wrong to think that the development and nurturing of artistic attitude towards virtual environment cannot be applied or properly appreciated. At the same time, physical characteristics of virtual environment and, above all, the glowing screen of a PC monitor are attributes of close attention given, among other things, to aesthetic properties of colour, which, without special orientation in terms of judgement, is only exercised at a low level of aesthetic requirements. Infinite identification of images is ignored and, consequently, the indifference develops toward the inadequate characteristics of an arbitrary original. Aesthetic judgement of various properties of static and dynamic images emerging on the screen of a PC monitor makes it possible to broaden the sphere of visual mentality, emotional attitude, orientation in one's actions, which becomes crucial when the user finds himself in cyber space. Unfortunately, neither the place, nor the role of elaborating the developing procedures of nurturing aesthetic judgement of perceiving virtual environment have been established at present, which may be 'associated with graphic art activity on the screen of a PC monitor. Nor has the philosophical aspect been developed that determines the procedure of assimilating the judgements of virtual environment: this, ultimately, impedes the progress of a user-computer dialog, which, just like art, may be regarded as a potent means of portraying the world.

On a practical level, there is a series handicap in the adoption of systems of teaching computer methods of creating images, common to all interdisciplinary subjects. On the one hand, the development of contemporary science calls for teaching the fundamentals of interdisciplinary areas, for new approaches to education (e.g. introduction of associative systems of education proposed by prof. Sheaffer). On the other hand, as was demonstrated at the Moscow Synergistic Forum (January, 1996), some traditional scientists and pedagogues are rather hostile towards interdisciplinary sciences regarding them as being devoid of firm foundations, which, in their view, are an inalienable characteristic of classical subjects.

Taking the teaching fundamentals of aesthetics as an example, through computer-aided images, once again we are faced with the need for studying and promoting the basics of interdisciplinary research, establishing harmonious, coherent interdisciplinary links. At present, there are two «poles», «categories» of specialists in Russia who are capable of and would be interested in advancing and adopting computer methods of creating images and who, at the same time, complement one another. At the one pole, we find engineers, programmers, developers of computers and software, who have special knowledge in the field of computer engineering, but a vague idea of aesthetic problems (such as colour, perspective, subject and other special issues associated with arts creativity). At the other pole, there are professional painters who are either unfamiliar with computer technologies, or use PC as an expedient means. We suppose that provision of conditions for co-operation of the aforesaid «poles», securing the coherence of their interaction will be a crucial step towards laying down the foundations of a new natural-science and cultural-and-historic paradigm on the threshold of the third millennium.

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*NEW INFORMATION TECHNOLOGIES IN PRESERVATION AND EFFICIENT USE OF HAND-WRITTEN CARD-CATALOGUE OF THE RUSSIAN VOCABULARY OF 11 - 17TH CENTURIES IN EDUCATION (EXPERIENCE OF WORK UNDER UNESCO PROGRAMME «MEMORY OF THE WORLD»)**

Yu.N. Filippovich (Russia)

The purpose of this message is to render influence to politics of using of new information technologies in the field of education. The base for choice of such purpose is positive experience, saved within the framework of joint activity of scientists of the Russian Academy of Sciences and of the professors of higher schools in realization of the project «New information technologies of preservations and of the efficient use of hand-written card-catalogue of the Russian vocabulary of 11 - 17 th centuries on CD-ROM» (which is the part of the UNESCO program "Memory of the World").

The main two concepts are new information technology and educational technology.

More often it is total under information technology activity of the subjects; directed on transfer and transformation the information is understood. In our particular case we shall represent information technology as activity, directed on representation and transfer of knowledge, that is saved experience of activity of the subject in subject area. Such understanding permits, first, to consider any teaching (education) as some information technology, that is the information technology and educational technology at such understanding are considered as synonyms; secondly, to represent educational technology as a sequence of procedures and operations of extraction of knowledge and experience of the subject, their normalization and representation.

Hereinafter the exposition will concern "new" information technologies widely not used in educational and "new" that is offered for the first time educational technologies.

Allocate tool and subject information technologies. To tool the concern of technologies processing of the texts, diagrams, databases, spreadsheets and other. Of their presence almost of a "standard" set of universal operations and procedures of transformation of the information, submitted in a kind of the text, graphic image, numerical number is characteristic. To subject information technologies unique sets of special and universal procedures and operations, used in specific subject fields of knowledge, submitted by particular artifacts concern. In present message some tool technologies and one lexicographical work subject are considered, which is one of the main in such field of knowledge, as historical linguistics.

The educational technology in relation to tool and subject information technologies are integrated, i.e. uniting in self set of general and private procedures and operations of extraction and transformation of tool and subject knowledge. Developed in space and time, educational technology is defined not only by set of some procedures and operations, but also by set of the subjects, realizing these procedures and by set of resources (objects of knowledge).

The subjects of the educational technology are the teacher and schoolchildren, forming educational collective. We shall consider in quality of the "generalized" subject of the educational technology "educational-scientific collective", consisting from students, post-graduate students, experts with high education, teachers of high school, scientific employees.

The card-catalogue of the ancient Russian dictionary (CCARD) represents unique hand-written assembly of the citations from manuscripts and published texts of 11 - 17th centuries (chronicles, stories and messages; business books and letters, private letters and state bills). Total extracts comes nearer to 2 million. The extracts represent paper cards of the different sizes, laying within the limits of 20 - 120 mm. The extracts that are made by more than two hundreds men basically with feather handles and with inks of different colours on paper of poor quality and various density, are subject to influence of time - card-catalogue more than 70 years. The cards are stored in library boxes on the average on 1700 - 2000 pieces in each. The work with card-catalogue requires observance of rules of personal hygiene and sanitary norms.

The card-catalogue is base, on the basis of which multivolume Dictionary of Russian language (DRL) 11-17 th centuries is let out since 1975. (It was let out 21 volumes in 1995, with the words on the letters P - R). This dictionary is the result of researching work of large collective of the scientists - philologists, in creation of each volume there take part 15-20 persons. The period of preparation of one volume makes on the average 3 years. Each volume contains about 2.5 - 3 thousand words, the size of a volume - 35 author lists.

The card-catalogue and Dictionary are a powerful source of knowledge in the field of Russian historical lecsicology and lecsicographics, history and culture of Russia. The knowledge are submitted basically in two forms: in the kind of artifacts (it first of all CFARD and DRL) and in kind of lecsicographics technology as the set of receptions and procedures of work with cards and sources, organizational structure (Historical-lexicological and lexicographical Department of Institute of Russian Language named after V.V. Vinogradov of the Russian Academy of Sciences) and methodical measures.

CCARD as artifacts has three-level structure - FILE - THE CARD - THE BOX. The CCARD file has alphabetic organization. Each box CCARD has unique number, is characterized initial and final parting words and contains cards of two types: cards of parting words and card with citations. The card contains the citation рукописную an extract from certain source, underlined word in text of an extract, brief designation of a source, from which extract, and date of a source is made.

DRL has more difficult structure, however in it is also possible to allocate three levels: the DICTIONARY -ENTRY - CITATION. As well as the card-catalogue, Dictionary has an alphabetic structure. The entry is submitted by a named word and general items of information, relating to it (reference words, grammatical comments and other). Each entry is characterized by a set of attributes: by interpretation, degree of reliance, shade, presence of a connected word collocation, Greek or other language connection, source and other.

Main components of the lexicographic technology are the following procedures: formation dictionary and entries of the next volume DRL, work with sources, preparation of the text of the dictionary, edition of the dictionary. The most valuable is the experience of realization first four procedures.

Considerable meaning there is the organization of dictionary work, which has found reflection in structure of a department, distribution of the responsibility, duties and sequence of realization of separate operations.

Modern measures of lecsicographics technology contains the instructions and manuals on realization not only traditional of lecsicographics work, but also reflects experience of the using of tool information technologies, such, as technology of textual processing, technology of scanning and processing of the images, technology of databases, OCR-technology.

The integration subject (lexicographics) and tool information technologies permits to define new whole thing. Those is electronic copy of a ancient Russian card-catalogue in the form of databases and information systems, ensuring effective access to it. In itself electronic CCARD copy, placed on machine carrier of the information, represents object, access to which after its duplicating can be supplied for large number of the possible users. Thus will be saved CCARD as a historical and cultural monument. The integration subject and tool technologies in this case represents technology of preservation of historical and cultural object - the ancient Russian card-catalogue. Two various ways of duplicating electronic copy of a card-catalogue can be offered: first, duplicating by record on compact discs (CDR or CD-ROM); secondly, by maintenance of telecommunication access (creation WWW-server).

Procedures of technology of preservation CCARD are procedures of technical and philological preparation of card material to translation on machine carriers of the information; scanning and processing of the images of cards; creation of card databases; inputting of the texts of entries; creation of dictionary databases; integration of databases; creation of information systems; duplicating of components of databases (thematic samples, results of researches etc.).

Main peculiarities of integrated technology are, first, peculiarities of objects CCARD and DRL themselves (significant volume, weak normalized, semantic complexity, essential labour input of routine procedures and operations and some other); secondly, peculiarity of subject technology (the lexicographic technology of creation on basis CCARD of the dictionary is insufficient is documentary and submitted basically by experience lexicographers, which can only be observed and studied); thirdly, peculiarity of organizational and financial support (financing basically of material inputs on buying of the equipment, not enough means for payment of live labour, not regular financing and other).

The main purpose of activity of education-scientific collective is the realization of the project «New information technologies of preservation and efficient use of hand-written card-catalogue of the dictionary of Russian language 11-17 centuries on CD-ROM», maintained by UNESCO. For realization of the project it was required to bring in to integrated information technology a number of changes and additions, which are basically reduced to making the main procedures and operations of technology of character of the trainees. It changes technology and makes her educational.

On the basis of the work on preservation CCARD can be delivered and applied and fundamental scientific researches are realized, which can become a subject bachelor and master diploma projects, candidate and doctor's dissertations in the field of 'linguistics and computer science.

For 1,5 years within the framework of the project there were carried out five diploma projects on computer science, 18 individual home tasks, 32-hour cycle of laboratory work "Multimedia systems", scientific and research work, there were carried out three iniciated scientific and research work in the field of linguistics, scientific development of the postgraduate students of the philologists were conducted. Significant work on preservation CCARD is at the same time made: tool and subject information technologies are developed, databases electronic copies of a card file now make more than 10 Gb of the entered information; the first domestic compact disc with card assembly is created; a series of compact discs with thematic samples of card and dictionary materials is prepared to issue.

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* See also *the reports of T. A. Isachenko works: «Implementation of new computer technologies for preservation of library and archive valuables», K. A.. Maksimovich et al. «New information technologies in historical and lexicologiical investigations» in this book. (Editor's reference).*

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HYGIENIC ASPECTS OF STUDENTS' WORK AT VIDEODISPLAYS

E.A. Gueltishcheva (Russia)

Implementation of computers into the process of teaching has called for the solution of certain problems of hygiene that equally apply to students at institutions of higher education and to schoolchildren.

Since 1981 our institute is one of the first in Russia that has been engaged in the integrated research of the work of students and schoolchildren (grades IX, X, XI) at video-display terminals (VDT) and personal computers (PC).

In the course of the research, we co-operated with a number of educational establishments and scientific research institutes (Moscow Engineer-Physical Institute - *«MIFI»,* Research Institute of School Equipment and Technical Means of Education, Research Institute of Lighting Engineering, Central Research Institute of Experimental Designing of Academic Buildings, and others).

Subject to study were the following hygienic aspects:

- working conditions at VDT and PC of various types, including colour video monitors;
- organizing of work stations;
- VDT and PC working schedules for students and schoolchildren during classes as well as for students on a mission in students' field teams (during summer holidays) and for schoolchildren - during practical training;
- functional condition and health of students and schoolchildren.

Emphasis was placed on preventive measures aimed at health protection and avoiding overwork.

Work at VDT and PC in classrooms produces an unfavourable environment. This applies, above all, to microclimate: air temperature increases up to 27°C, sometimes higher; relative humidity drops to 12-18 %, the air being nearly still. This results in dry mucous membranes of the upper respiratory tracts and is detrimental to the cardio-respiratory system and kidney function. The air indoors gets polluted with harmful chemicals both due to antropogenic pollution as well as due to the destruction of polymer materials used for decorative finish of the interior of classrooms (phenol, formaldehyde, ammonia, vinyl chloride, etc.). Air-ion conditions change, too. Energizing a VDT alone in the absence of people resulted in a greater amount of negative ions, largely at the expense of heavy air-ions. As it did, the number of air-ions increased in proportion with the length of time during which VDT was in operation, and already in 1.5-2 hours their number grew 4.75-fold, exceeding admissible ionization levels. VDT and PC are sources of electromagnetic radiation. Our studies indicate that secondary X-ray radiation was below rated values. There was no infrared or ultraviolet radiation in areas «B» (320-280 nm) and «C» (280-200 nm). Electrostatic tension near the video monitor screen sometimes went beyond the rated values (150 V/cm or 15 kV/m). At times, electrostatic pressure registered near the side surface of EC 1841 video monitor was equal to 750 V.

There still exist old Russian-made VDT and PC (*«Elektronika 15И3-00-13», «EC 7066», «EC 7927», «Iskra 1030», «Iskra 1030.11», «EC 1841», «ДВК-2», «ДВК-3»*). When these are connected to the mains and begin to function, they produce noise whose level reached 63-65 dBA, in excess of the allowed 50 dBA. The specter was dominated by audio pressure levels in the area of medium and high frequencies. Operating these types of VDT and PC impaired the functional condition, in particular, of the central nervous system.

Students and schoolchildren of health groups I and II were under observation. Trainees suffering from myopic ocular refraction were sampled for studies.

Psycho-physiological tests were carried out in the course of classes, during a working day and throughout the entire period of work in students' team as well as in the dynamics of a single day and course practice.

Students and schoolchildren programmed problems using a VDT and PC. Work intensity was high, reaching 97 % of the working time. As they worked at VDT and PC, the students and schoolchildren complained they suffered from headache, sometimes from dizziness, early fatigue, and general tiredness.

Crucial to reducing fatigue of trainees' visual analyser is good illumination of the desk (an optimum illumination of desk surface has been determined - 500 lux), design features of VDT and PC: resolution, contrast, colour index of information against the backdrop of the screen.

Special studies of 10 light combinations of information colour index and screen background colour index, chosen with the participation of trainees, indicate that the 1st rank place corresponds to white information characters against a dark-green background, the 2nd rank place is filled by green characters against a black background, and the 3rd rank place occupy white characters against a black background and white characters against a blue background. An optimum distance of 60-70 cm from the eyes to the screen is established.

Concentrated mental work at a VDT or PC, complexity of problems, limited time determined by the schedule of classes result in stress situations and have an adverse effect on the functional condition of user systems. This is manifest in slower speed of data processing, loss of concentration, falling efficiency, longer time for reflex mobile responses to light and sound stimuli, etc.

The greatest visual analyzer fatigue and general tiredness was noted in persons with myopic refraction compared with individuals having a normal eyesight: they would get tired sooner, and changes of the functional state were more pronounced.

It is established that over the same length of time, computer games produce the greatest adverse changes in the visual analyzer and central nervous system, compared with operating a VDT or a PC.

VDT or PC operation for a long time, especially with an improper work station organization in fatigue and pain of the backbone, shoulder girdle, hands and legs.

In connection with the aforesaid, workstation parameters for VDT and PC operation were determined on the basis of which firm *«Elektronmash»*, Kiev, designed a desk. Its peculiarity consists in a smooth change of the surface height for the video monitor and the keyboard. Desk surface for the keyboard may change the angle of inclination, which helps to maintain a correct working posture, without a sharp include of the head forward, while the depth of this surface the distance between the eyes and the video monitor screen.

Complexes of exercises for the eyes are prepared and their efficiency is demonstrated as well as the efficiency of breaks for stretching.

As a result of studies accomplished the following parameters are substantiated:

(1) minimum area (6 m^2) and cubic capacity (24 m^3) per computer, i.e. per work station with a VDT or PC;

(2) optimum and admissible temperature and relative humidity parameters for classrooms with installed VDT and PC;

(3) VDT and PC working schedules during classes and in leisure time (students' field teams and practical training);

(4) minimum and optimum duration of intervals between paired classes.

Requirements are elaborated to organizing a workstation and to computer science studies, lecture rooms with VDT and PC. It was demonstrated that screen filters (glass-film ones, type C-14A and C-14B of South Korean manufacture, «Leer» screen filter, manufactured at Voronezh) reduced visual analyser fatigue.

An anti-X-ray varnish produced by the Research-and-production Enterprise «Spektr», Rostov-on-Don, was approved.

On the basis of the aforesaid, preventive measures are elaborated aimed at normalizing the training environment and VDT and PC working schedules, preserving the health and efficiency of students and schoolchildren.

Materials of long-term studies served the basis for elaborating 10 normative-and-methodological documents in the form of sanitary specifications and norms, methodological instructions, recommendations and normatives.

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The original is presented in Russian

ARCHIVES GO INTERNET

Siegfrid Hermann (Austria)

5000 generations have enjoyed discovering patterns in nature. They teached each other to interpret what they saw. During the past 500 years printing was perfected. During the last 150 years photography offered universal access to the creation of high-quality images. And now in our generation photography became a mass culture tool. Computers began as number electronic machine, electronic networks promise universal dissemination of images. Think of yourself as a multimedia machine. In a new way you have to explain and understand things. Call it what it will: television, film, graphics, literature, magazines, broadcast are part of multimedia, integrated media, communication media... Education system means the collision of everything.

There is rapid development in communication media. Learning and research structures change. Together teachers and students learn in a live long process. Permanent new audio-visual medias change dramatical our routine life. New didactic effects in education arid research create new learning technologies. In education there are no borderlines. Countries are not isolated any more. Even the village in out country has permanent contact with the surrounding world. Information comes through glass fibre or satellites. Education and research become part of spontaneous interaction.

Especially young people accept this new amazing situation, A growing flood of information and research dates are potentially available anywhere in the world. Digital information technology enables the integration of text, graphics, film, animation (this are characters that move across the screen till digital holography), voice and music. MGEG enables the compression of images. New optical storage technologies use lasers to write dates on a recordable optical surface. Modelling allows three-dimensional animation. The final stage in the 3-D animation process is rendering. It blends together light sources, background images, texture and surface attributes. With morphing a seamless change of one image into an other becomes possible and warping, where only one image changes over time.

Multimedia and Internet benefits both the educational and public sector. Today's information technology is potential. We start to combine all current media more smoothly together then ever. We use technology at a price that was not dreamed of ten years ago. Teachers and researchers will become an integral part of multimedia education. One good teacher is still worth more than any amount of hardware, no matter how sophisticated the technology. Multimedia in education, and together with Internet, provide new ways for teachers and students to learn. In-class presentation and self-learning will allow to explore topics from broader perspectives. The result is interactive information and life long interdisciplinary learning.

We create a conspicuous relationship to our machines and learning programs. We become active in a very new way. Our new functions in learning are not the production of same-same-same than the creation of different-different-different. With new media a technology of diversity is invented. Therefore ARCHIVES GO INTERNET.

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The original is presented in English

*IMPLEMENTATION OF NEW COMPUTER TECHNOLOGIES FOR PRESERVATION OF LIBRARY AND ARCHIVE VALUABLES**

T. A. Isachenko (Russia)

Since 1992 Russian State Library (RSL) started with realization of «World's Memory» UNESCO programme with the purpose of preservation of the library and archive valuables, which are currently under the treat of loss as a result of possible natural disasters or «cataclysms maid by people». The project objective is to imprint the most valuable from the artistic and documented points of view memorials, which are of great interest for researchers connected with the various fields of knowledge, i.e. philologists (peculiarities of writing), historians and ethnographers (connection with the regional cultures), art critics (artistic design).

The process of forecasting of future works concerning optical disks development is retarded by the facts as follows. The possibility for fixing and distribution of such information is questionable since high cost of the equipment; it is difficult to provide mass libraries and cultural centres with corresponding techniques; the readers (researchers) are not ready to work with new technologies. In spite of optimistic predictions of project authors, all the above-mentioned circumstances even now present the stumbling block for determination of principles for selection of these or that documents for saving them on CD-ROM discs and for determination of regular succession of these works.

The works which are carried out at the Department of Manuscripts under RSL and that are concerned to the composing of description of manuscripts collections, as a main point, suppose the effective utilization of computer technologies. The speed, completeness and convenience of the information sources obtaining are connected with the use of computer technique for solution of the following tasks:

1). scanning of manuscripts with consequent processing of the result patterns;

2). the introducing of the textual and graphic information on the machine carriers with consequent creation of the databases and the information systems, capable to increase the effectiveness of the work with indexes with the purpose of to acceleration of the access to manuscript patterns;

3). storage and preservation of the scientific investigation materials and the results of such investigations in the form of hyper-text database, which are being implemented, in particular, at the Institute of Russian Language under Russian Academy of Sciences.

Finally the preparation of electron publishing of the whole multi-volume «Description of Museum Collection of Manuscripts» is planned for consequent replication on compact discs.

We plan the following results of the work:

- the data of about 500 pages of graphical material will be selected and written on machine carriers (the description of 300 preservation units with accessible illustration);
- the indexes will be composed (alphabetical - for the articles and author's names and chronological) and also accordance of new and old codes will be made;
- with consideration of the recent investigations in the field of source science and codicology a bibliography will be composed;
- a database will be created and partly filled in.

The work on the composing of descriptions for manuscripts collection with the new computer technology application has no analogues in Russia. The representation of the manuscripts in the form of graphical patterns and the use of the information systems for the access to the mentioned manuscriptic memorials will allow t6 obtain maximum information about the collection of manuscripts for the scientists in the centres, equipped with CD ROM-hardware.

The realization of the project will allow the creation of the condition for partial self-funding for composing of the next volumes of the Museum Collections,

The second priority direction of the work of the manuscriptical department of RSL is the development of a set of electronic edition on the material of the memorials of Old Russian writing.

The issued texts shall possess the following priority features:

- the expression (to satisfy the interest of the readers to the published texts);
- the informativeness (to response mainly the memorial-encyclopaedic genre);
- the rarity (to possess the priority of elder lists against consequent replications).

Instead of facsimile editions of typesetting texts more active way was selected which comprises editing by means of photo-type representation method.

With the active support of the Historical Lexicology and Lexicograhy Department of Russian Language Institute n. a. V.V. Vinogradov of the Russian Academy of Sciences and at the active participation of specialists from the Moscow State Technical University n.a. N. Bauman, currently the unique memorials of the Old Russian writing and 16 th-century culture are prepared to be published on CD-ROM. These memorials are oriented to the composition of complete text database:

1. Translations of the literature of 16th century in the field of natural sciences which comprises a large texts-sources of Russian Language Dictionary of 11-17th centuries, rendered a significant influence upon the development of Russian science, culture and language. Firstly, they are as follows: «The Garden Granting Cools 1534, («Herbarium of Lubech Inhabitant», according to the list of 1616), and secondly, «On the Art of Liqueurs Preparation of Herbs» (according to the list of the end of 16th century).

2. Canonic texts of the epoch before the Ivan the Terrible reign, which are important and actual for making comparisons with the epochs of the Russian Supreme power formation. They include, first of all, «Composite Nomocanon by Metropolitan Makarii» (the 16th century manuscript).

The edition of such texts by the traditional polygraphic method is difficult due to set of reasons, in particular, due to their significant volume.

The project on the electron edition is based upon the lexicological, lexicographical and archeographical investigations of manuscripts and the scientific interpretation of type-setting texts; it is followed by coloured graphical patterns of the texts, pictures, miniatures on compact-disc, produced for consequent circulation and distribution.

* See also *the reports of K. A. Maksimovich et al. «New information technologies in historical and lexicological investigations» and Yu. N. Filippovich «New information technologies in preservation and efficient use of hand-written card-cataloque...» in this book. (Editor's reference).*

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The original is presented in Russian

PHYSIOLOGICAL COST OF COMPUTER SYSTEM APPLICATION IN TRAINING OF MEDICAL STAFF AND FACTORS INFLUENCING IT

V.R. Kuchma, N.D. Bobrishcheva-Pushkina (Russia)

The goal of the present investigation is the study of work capacity and functional organism state of persons, who are dealing with automatic teaching systems (ATS), and revealing of factors, which influence on them.

There was developed ATS, which allows to train and interrogate the user in dialog regime; evaluation of it pedagogical efficiency and physiological cost was carried out.

The expert group, which studied the theme with the help of ATS, consisted of 46 students of the 5-th form of Moscow Medical Academy (MMA). They worked with IBM PC/XT compatible computer with colored video terminals of EGA, VGA types with block letters on blue background. The studies were carried out in a computer class, where sanitary-hygienic conditions corresponded to hygienic requirements. The duration of work with ATS varied from 1.5 up to 3 hours and included not only indication and explanation of errors, but also their correction.

The studies of control group (39 persons from the same department) were carried out in similar sanitary-hygienic conditions, in lecture-room according to the algorithm, realized in AT and had a duration of 3 academic hours with two 10-minutes interruptions.

Physiologic cost was evaluated according to the investigation of mental work capacity with the help of proof tests, with consequent estimation of individual shifts; the state of visual analyzer according to the time of appearance of successive contrast (TASC);
subjective state with the help of test.

It was identified that knowledge mastering in control and experimental groups trustworthy did not differ, while the application of AT allowed to individualize the rate of studies, decrease of load on the teacher, to evaluate the student's knowledge more objectively.

In the process of estimation of physiologic cost of studies it was revealed that students, who have used AT trustworthy more often one could notice significant tiredness while investigating of mental capabilities with the help of proof tests (54,4 % against 25,7 %, $p<0,05$).

In this group there appeared a little bit more persons with decreased state of visual analyzer though there were not revealed statistically trustworthy difference. One should take into account a significant variability of individual sensitivity of visual analyzer. For example, the deterioration of its state was fixated not only in 48,8 % students, who had worked with video terminals, but also in 36,8 % students of control group, where the load on visual analyzer reduced to episodic reading of the information from the blackboard or textbook and writing it into the copy book.

We did not obtain trustworthy difference in the groups according to number of students with deteriorated patent feels, activity and feel at the end of the lessons. At the same time the analysis of average magnitudes of these parameters allowed to estimate, that the parameters of patent feels and activity trustworthy decrease at the end of the lesson in both groups, while the parameter, characterizing the spirit, trustworthy decreased only in control group. In the experimental one this parameter maintains at the former level. This result is connected with interests of students towards new form of studies and satisfying of work in such conditions. Thus, the studies with ATS have appeared more tiredness for students, though subjectively have been higher evaluated by them.

In connection with this, we have carried out search of factors, which influence on the work capacity of students with the aim of their optimization.

The introducing of ATS has allowed to individualize the rate of studies. If in the control group all the students finished it simultaneously, in experimental one 24 % of students worked up to 2 hours, 43,4 % from 2 to 2.5 hours, 33.6 % - more than 2,5 hours. According to hygienic requirements ATS proposed to students to make an interruptions in their work every 25-30 minutes to conduct gymnastics for eyes and physical-culture pauses, however only 26 % students followed these recommendations.

We have analyzed the influence of these factors on the intellectual work capacity and state of visual analyzer. It was found out, that the mental work capacity is subjected to the influence mainly of the studies duration: with it increase the number of persons with significant deterioration of visual ability increases from 27 % till 64-78 % ($p< 0.05$). On the status of visual analyzer a serious influence has the maintenance of interruption regime: among students, following hygienic recommendation there one more persons with favorable changes of TASC – 78 % against 38 %, and there are no persons with significant deterioration of it, while in the group, which worked without interruptions, the amount of such persons is 43 % ($p< 0.05$).

The SAN test analysis did not reveal the interconnections between the work duration and maintenance of the interruptions. It did not revealed the connection between the SAN parameter dynamics and that, obtained during the work with ATS estimations.

A interconnection was shown between work capacity parameters, subjective self-estimation and the presence of skill of systematic work with personal computer. The students, who have had such experience, trustworthy more rarely have revealed significant decrease of intellectual work capacity. More often the increase of spirit was mentioned at the end of the work.

The influence of strength and liability of nerve system during the second signal informational processing, extraversion and neurotizm (by H. Eysenck questioner) on the work capacity and subjective state of the organism was analyzed. Taking into account this goal the examine were divided into groups with high and low strength of nerve system (according to parameter of second signal information processing); liability of nerve system (the number of errors at decoding) higher and lower the group average; the extraversial level higher and lower than 12 a.u.; neurotizm state higher and lower than 14 a.u. After that in each group there was analyzed the distribution of individual shifts, proof tests and SAN test, while the processing included only the results of student's investigation, who worked with personal computer from 2 up to 2,5 hours.

There was not revealed any influence of these factors on the dynamics of mental work capacity according to proof tests. It was stated, that persons with poor nerve system sufficiently more often react on traditional study method by deterioration of all subjective parameters (50 % in the control group against 25 % in the experimental one). It's evident, that the work in the dictated rate, the necessity to support the attention, when the teacher interrogates other pupils, and, probably, fright of answer, typical for persons with poor nerve system, leads to quick appearance of tiredness feel and decrease of spirit. At the same time persons with week nerve system are more withstanding to monotony, which is noticed in the work with personal computer. This fact is confirmed by the presence of trustworthy negative connection ($r = -0.406$) between the parameter of nerve system strength and duration of work with PC.

One ought to mention the tendency to frequent decrease of all the parameters of SAN test in the experimental group among persons with the factor of liability higher than group average. It was revealed the connection between the duration of work with computer and liability ($r = 0.46$), that, probably, may be a reason of subjective deterioration of such student's state. It was revealed a strong trustworthy connection (the correlation coefficient + 0.86) between the knowledge mastering and extraversion expression in the experimental group. At the same time in the control group this coefficient was equal to + 0.18. Evidently, here the interest to new training forms, peculiar to extroverts, became apparent. This interest created a positive emotional background in these persons, and led to material mastering.

Since the functional status of the visual analyzer depends on the combination of screen phone and information, there has been carried out a questioning of the students through the video terminal screen about the preferable combination from their point of view. 66,7 % of students, who had a long work with video terminal, chosen the positive screen, more often the variant with black letters on blue background. The analysis of the TASC dynamics for the persons, whose choice of color screen decision has coincides with that, realized in AST or appeared to be opposed, did not reveal trustworthy changes.

The investigations, have been carried out, reveal the necessity of individual approach in case utilization of ATS on the base of PC and caring out of further investigations, concerning revealing of the factors, which might influence on the physiologic cost of contemporary informatics technologies applications in staff training.

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CHILDREN'S HEALTH PROBLEM IN CONNECTION WITH THE USE OF PC IN THE EDUCATIONAL PROCESS IN KINDERGARTENS

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Using of new information technologies in educational institutions of our country continues to increase rates. Personal computers (PC) are applied at the moment at all stages of the children education, teenagers, youth. They are used and in education process of preschool establishments - in kindergartens. Thus is planned the obvious tendency to gradual increase of number of kindergartens, using PC on employment of preschool children.

Expediency of application of this new pedagogical means is convincingly proved by the teachers and psychologists, which consider, that with the help of PC it is possible to decide the problems of general intelligent of child development more effectively (I.G. Belavina, U.M. Gorvic, E.V. Zvorigina, S.L. Novoselova, N.N. Podyakov, O.K. Tihomirov et al.).

However thus there is the very important problem of safety child - PC dialogue, as consequences of such dialogue for preschool child health are not yet investigated. The decision of a problem becomes extremely important in connection with known specifically influencing by the factors and conditions of work on PC, and also in light of known from the publications of the items of information about possible adverse influence of work with PC at organism of the adult workers and pupils of average schools. It is necessary to pay attention also at peculiarities of the growth morfophysiology development of preschool children of 5-6 years (with the children just this age employment with using PC). It is known the special liability, sensitivity of their functional systems, that, at first, promotes fast adaptation to the varying factors of the environments, but, with other, - makes defining of inability adequately to react on strong and long for this age influence. In communication with it there is a potential opportunity of occurrence of convertible deviations, and then - and irreversible diseases. All this makes the problem of study of a condition on health of the children, connecting with PC, rather urgent. The purpose of the present research was to study a condition of health of the children of 5-6 years, working with personal computers on developing employment in a kindergartens, and to compare results with a condition of health of the children the same age, not engaging on PC; research carries out in dynamics of an educational year (beginning - end).

Under supervision there was 1100 children 5-6 years: 500 preschool children, working on PC, and 600 - not working on PC. All children were from kindergartens from regions of Moscow identical social conditions of life and organization of education process. The children worked on PC *«Электроника-БК»* with color monitors as *«Электроника 32 VTC 101»* or IBM-PC on developing employment 2 times a week. Each employment takes 30 minutes, during which the children worked on PC during 10-15 minutes, i.e. the duration of dialogue with the computer was strictly regulated according to our recommendations, made earlier on the basis of experimental researches. Sanitary - hygienic condition in a computer hall of a children's garden were according to the working requirements. Used computer programs were developed by the experts (teachers, psychologists, programmers, hygiene doctors) with the account peculiarities of functional development of 5-6 years children, including the visual analyzer development, function of visual perception.

Summarizing the data of foreign and domestic researchers, concerning the study of influence of work with PC on adult organism of the PC operators, senior schoolboys and students, and taking the peculiarities of influence working with the video terminal on various physiology organism systems, we have developed the appropriate program of researching of a condition of preschool health. In medical surveys there were doctors of different participated specialities (pediatric, ophthalmologist, psycho-nevrologist, hygienist).

The results of research shows that the quota of the children on a condition of health was typical for Moscow. Essential difference between the children of experimental and control groups in the beginning of educational year was not revealed on any parameters of health. A complex estimation of health (on health groups, best was the first) there were shown, that I, II and III health group had accordingly 23, 56, 21 % of the children, engaging on PC, and 24, 54, 22 % of the children, not engaging on PC. At reinspection at the end of an educational year the tendency to reduction was revealed numbers of the children with I health group, that occurred for the account in general by growth of number of functional infringements of bearing.

It was possible to assume, that at the children, engaging on PC, the infringements of bearing to the end of an educational year will meet more often, since the work on PC is connected to a compelled sedentary pose, and it is often accompanied by muscle discomfort at adult and the schoolboys.

However the assumption made by us has not proved to be true: the functional infringements of bearing in the beginning of an educational year met in both groups of the children, number of the children with is identical frequently, and to the end of a year the broken bearing accrued too equally - on 14-16 %. Hence, the infringements of bearing of the children did not depend on their work on personal computer.

The following series of researches has confirmed this conclusion. It was shown that the number of functional infringements of bearing at preschools children during dialogue with PC is connected with infringements in argonomic and sanitary - hygienic requirements on the computer hall of a kindergarten, and also with mistakes of organization sport - sanitation work and impellent mode in kindergarten.

Thus, on the basis of the research it is possible to make a conclusion, that dynamics of a health condition of the children from a beginning to the end of educational year does not depend on their employment on PC, if they are organized with all hygienic and epgonomic requirements on a computer hall, on working place and they are carried out in strict conformity with the requirements to duration of child - computer dialogue.

Besides this conclusion concerns only developing employment, - employment, which were carried out on determined technique, that was scientific reasonable by the teachers and psychologists. It is possible, that in other conditions of the pedagogical process, at other technique work of the children, PC will render other influence on organism.

In this connection it is necessary to continue medical and physiology-hygienic control for health condition and functional condition of the children, connected with PC on employment in a kindergarten.

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NEW INFORMATION TECHNOLOGIES IN THE HYSTORICAL AND LEXICOLOGICAL INVESTIGATIONS *

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In the Institute of Russian language of the base of Old Russian dictionary card index (ORDC) creation of a principally new investigations on *hystorical lexicology of Russian language* recently started.

The novelty of lexicological investigation set is determined by the following parameters: the computer techniques is used for every investigation; a special program is composed for each investigation of lexicological series [by the efforts of high-educated engineers-programmers with the attraction of graduates of the Moscow State Technical University n.a. Bauman (MSTU)]; in each case a special methods are designed (from the one hand, this is individual philological methodics, which are determined by the problems of investigation, while from the other hand, - this is well defined technological methodics, which allow the realization of these problems).

The main goal of the present work is creation of series of laser discs, presenting the .whole information volume, storage in the card index ORDC, and its philological processing.

There has been formed sufficiently large collective from high-educated philologists and engineers-programmers — from the one hand, and from students-philologists (Moscow Pedagogical State University, Academy of Slavonic culture) and undergraduate-programists (MSTU) - from the other hand.

The peculiarity of the present series. is the searching character of the design, which determines partial nonpredictability of the results, since at the primary stage of the investigations only part of the problems are formulated, while the other problems are formed in the process of activities. *The searching colouring of the work* means its creative character. This feature - one of the most attractive for co-ordination of the efforts of the specialists, presenting two polar fields of science. The other feature of this investigation of series is their interconnection, defined de ORDC as united basis. In every investigational series the uniformal processing of card index is carried out by scanning (for data base «Gard index» and data base «Source index to card index»).

In the contemporary lexilogical investigations as a wide recognized factor the consideration of lexics in the frames of thematic groups is considered. In such groups the words are united not only by the theme, but also have similar semantic changes, are used in the same set expression and syntactic constructions. In their history they influence one on another. The thematic lexical groups, e. g. words, picked out on the base of their connection with actual reality, may be successfully put in the base of lexicological investigations with the use of new informational technologies.

For the investigation of lexics using new methodics there were chosen three *thematic groups* differed by content and structure: juristic terminology of Old Russia, traditional metrologic Russian lexics and a theme «Person in the Old Russian and Bizantian memorials».

The first and second themes are connected with *terminological lexics,* for which it is natural to suppose lexicographical methods of description in new computer investigations. The fact is that the dictionary by means of constitutes of ancient text and interpretation with corresponding comments is able to introduce into scientific circle a large culturological material, combining two cultures - culture, which has gone, and current culture.

Concerning the first theme «Old Russian and Church-Slavonic juristical terms» (the author-composer K. A. Maksimovich) it's supposed to create a fundamental reference guidance on the Old Russian juristical terminology, which would cover the period of creating and development of Russian state from XI up to XVII centuries. Thanks to it not only study of terms and ideas of Old Russian and Old Slavonic right became easier, but a lot of new data about functioning of Russian legal motivates in the prenational epoch are presented. There is presented new and often nowhere accounted material about complicity and functioning of Russian language book-written variety in the middle-epoch. Careful account of the data, taken from texts allows to watch the stages and peculiarities of Bizantian and West European legal terms and ideas reception in Old Russia. If necessary these is presented of comparative of Russian juristical terms and directions of Roman-Bizatian right, with corresponding terms and states and right of contiguous Slavonic peoples.

On the first laser disks it's supposed to write lexical and other informational materials, connected with the theme «Legal procedures». There would be created 5 data bases: CARD INDEX, DICTIONARY, COMMENT, SOURCE, INDEX.

The data base CARD INDEX contains ORDC scanned material from the word JUDGE up to the word JUDGABLE. The data base DICTIONARY contains lexicographical processing of given material. The base COMMENT contains systematic investigation of juristic lexic (by this a content systematization of the materials is presented in the data base DICTIONARY in the alphabetic order). The data base SOURCE contains scanned patterns of the contexts from rare and difficult of access juristic memorials. Finally, the data base INDEX includes shortened and full rate titles of the memorials, have been used during the work with this thematic group.

In prospective in the frame the thematic group «Old Russian juristic lexics» it's supposed to create a series of laser disks, material of which will be distributed between different legal spheres.

The work on theme «Dictionary of the old Russian measures» (author-composer G. Ya. Romanova) is oriented on the investigation of one the most significant layers of traditional Russian lexics - metrilogical terminology, beginning from the first memorials of Old Russian written language and up to the beginning of XX century (1918), when Russian measure system itself was substituted by metrical system of measures, born by French revolution. This lexics up to now did not have its own independent lexicographical description in Russian. The dictionary is created on the base of ORDC and its own card index, containing fragments from Old Russian memorials, abundantly using metrological lexics, as well as exceptions from the dictionaries of Russian language and artistic literature.

The study of metrological lexics present a complex problem. Metrological terminology is a subject for investigation not only by linguist, but also historian and ethnography. That is why pure philological methods and approaches to the material (etymological, textological, linguistographic) are supported by ethnographic methods. Lexicographical description of methodological lexics is carried out in a «wide cultural context», and thus it solves not only properly linguistic, but also historical-ethnographic problems. The dictionary is constructed according to the encyclopaedic-interpretation dictionary type.

In this theme the first realized in the form of laser discs, there would be measures of length, where there would be presented the following data bases: CARD INDEX, DICTIONARY, SOURCE, INDEX, ILLUSTRATIONS.

In the data base CARD INDEX there would be scanned the patterns of cards with metrological meaning, present in ORDC. The data base DICTIONARY will contain lexicographical investigations of metrological terms with linguistic-historical comment. Into the data base INDEX the would be included bibliographic information about written language memorials, utilized in the Dictionary. The data base SOURCE will contain the data about scientific sources, dictionaries, artistic works, used in the process of metrological lexics investigation. More subjective character of the lexics, included in this thematic group, in compression, for example, with semantic group «Old Russian juristic lexics», allows to create one more data base - ILLUSTRATIONS, containing figures, video fragments and audio comments, intended for illustration of textual and card index information concerning metrological terms.

The third theme «Person In Old Russian and Bizantian memories» (part I, «Appearance») (author-composer M. I. Chernishova) present a principally new scientific development in the field of Russian historical lexicology and medievistics. On the base of ethimological investigations a reconstruction of ancient Slavonic presentations about a person and his appearance is carried out. Then an analysis of card index collection is also carried out. The Old Russian presentations are revealed, the lexics of translated memorials are corresponding literature is investigated, due to which a Christian-Bizantian layer is determined. The material shows that in Middle-Ages several most important parts of the body have carried even in their appellations a special load. Thus, it's necessary to reanimate pattern associations, had appeared in the consciousness of middle-age human being.

The most important part of the work is comment, which apart from philological aspect (lexicological and semantic comments of the investigator), contains theological and philosophic considerations. In the comment it's presented a comparison of primordially Slavonic perception of the person - from the one side, and Cristian-Bizantian - from the other one. In this comment the elements of likeness and divergence between different cultural layers are also revealed.

Apart from the card index, substitional widespread additional materials is also demonstrated, for example, the most important textual fragments on Old-Slavonic, Old Russian, Greek and Latin languages. During the work on the theme 12 data bases were created: CARD INDEX, CARD INDEX+, DICTIONARY-1 ... DICTIONARY-7, SOURCES, INDEX, COMMENT.

The data base CARD INDEX contains more than 400 scanned patterns of the cards, which illustrate the use of 50 words-dividers of ORDS. The data base CARD

INDEX+ contains marks, presented by fields: extraction from the card or other source (more than 5000), text of foreign original (about 500 citations), complementary of the investigated word (objective, verbal, lexic, repeated, stable), its application (pattern/transferred, with compression), comment. In the data bases DICTIONARY-1...DICTIONARY-7 seven dictionaries are presented: historical dictionaries of Russian language, ethimologic, freeing dictionaries. The data base COMMENT contains the author's text-investigation. The data base SOURCE presents a special reading-book, containing more than 40 textual fragments, while some of them present a widen context of a citations. The data base INDEX contains brief and full rate names of more than 500 sources.

For the convince of the work data bases *screen forms* were developed, which allow to visualize either each data base independently, or their combination, reflecting the «view» of the authors of the investigation on the most interesting and deserving the attention aspects of the theme «Person-Appearance». All the screen forms are presented also in the data on the paper. The bases are connected according to the principle «one-to-many», corresponding to navigational means.

The importance and actuality of presented investigations is connected with their directions towards maintaining of the unique citation values of ORDC, referred by UNESCO to the objects of special cultural value in the frame of the program «Memory of the World».

• See also *the texts of reports T. A. Isachenko «Implementation of new computer technologies for preservation of library and archive valuables» and Yu. N. Filippovich «New information technologies in preservation and efficient use of hand written card-cataloque...» in this book. (Editor's references).*

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TEACHING COMPUTER SYSTEM «CULTURE OF NUTRITION»

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During all its history of humanity human nutrition draw a global influence on a lot of processes, taking place on the Earth. During several last decades the structure of nourishment has sharply changed in most of European countries, and in parallel the structure of morbidity and mortality also changed dramatically. On the base of a lot of investigations there have been determined diet connections between appearing of some diseases, death rate as a result of these diseases and nutrition structure. That is why in many countries the questions concerning nutrition normalization are put on the level of governmental policy.

In spite of the fact, that the necessity to change the current structure of nutrition become practically universally recognized and even confirmed by the presence of corresponding governmental programs in several countries, the practical introducing of the new nutrition structure is strongly empeded by a set of objective and subjective reasons.

In particular, these changes are impeded by the lack of sufficiently high educational level of the population in the field of nourishment. Its increase might significantly slope the situation by the way of nutrition structure changing, redistribution of individual and governmental means, more proper nutrition products storage and preparation, utilization of nontraditional types of food.

The important and practically non-developed question of any nutrition system efficiency subjective human ability to transfer on the proposed nutrition method, e.g. the question of diet's «psycho-physiological acceptability» for a given person, as well as algorithms of the transfer to the new nutrition regime. Finally, the success of the whole work, concerning transfer from one nutrition system to another and the duration of its use depends namely on «personal psycho-physiological characteristics».

Sufficient input into decision of mentioned problems may be put by teaching computer technology. It will allow to carry out the individual learning, to popularize knowledge in the field of healthy nutrition with the help of utilization of generalized and formalized in the form of data banks about the interaction between nutrition, health, individual peculiarities of the person and ecological conditions. It will allow also to evaluate personal psycho-physiological peculiarities, to choose, taking into account mentioned evaluation, the individual full value fond allowance on the base of optimized procedure; to control the process of diet application.

Computer systems are widely used in the scientific investigations concerning nutrition and physiology. However, we did not meet the systems, where the methods of physiological diagnostics and correction in the sanitary dietology might be used. The novelty of the proposed approach consist of the teaching of complex nutrition, health and ecological problems solution. The technology, has been designed, will allow to create new criterions for evaluation of food production quality from the point of view its influence on the increase of the duration of healthy and active life. This would lead to the global transformation of production and consumption of food products in general. The use of physiological adaptation methods to the problem of changing of habitual food ration present it self as new and significant step towards the real normalizing of people's nutrition structure.

Currently we carry out a set of investigations, the aim of which is the creating of methods and computerized technology for sanitary nutrition teaching, directed on the health increase and duration of active life; for teaching of adaptation to individual diet methods; for construction of individual rations of prophylactic, sanitary and destination; for control of the results of the diet application; for teaching, planning, evaluation and control of nutrition on the group level, including municipal, regional and state levels.

Earlier there were developed several versions of computer systems in the field of nutrition, which were intended for evaluation and planning of nutrition on group and individual level for both children and grown up. They include experimental version of real nutrition evaluation system with the help of which, in particular, the Moscow provision by fruit-vegetable production were analyzed. As another example one could present the system, developed according with the order of Ministry of nature and environment guarding for planning and evaluation of regional nutrition with determination of sources of pollution number, that are introduced into human organism with food. This system includes the block with recommendations concerning nutrition in ecological unfavorable conditions; characteristics of some types of pollution sources and their influence on the human health; characteristics of some food components from the point of view of their use as detoxicants. The proposed technology might be used in the governmental scale for organization of national and regional programs, concerning with changing of nutrition culture, as well as development of the strategy of agriculture, production and consumption of food products development.

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OUTSTRIPPING EDUCATION AND FORMATION OF INFORMATION CIVILIZATION

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Recently an intensive search of new model for the educational system (ES) took place. This new system ought to correspond to future civilization postindustrial information society.

Surviving is a goal, which humanity has put for itself and which is possible to realize only in the case of deciding of the whole complex of global problems, threatening by omnicide. The education also presents one of the global civilization problem and is in global crisis, assisting the prolongation of the unstable development model of existing. In became clear, that the way out of the educational crisis is connected with the creation of new stable (information) civilization model, which will be able to survive, while one of the main mechanism of this surviving may and ought to appear education.

Such narrow interconnection between the educational model and information civilization formation doubly seems unexpected from the philosophic point of view. The same for the fact to current civilization with its ES - is some whole and the parts. Traditional education, being the most wide social system, is at the same time one of the most conservative systems. Not for the first decade ES in its global dimension does not satisfy the needs of social life, conduction into future the values of industrial - consuming society, promotes the approach of global anthropological catastrophe.

Hence this is the essence of universal ES crisis, which, form the one side, don't satisfy the needs of contemporary society, while from the other side, already don't promote it future surviving. Being burdened by the tradition of past, contemporary conservative ES inexorably carries away the whole civilization to the gulf of approaching ecological and anthropological catastrophe. Its prevent requires the search of new mankind and ES development models.

The search of the way out from global crisis of the contemporary civilization has already led to nontrivial concepts of our common future. Even in 1987 there was published a report of the International commission on environment and development under the guidance of G.H. Brundtland, which introduced new idea of «Sustainable Development» (SD). Moreover in 1992 a UNO Conference on environment and development took place which accepted this, model for our common future.

We shall mean by the term SD a future form of interaction between the society and nature, which points out two main goals - maintaining of biosphere, surviving and arbitrary long development of the human race (immortality). In short, the transition to SD must provide the harmony or co-development (co-evolution) of the person, society and nature.

According to its essence the world education is one of the aspects of the whole industrial (unstable) civilization crisis. Thus the transition to the new educational system of XXI century must appear one of the main component of the overcoming the mentioned crisis and formation of new civilization in the framework of information- computer revolution.

Namely due to this reason the way out the crisis can't be found without the global transformations in the society itself. The main idea of the transition to new society is defined by global strategy of moving towards SD. The informatization of the society is one of the main component of this strategy, which sufficiently influence on all other components of this «great transition» towards new civilian paradigm.

The informatization of the society in its principle apart from everything else, has its main goal of creating of hybrid integral intellect of the whole civilization, capable to predict and control of joint mankind activities. This is the cause of the global *noosphere transformation* of social development, when united collective intellect of civilization might be able to direct its development and provide priority of mind, spiritual - intellectual values over pecuniary - energetic, material ones. In comparison with past and current situation, in the mature information society the consciousness in its main part will outstrip the objective reality, predict its development and consciously direct it along the noosphere trajectory of advancing moving.

In this sense the information society becomes one of noosphere stages accumulated the necessary intellectual-information potential for solving global problems of civilization, taking it out of the crisis status.

The model of SD may be realized only in the case of cardinal structural changes in the goals and structure of social activities and in the sense of concerned problem of changing of the SD role in the society. In principle it's possible to delay the date of mentioned changes approach up to future times, for example, till the global ecological catastrophe, if decelerate the whole social process and to transfer to «zero» development. However in this case one can't eliminate the catastrophe. New qualitative model of civilization development is necessary, but not elemental, rather global - controlled development, that is impossible without constructing of information society.

In the framework of this model some processes would be actually delayed, and even eliminated if possible. We mean here the social- pathological processes, distracting the mankind civilization. At the same time .other tendencies and development mechanisms, natural to socium, ought to be stimulated and even accelerated, reorienting towards the SD aims. These tendencies and mechanism include science, education and some other mainly information processes and social activity spheres, connected with informatization.

The most priority mechanism to go away from global crisis and transfer to SD model include science and education, but not in their traditional and contemporary appearance, rather SD- transformed. (The term «*SD-transformations*» means all the changes, directed towards transition to SD model, to formation informatized civilization). The science, rejecting its former features of development (which may be considered as forms of unstable development), neglecting practical all former forms of rationality, ought to transform to an activity system of noosphere-information orientation.

One of the goals of global-noosphere revolution in science is creating of SD civilization model, which will give the optimal trajectory of the transitional process into the future sphere of mind, gradually moving informational values towards the priority place.

This model ought to be realized in the framework of two main directions - scientific - technical one and scientific-educational one. These must be mainly information global - noosphere process, outstripping other social tendencies, while they create the base for SD - transformations of all life activities of people.

Scientific-educational process ought to take place in such accelerated rate and with such qualitative changes, that it may be considered a scientific-educational revolution, which would spread in the XXI century and become important consistive part of information society.

SD, absorbing scientific knowledge of noosphere-oriented science, gradually transforms from conservative system towards outstripping system, thanks to the fact, that only this information system is able to provide the surviving of the whole human race.

Only being able to predict and forecast, one would be able to realize a set of preventive, warning steps, intended to civilization surviving. ES, promoting the transition to SD model, will gradually transform to outstripping system, along with science. As a result of its «futurization»: the accents in the science will bias from past towards future. This would be a fundament of not only revival of spirituality as a result of integration in solving of global civilian problems with other cultural forms, but also of outstripping of collective human consciousness over its being. Only in this case the unstable, fraught with catastrophe objective reality yields the place to being of noosphere orientation guiding by outstripping intellect.

The noosphere-informational orientation of the new education system defines among others a lot of it important features, in the whole complex of which one can see this outstripping system. Among these features we should mention the following: creating and development of global educational system; continuity of the education through all the life of the person with prevailing of self-education, diversity, individualization and increase of diversification of education standards and specialties. Correspondingly, different models of remote education, opened and flexible education systems, automatic and expert learning systems and other education models and methods would develop with the help of informatics.

The model of outstripping ES of XXI century, based on the model of SD-civilization (the principles of which were already proposed [1]), would not translate from generation to generation unstable, pathologic life order of contemporary inhabitants of the Earth, common to all mankind archaic values, knowledge and skills, which bring nearer ecological catastrophe. The noosphere (outstripping) ES, becoming temporary permanent and over all-global, will transfer the information and activities to the present and future generations. These information and activities are oriented towards the mankind surviving, formation of global Information society, as a first stage of intellect. New scientific - education system together with other systems of spiritual sphere, promoting transfer to the SD, will become the base of information postindustrial society not only as society itself, based on knowledge, but also as «self educational society».

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THE NECESSITY FOR STATE REGULATION OF THE INFORMATION PROCESS IN THE SOCIAL SPHERE

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The readiness of a society for the economic development through implementation of information and telecommunication technologies (ITT) is determined by its information background.

The models of using the information and knowledge, qualities of information processes and flows depend not only upon economic and technical factors, but also upon national I culture features.

Social and culture components of the economic analysis come more important under the conditions of distribution in connection with the fact that great majority of factors, suppress informatics development, concern mainly to this sphere.

The negative influence of the cultural and informational factor cannot be over-emphasised. The cultural background of wide layers of the population, including the computer knowledge, is very low. The people do not frequently know, what information is accessible to them, what is possible to make and how to realize these possibilities; the function «to know for to be able» is weakly developed. This problem has sharpened; and the significant part of the population is disoriented, and it has no strategy of action. At the same time, the skills in ITT field become one of the major characteristics for finding good job.

The process of informatization is doomed to failure in the case when no account is paid to existing social and cultural background of a country. For a long time the state did not give due attention to social questions, and during last years in social sphere and at first in the spheres of education the informatics was put out to the market.

All over the world the state regulation of informatization of education receives primary emphasis now. Today at the new stage of the development of an information society the role of the state in advanced countries varies from easy support to direct management.

With the purpose of overcoming of social and cultural barriers in the process of informatization development in our country, development of informatization activity of the people and formation of new information culture the state should actively join the process of informatization of social sphere and to carry out certain measures directed to calling attention of wide layers of the population to ITT. As to international experts, the influence of ITT in social sphere is acknowledged to be the most important both now and in the future.

In social sphere economic strategy for management of informatization development shall be founded upon those major measures forms of influence that are capable to help a state to solve existing social and cultural problem. They are as follows:

1. Organization of the advertising campaigns, making the experimental projects, aimed at propagation of ITT opportunities. This aspect was and remains the main one. Even though a lot of developed countries leave the development of electronic networks to the market structures, the state always actively participates in formation of demand for electronic services. Social and economic efficiency of the demonstration projects is very great, and international experience, especially experience of both France and Japan as well as our domestic experimental projects testify this fact.

2. Creation of conditions for manufacturing and distribution of consumer electronics and modern entertainment, promoting training through entertainment. Mechanisms of state support here are just the same as in the case of other industries. It is as follows: favourable taxation for private companies and state support of domestic industry.

The increase of distribution volumes of home ITT is considered as an attribute of the introduction into information society. The presence ITT at home stimulates interest to its use in educational and industrial sphere.

3. Supporting of new original decisions on computerization of provincial and agricultural schools as of the main structure that still stays viable under the conditions of an economic crisis through the development of the idea of «electronic buses», the use of old hardware of advanced domestic and foreign companies, organization of new kinds of the humanitarian support and others.

4. Support of the development of information service base in Russian language through development of domestic original software and computer games, multimedia and other products of high professional and literary quality. This support will result both in the increase of the international role of Russian language and in the development of Russian market for the modern information services in Russia, CIS countries and countries of former socialist community, where almost the whole adult population speaks Russian. It will also allow introducing the population of small cities and villages of» Russia - to civilization. Social and economic effect of even the insignificant investment in this sphere can be hardly overestimated. These investments would be a contribution into the increase of international prestige of our country, into education and culture, into the process of upbringing of young generation.

5. Direct participation of the state in following spheres: development of the informatization system for support of socially disadvantaged part of the population; development of distance learning services for disabled persons. This system can be implemented by means of the network of cable TV in medium and large cities. In the nearest future expected occurrence of the interactive cable TV shall result in a feedback that can provide an important increase of social maintenance quality through ITT.

The «out-of-budget» financing of such projects is possible in case of higher attention of local authorities; philanthropists and humanitarian help means. The offered practical recommendations permit to use the ITT opportunities for overcoming geographical, medical and economic restrictions, for creating of the conditions for improving informatization cervices in Russia, for creating of new organizational and informatization culture in Russia, and for development of new information society. As a whole, the policy of equal opportunities for ITT use for both healthy and disabled, for both young and old, for those who live in central regions and those who live far from large cities in the country, such a policy is the basis for not only informatization society but also for civil society.

The slogan founded in the industry "from living to development" as a whole can be used in the sphere of informatization. Search for the rules of such transition is a priority problem of state importance.

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Theme 5

EDUCATIONAL POLICIES

SYSTEM ANALYSIS OF STRATEGIES IN EDUCATIONAL INFORMATIZATION

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The informatization of education present sophisticated long term and multiaspect process of transition from traditional to scientific capacity educational technologies. It is connected either with cultural educational traditions, root problems of educational philosophy, or pedagogical practice, requires sufficiently wide psychological-pedagogical investigations, significant volume of organizing-methodological work and creating of capital capacious infrastructure of informatization [1]. In this circumstances the efficiency of the works on educational informatization is mainly determined by methods and mechanisms of their organization.

In 1980-90 in Russia on the base of program-goal principles there was formed a planning system for long-term complex programs, concerning management activity informatization, the teaching process, project development and scientific research activities.

The development of complex programs were based on the designed by authors [2,5] methodology of system projecting. The complex program presents a document which contains combined by a goal setting complex of advisable actions, the integration of problem oriented tasks, targets, plan of resource providing and measures for its realizing. As an example one can refer to Complex program of work on creating of typical solutions of automated system of higher school management [2,4]. In the framework of this program there were foreseen the fulfilment of 715 targets on the following chapters: scientific research works on the problems of modification of higher school management (57 tasks); project works on the creation of the design of typical subsystems (30 tasks) and their development (16 tasks); the development of providing part (12 tasks) and introducing of the typical project solutions (600 tasks). The work experience of its realization has confirmed the completeness and sufficiency of formed targets, the efficiency of program-goal planning mechanisms in combination with the application of management, normative and methodological materials for users.

The resource concentration in the framework of the program allowed to reduce more than on the order of magnitude the number of designers, to -shorten significantly the terms of the development and realization, to increase the quality of the project decisions and to provide the introducing of typical solutions more than in 100 higher schools.

In 90-th years in Russia there is carried out the exchange of informatization paradigm, caused by the formation in the country of new social-economical structure, reformation of high school and principle innovation of information media. Personal computers of multisphere presentation and information processing, network local and global technologies required recomprehencion of informatization problematics, their place in higher school. This factor has found its reflection in a set of new informatization concepts. These concepts firstly contains:

- concept of higher education informatization in Russian Federation, which was developed in 1993 by advanced scientists and experts of high school according to the order of the State Committee for Higher Education of the Russian Federation *(GOSKOMVUZ);*
- concept of system integration of information technologies in higher school, designed by the State Information Systems Research Institute of Russia *(GOSNIISI)* in 1993 according to the order of *GOSKOMVUZ* of the Russian Federation;
- concept of telecommunication network in higher school education system of the Russian Federation, developed in 1994 by high school scientists according to the order of the *GOSKOMVUZ* at the support of *the Russia information systems research institute (РосНИИИС).*

All three concepts were united in the sense of necessity to create a modem information media of higher education and science as important component of the whole education system transfer to the contemporary methodological and technological base, that would result in principally new information culture.

The authors of the concepts consider, that simultaneous and frontal informatization of higher school education in Russia is impossible due to economical reasons. It is also impossible due to incompatibility of modern information technologies with traditional organizing and social-economic structures, cultural traditions and unreadiness of most of population, including the higher school workers, to act in correspondence with the requirements of information technology in the conditions of inadequate culture. The society, possessing inadequate culture, with great difficulty accepts external, in particular, technological innovations. This phenomena was well noticed by V. O. Kluchevsky in consideration with Peter's the First reforms. The failure of the reforms in this period, in his opinion, is caused by the intention of Russian to own west technology without west culture [1].

In order to form a system morphologic matrix of possible *global strategies of higher school informatization*, let's carry out the stratification of its vital activity space.

The vital activity of higher school as an organizing system, on a global level is determined by three systems: management system, spontaneous activity of higher school itself and interaction with existing media (economics, the population of the country, culture etc). There three systems, allotted according to the principle of their significance, determine the organizing strategy of higher school informatization.

The management system realizes the organizing activity concerning the process of informatization, which is characterised by centralised and decentralized management.

The significant media and management system may realize the resource provision of informatization process in different ways: uniform distribution of the resources, allotting for informatization among all the higher schools; and purpose distribution.

The high schools may realize their interaction with the existing media in the process of informatization as «closed» or «open» systems.

On the base of present model there was constructed morphological matrix of organizing strategies in higher school. The feature of this matrix consist of the fact, that it provides a full set of possible organizing strategies of modernization under accepted suppositions. The whole set consists of eight different quality organizing strategies: undirected global surviving, undirected global increase, directed global surviving, directed global increase, undirected local surviving, directed local surviving, undirected local development, directed local development. To realize that or other strategy of informatization, it's necessary to transform this strategy into a definite scenario, which in the framework of «general principles, defining this strategy, contains the description of the activity elements in the sphere of informatization.

The problem of informatization scenario forming, concern to the class of complicated weekly stratificated problems, the solution of which is impossible without qualified expertise, utilization of creative potential and personal knowledge of experts. Nevertheless, the proposed by the authors methodological means allow in a certain degree to structurise the process of acception of main decisions, defining the orientation, content and organizing forms of activities in the field of higher school informatization.

The first stage in the informatization scenario construction is the choice of strategy. According to presented model this is the choice between stagnation (surviving), quantitative (increase) and qualitative (development) changes on the informatization level; between global and local, directed and undirected informatization processes. Let's consider the most advanced strategies, oriented on qualitative shifts on the level of informatization. Thanks to the fact that selected strategies suppose purpose distribution of resources, the scenario of informatization management necessarily includes centralized function of planning and prediction. The open character of interaction with external environment in the choused strategies allow to eliminate the scenario, which suppose centralization of all management functions.

The management mechanism, typical to the developing systems, differs by the presence of two feedback contours, one of which is intended for quantitative information collection for management of functioning, while the other one is realized by the way of creating of semantic filter, which carries out the collection, storage and processing of qualitative information for management of the development [3]. The realization of such management type may be achieved by creation of Centers of informatization and redistribution of functions between *GOSKOMVUZ*, higher schools and Centers of informatization.

As a result of such redistribution there appear two feedback contours. The first one carries to *GOSKOMVUZ* level the quantitative parameters of the informatization process. The other one is intended for storage of qualitative information, its filtration, generalizing and utilization for prognostics and planning. The first of the mentioned contours is realized in standard management technologies, while the other one presents a channel of soft, reflexive management and may be realised in the activities Centers of informatization.

The next step in the informatization scenario building is definition of resource provision methods. In accordance to choused strategies the provision ought to be purpose one. So, according to expert's opinion, one of the most significant goals of high school informatization consists of infrastructure creating of informatization means and providing of its functioning. This allows to choose among possible scenario those ones, in which the purpose resource provision is oriented on informatization means and its staff support. In practical plane the choose of these scenario means the transition to purpose financing:

- of the works concerning creation of technological conditions, hardware and software, telecommunication systems, *providing satisfying of student's informational* needs, the same for teachers, managemental persons and scientists of high school;
- of arrangements concerning creation of industrial-technological base for the production of national competitive informational resources and technologies;
- scientific-educational structures and institutions, ensuring the outstripping production of information and knowledge.

While development of the scenario of interaction with the external media in the informatization process one ought to take into account, that the greatest deficit of information exists not on the level of state structures, but on the level of regional management organs, enterprises and individual users. From the other hand, the employer's-commereial structures are not ready yet to formulize and realize their informational needs, to finance expensive projects. That is why the realisation of the open type interaction with external media in selected informatization strategies ought first all to be carried ought through collaboration between higher school and regional structures.

As an other example of system analysis one may consider the corporative interests of higher school on the regional level of informatization, which obtains the increasing significance.

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TEACHING INFORMATICS AND THE INTRODUCTION OF THE NEW INFORMATION TECHNOLOGIES INTO BULGARIAN SECONDARY SCHOOLS: PRESENT STATE OF AFFAIRS, PROBLEMS, PERSPECTIVES

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Information technologies influence the social and economic development in Bulgaria as well. Regarding the phases of development in the use of IT within government, commerce and wider society, Bulgaria is in the second - information phase [1]. If IT should be coming into everyday life, an adequate training is to be ensured as early as at secondary school level.

In 1994 an international conference on «informatics in the Secondary Schools - Today and Tomorrow» *took place in Bulgaria. The present paper presents a summary of the problems discussed at this conference, highlights those approaches and results that are put into practice today and reflects our views on the future development of the teaching of informatics and IT in Bulgarian schools.*

I. WHAT DIFFICULTIES SPRANG UP WHILE INTRODUCING INFORMATICS AS A COMPULSORY SUBJECT?

Since 1986/87 academic year Informatics has been introduced as a compulsory subject for secondary education. Since then a number of problems have emerged with the introduction of the new discipline. These can be outlined as follows [2]:

• Being a new subject, Informatics had to find its proper place in the school curriculum among the subjects already established as secondary school disciplines, this led to a reduction of the workload assigned to other subjects and ultimately resulted in the emergence of some negative attitudes towards the new discipline expressed by some specialists in the Ministry of science and education. The bulk of Informatics in the school curriculum was being continually reduced as well as the age group (the class) changed. The teaching materials, designed for a particular class had to be used for different classes and workload. The balance of the position of many Informatics teachers was lost.

• The attempt to integrate Informatics in the Mathematics courses at the primary and lower-secondary level proved to be unsuccessful due to the fact that not all Mathematics teachers were adequately trained in Informatics and not all schools had tie necessary software and hardware supply.

• Neither the quantity nor the quality of the computer equipment available in the country is sufficient to start a comprehensive programme for teaching separate courses in Informatics or integrating IT within other disciplines. Although hardware and software providing of schools has been changing for the better lately, many Bulgarian schools can still be classified in the Automation phase of development in the use of IT. The number of schools whose development regarding IT can be ranked in the Information phase is considerably small, and still fewer are those schools which can be considered as making attempts to enter the Communication phase in the use of IT in the process of teaching and learning.

There are still no unified state standards and requirements for the teaching of Informatics. Undoubtedly, this constitutes yet another serious obstacle for teachers and students.

II. THE TEACHING OF INFORMATICS AND THE INTRODUCTION OF IT IN BULGARIAN SECONDARY SCHOOLS: *PRESENT STATE OF AFFAIRS AND PROBLEMS*

At the present time, a wide range of software and hardware supply is used in Bulgarian schools. Unfortunately, there still are upper-secondary schools which are only equipped with 8-bit computers in a minimal configuration of 48 KB RAM, with no floppy-disk drives. Other schools use 8-bit computers with floppy-disk drives and RAM upgraded to 64 KB. The greater majority of schools use 16-bit Bulgarian Pravetz-16 computers which are IBM PC/XT compatible. Some selected schools are provided with highly productive

IBM compatible computers with 80286, 80386 or 80486 processors or with APPLE MACKINTOSH computers. The hardware diversity in schools is inevitably linked to a diversity in software.

Most schools have only one small computer laboratory, which binders to the great extent teachers' attempts to integrate Informatics and IT into other subjects.

In 1994/5 the diversity of computer provision led to the introduction of 6 different standard Informatics curricula (modules). The availability of both equipment and specialists had to be taken into consideration as well as the students' choice of compulsory and non-compulsory subjects. These curricula, their objectives, their hardware and software provision are displayed in Table 1.

There are three ways of teaching Informatics in Bulgarian schools:

- as a compulsory subject in the Secondary Comprehensive Schools.
- as an extra or optional subject in the Secondary Comprehensive Schools and Secondary Technical Schools. Informatics is studied in the; 9th - 12th grade of the forms and in the 1st - 3rd grade of the latter. The workload assignment constitutes 72 lecture hours per year; teaching follows Curriculum No 6 or includes the information technologies described below.
- as a subject of specialization; instruction fellows Curriculum No 6 and standard final state examination is held. The examination consists of two parts: theoretical and practical.

Introducing information technologies in Bulgarian Secondary Schools

Since 1994/5 academic year a subject named *Technologies* has been in reduced in the curriculum for the 9th and 10th grades of the Secondary Comprehensive Schools through a Ministry decree N P-09-395/16. 06. 1993. The syllabus of this subject is designed by each school on the basis of the curricula offered by the Ministry of Education, Science and Technologies. One of the sub-disciplines of *"Technologies" is "Information Technologies".*

The teaching of IT varies depending on the type of school. In comprehensive schools IT is studied as a compulsory subject, 2 hours per week. The course is divided into two parts: general and special. If the 9th grade students have not attended a course on computers and operational systems before, the instruction follow a standard syllabus on *"Operating Systems with Text Interface"* ith a volume of 36 hours during the first term. This syllabus provides basic knowledge and skills necessary for the operation of IBM compatible computers and the use of other software products.

The special part varies depending on the available software the teacher can choose between some of the standard syllabi listed in the variable part of Curriculum No 6 in Table 1. The course workload of each of the syllabi is 36 hours. At the end of the course each student submits a paper, which is evaluated and graded by the teacher.

In the specialized schools the teaching depends to a great extent on the specialization. The design of the syllabus emphasises areas which meet the needs of the specialization.

With the suggested syllabi an attempt has been made to avoid the problems caused by the differences in computer provision and teachers' training. The syllabi show a differentiated approach to the teaching of informatics. However, at the same time some of them pose some contradictions and difficulties. These can be summarised as follows:

- As an extra or optional subject informatics is introduced in the 9th grade while the compulsory informatics course is in the 11th grade. Not all students choose to study Informatics in the 9th grade. The problem aims for the teacher who should be able to organize the teaching process in a way which will ensure the motivation of each student. What should be the minimum of knowledge and skills necessary to pass the course? What should be the criteria for assessment if the students have different levels of skill at the entry point of the compulsory informatics course.
- Similar problems arise when a particular school has chosen to introduce IT as an extra or optional subject in the 9th and 10th grade, The compulsory course starts as late as the 11th grade.
- In the technical schools Informatics is not a compulsory subject at all. This definitely is a deficiency of the curricula at the moment, considering the future incorporation of these graduates in the spheres of industry and services where the presence of the new IT is an indisputable fact.

III. WHAT ARE THE PROPER WAYS TO OVERCOME THE PROBLEMS LINKED TO TEACHING INFORMATICS AND IT AT UPPER-SECONDARY LEVEL?

1. The Ministry of Education, Science and Technologies should adopt uniform and consistent conception of the teaching of Informatics and the introduction of IT in education. In addition, sufficient funding should be provided for an adequate supply of at least 16-bit IBM PC/XT compatible computers for all schools. This will make it possible to match the teaching of Informatics with the increasing requirements of modern life. Taking into consideration the social and economic state of the country this problem could be solved in no less than a few years' time.

2. Standard requirements for the teaching of Informatics should be specified. Since January 1996 a commission has been appointed by the Ministry with the task to establish state standards for the teaching of Informatics.

3. The teaching of Informatics should be done in two stages:

- First stage: includes a compulsory minimum of knowledge and skills for all secondary school graduates; the teaching for this stage should be incorporated in the curriculum for the 9th grade of the Secondary Comprehensive School and the 1st grade of the Secondary Technical Schools.
- Second stage: includes additional knowledge and skills; the content of the second stage courses may vary depending on the vocational specialization of the infliction and/or hardware and software provisions. This can be incorporated in the curriculum for the 10th -12th grade of the Secondary Comprehensive School (SCS) and the 2nd - 3rd grades of the Secondary Technical Schools (STS) as an extra or optional subject. IT can also be introduced as a subject in the 10th -12th grades of the SCS and 1st - 3rd grades of the STS.

The introduction of Informatics in the 9th grade of the SCS and the 1st grade of .the STS will motivate students to choose it as an extra or optional subject in the next glasses and will provide the basis for the proper integration of IT into other subjects.

The teaching .materials, and documentation for the two stage teaching of Informatics can be arranged in modules. A successful attempt to put this idea into practice are the above mentioned curricula No 5 and No 6. The teaching materials for these curricula comprise of the course book *"Informatics II"* and the practical modules: *Word-processing - Spreadsheets; Databases; Desk Top Publishing; Computer Graphics/Computer*

Aided Design.

Such a curriculum complies closely with IFIP recommendations for Informatics curricula given in UNESCO's report entitled "Informatics for Secondary Education: A curriculum for schools".

Adopting the modular approach makes it possible to differentiate the teaching of Informatics. While the foundation level will be defined by the authorities through the educational standards, the advanced level is unlinked, matching learned interests and needs, depending only on hardware and software provision.

4. The effective implementation of IT in secondary education is directly connected with the training of Informatics teachers - for the prevent and for the future needs in this field. It is necessary to establish more regional and university centres that will train teachers of Informatics as well as other disciplines needed for the proper implementation of IT in the educational process as a whole.

The points stated above make it evident that educational institutions in Bulgaria still experiencing problems with the introduction of informatics and IT into education. Yet those problems can be solved. As the necessity of implementing IT in Bulgaria is inevitably increasing, establishing the teaching of Informatics in the secondary schools becoming a non-reversible process.

Table 1

Hardware provision	Software provision	Curriculum	Objectives	
			STUDENTS MUST KNOW ABOUT:	STUDENTS MUST BE ABLE TO:
8 bit computer 48 KB RAM, no FD	programming language - BASIC	C1	basic informatics concepts, computer architecture and functions, arrays, algorithms, programming language - BASIC	acquire basic computer skills, solving simple problems
8 bit computer 48 KB RAM, with FD	programming language - BASIC, OS DOS 3. 3 for 8 bit computer, Training File system	C2	basic informatics concepts, computer architecture and functions, arrays, algorithms, programming language - BASIC, Operating systems, Files, file management	acquire basic computer skills, solving simple problems, process Files, create simple information systems
8 bit computer 64 KB RAM, with FD	programming language - BASIC, DOS 3. 3 for 8 bit computer, Training programme environment simulating MS DOS and Text Editor	C3	basic informatics concepts, computer architecture and functions, arrays, algorithms, programming language - BASIC, Operating systems, word-processing	acquire basic computer skills, solving simple problems, work in OS for 16 bit computer conditions, acquire basic word-processing skills
	programming language - LOGO	C4	basic informatics concepts, computer architecture and functions, programming language - LOGO	acquire basic computer skills, solving various problems using LOGO
	Training programme environment simulating MS DOS and Text Editor	C5	operating systems, word-processing; The curriculum is designed for students who have attended C1, C2, C3 courses	work in OS for 16 bit computer conditions, acquire basic word-processing skills, process simple text documents
IBM XT/AT compatible computer or IBM compatible computer with 80286, 80386 or 80486	MS DOS, TURBO PASCAL 5. 5, PC TOOLS, DOSSHELL...	C6 obligatory part	basic informatics concepts: information, data structures, algorithms, program languages, operating systems, computer architecture and functions, stages and technologies of information servicing	use available tools to solve practical problems, use freely OS and servicing software potentials
	Word-processors (MicroText, Word 5.*, Works, Winword...) Spreadsheets (Microplan, Lotus 1-2-3, Works, Excel...) Database (Microfile, dBASE 3+...)	C 6 variable part	principles, potentials and typical operations of word-processing systems, Spreadsheets, elements, data type, applications; principles and organisation of relative database.	use a particular word-processor; design simple documents; design and process simple spreadsheets; solve problems using spreadsheets; design and create simple databases and extract information nut of them
	Computer graphics (CyberCad, AutoCad...) System Planimetrics		functional potential and operation at a particular 2D graphics System: basic working principles of System Planimetrics; basic Infoitnatics and Mathematics concepts and relations	create simple drawings and 2D structures with practical application; carry out mathematical experiments and formulate hypotheses, create mathematical models and investigate their features

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ON THE SYSTEM OF INFORMATION AND METHODICAL ENSURING OF HIGHER EDUCATION

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One of the main and determining terms for accomplishing of directed evolution of higher school is a methodical and information ensuring, comprising:

- the process of creation of information sources on the basis of a scientific research;
- the satisfaction of information demands of educational training and scientific research process. Taking into account the complexity and multi-aspect character of the solution of problems for a methodical-information provision at any level (federal, regional (segmental) and domestic) a systematic approach to the problem was developed.

The traditional and new information sources in higher education are as follows:

- training means (textbooks, methodical - training guides, audio-visual manuals, training softwares and instructions):
- scientific literature;
- data bases and knowledge bases;
- official documents;
- and so on.

Their elaboration, manufacturing, quality estimation and marketing need a significant intellectual and material expenses, and a solution of the complex of scientificmethodical and organizing-management problems.

In this connection it is important to orient the scientific researches and developing management measures on the solution of the following tasks:

- to estimate the required means of information-methodical ensuring and their list on the basis of the state standards of professional training, of approximate curricula and programmes;
- to carry out the scientific-methodical works on determination of a structure and content of each teaching tool;
- to select authors, producers and compilers (on the basis of competitions);
- to elaborate the long-term (perspective) and short-term (annual) programmes- for creation, issue and production of education means;
- to arrange programmes fulfilment;
- to solve the problems of manufacturing, making copies of training means, gathering and carrying out of the orders from universities, academies and institutes;
- to solve the complex of problems concerning the organisation of information-methodical provision of each user.

The multi-variant character of realized in universities, academies and institutes professional curricula, as well as the independence of educational establishments, had demanded the appropriate invariability of programme-methodical ensuring, publishing activities of higher schools, providing a retention of general library-bibliographical approaches in services of information users.

Thus, the Programme of 3-level system of higher school publishing was elaborated for higher schools in Russia in 1993-1995, including:

- I level - printing of textbooks for humanitarian, natural-science, common-professional and common-special disciplines (federal set) through central and the largest university publishing houses;
- II level - printing of textbooks and manuals for special disciplines of regional (segmental) component through regional and segmental publishing houses of higher school institutions;
- III level - printing of educational literature for special courses, as well as teaching-methodical literature having regard to demands of educational process through publishing departments and centers, being in hand in all higher schools of the country. The programme takes into account the structure of a State Educational Standard of higher professional education and the possibility to issue textbooks prepared accordingly to authors programmes.

The programme offered is acceptable for creation and publishing of other educational means. The Programme involves the problems of development of polygraphic base of higher school. With this in mind a competition of grants between universities, academies and institutes of the State Committee for Higher Education of the Russian Federation was held in 1995-1996. The competition results revealed up to 65 regional higher schools in Russia, which are ready to accept the functions of inter-school polygraphic centers for publishing of textbooks and scientific literature.

In an effort to convert the university libraries into the centers of information provision in educational-teaching

process and scientific research along with higher Russian schools the following special programmes were developed and are now under fulfilment:
- the formation of book funds;
- the introduction of new technologies in library services;
- the provision of accessibility of higher school libraries for students, teachers and research workers;
- the fitting out of libraries with copy-multiplier machines and modern library technologies;
- the provision of preservation and involving into teaching process and scientific research the funds of rare books;
- the normative-methodical provision of library-information work in higher school;
- the setting up the foreign literature funds for higher school libraries;
- the development of international cooperation of Russian libraries.

For the purpose of operational and effective information distribution and the provision of higher schools of all users of state standards with approximate and authors' curricula and programmes, of information on teaching and other literature, on means and new technologies, there shall be established a special information fund of normative-methodical documentation and tools and technologies for higher professional education, and the basis for it should be the Research Center of quality problems in the training of specialists. A creative team of specialists of higher education was formed to establish in 1996-1997 the above mentioned fund and attract to its formation the universities, academies and institutes, training-methodical associations and scientific-methodical counsels.

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CURRENT STATE AND PROBLEMS OF TEACHING AIDS AVAILABILITY AT THE EDUCATIONAL ESTABLISHMENTS OF THE UKRAINE

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Successful adoption of new information technologies in education is impossible unless these are *effectively combined with traditional educational technologies on principles of harmonious mutual complementing one another.* This necessitates qualitative development of the traditional educational technologies and of teaching aids (TA) as their crucial component.

Assessing now the availability of TA at the educational establishments of the Ukraine, one should note the growing gap between the. current requirements to the tooling of the teaching process and economic-and-production capability of the industrial sector of national economics to meet them. The main reason for the gap is the collapse of the system of TA development, manufacture and supply to educational establishments that existed in the former USSR as well as the changes going on in the Ukrainian system of education. Content-wise, 60 % of the programmes of education and bringing up children at the kindergartens have been revised. New subjects have been introduced at general education schools (getting to know the Ukraine, valeology, fundamentals of ecology, and others), new sections in the traditional subjects (combinatorial analysis and statistics in mathematics, etc.), the number of hours allocated to study particular subjects has changed considerably. With the apperance of new types of schools increased (174 gymnasias, 154 lyceums, 74 private schools), differentiation between the schools has there are more schools now with an in-depth study of particular subjects. In vocational training 250 vocational training schools have changed their specialization, with 77 new higher schools, 5 fine-arts and 6 vocational school-cum-agricultural firms established. In consonance with the Ukrainian Law «On Languages», a further steady transition to the Ukrainian Language is under way as a language in which teaching is carried out. At present, 58.3 % of all children attending general education schools, 50 % vocational training schools, 65.2 % nurseries and kindergartens use Ukrainian as a language of teaching. Over 1/3 of the schoolchildren are taught in Russia, there are 7100 kindergartens for Russian, Moldavian, Hungarian and other children. This has resulted in a considerable variativity of the programmes, a profound restructuring of the curricula, in the state and school training components being introduced in the curricula.

Under the new syllabuses, the Ministry of Education of the Ukraine has developed standard lists of teaching and visual aids and technical means of education, on the strength of which effort is being made to raise the level of TA availability, at the educational establishments. The purpose of the said Lists is to secure the state component in education: they put together a basic TA module for each subject of the state component of an.appropriate type of educational establishment.

TA availability for various subjects at all types of educational establishments varies from 5 to 60%. The lowest availability is in the subjects of the humanities cycle (14%). This is due to the socio-political changes in the life of society and their influence on the process of training at school. TA availability for natural science and math subjects is low (22 %). For example, today, only 7-15 % of lessons in physics, biology and chemistry in senior grades can be held under the programme of laboratory and practical classes. The schools lack chemical reagents, the necessary visual aids, mock-ups, modules, etc.

Depending on the kind of TA, the level of TA availability for schools varies from 5 to 42 %. The situation is really bad with technical means of education. The level of TA availability at vocational training schools and secondary technical schools equals 30-48 %.

In pre-school upbringing, of crucial importance is a game and various appropriate toys. Plaything industry in the Ukraine numbered 400 factories in 1990, which turned out over 5000 different toys and met 25 % of the population toys requirements. After 1990 depending on the kind of toys, their assortment has fallen 3-7 times. The toy becomes increasingly primitive; the number of the teams of authors developing new toys has dropped 20 times.

Considering the pressing problems of providing schools with teaching aids, the Ukrainian Cabinet of Ministers undertakes centralized financing of several programmes developed by the Ministry of Education. Special emphasis is placed on cartographic products in geography and history. Production of 72 wall maps, 5 atlases and 2 globes has been launched. 20 wall geographic maps are being delivered to schools. A complex of aids in geography (a text-book, wall maps, an atlas, contour maps, working note-book) for the 6th grade was prepared and issued towards the 1995/1996 academic year.

An important area is the development and production of printed teaching aids. What makes it valuable is the low cost of the product, short production period and many potential uses. In 1995, more than 40 sets of posters in different subjects were prepared.

The entire Stock of educational films is being transferred to a video format, which involves an appropriate adjustment to the current programmes, translation into Ukrainian and copying.

In association with the Ukrainian Academy of Pedagogical Sciences higher educational establishments and sectoral institutes of the Ministry of Education of the Ukraine a programme is being developed for equipping the studies of physics, chemistry and biology on the principles of a modular approach and of transition to new generations of teaching equipment for a demonstration and frontal experiment, involving PC. The project will signify the first steps towards practical application of new educational technologies. A number of systems facilitating the study of physics, chemistry and other subjects are being tested on a pilot basis. These include an electronic reference version of Mendeleeff's periodic table based on a microprocessor module with a direct access to memory.

To implement the aforesaid programmes effectively, intense organizational effort is now under way associated with (a) integrating the sectoral and local budgets for centralizing the financing, development manufacture and delivery of TA, (b) searching for effective forms of attracting foreign firms as suppliers of TA to educational establishments, setting up a state-run system of protecting the sphere of education against the penetration of TA that fail to meet psycho-pedagogical, aesthetic and technical requirements. The first step in this direction is the establishment of an Intersectoral Artistic-and-Technical Board for toys and educational-game aids with a view to putting into effect the state policy in the field of developing and manufacturing toys, educational-game aids, playground environment for the children of all ages.

The programmes financed from the state budget include priority TA without which the study of particular themes is impossible. Developments submitted by authors are subject to reviewing and approval of the scientific-and-methodological commissions of the Ukrainian Ministry of Education.

Implementation of specific programmes in 1996 will make it possible to increase the availability of appropriate teaching aids by 10-17 %.

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REFORM IN THE EDUCATIONAL SYSTEM OF THE RUSSIAN NORTH ON THE BASIS OF NEW INFORMATION TECHNOLOGIES

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Arctic North of Russia comprises 70 % of the territory of the country situated northern in reference to the 65 parallel, its population makes up more than 12 million.

The natural potential of the Russian North is of global importance as far as here is concentrated, the huge amount of natural resources, such as oil, gas, nickel, cobalt, lead, gold, ores of rare metals etc.

The Russian North is the ecological and territorial reserve for our planet as a whole.

The extreme nature and climate conditions are typical for the Russian North. This region is far from cultural centres; the regional infrastructure is not developed, and the industry of the Russian North is characterized by enclave development. The population is not uniform and its tendencies towards migration are very strong. 30 types of the aborigine of the Russian North are interested in preservation of the traditional directions of economic activity and traditional *modus vivendi.* The communicative disunity inside the region is the main feature of the local life resulted from vast of the North.

The Arctic North of Russia is currently experiencing a crisis implying drastic decline in production which comprises the major part of Russian export. It is also characterized by serious social and demographic problems resulted from considerable decrease of construction of social tenant housing, public medial and cultural, housing, substantial increase of unemployment, decrease of standard of living of the North inhabitants, snowballing process of skilled labour outflows, escalation of both contradictions between industrialized regions and aborigines' needs and of general social tension converting in some places into clash.

In the Russian North the environment situation is hard in the industrial regions, the degradation of environmental systems continues and it threatens with pollution of the surrounding areas, including those out of Russian boundaries.

All-round strengthening of the social basis of the Russian North, prevention of degradation and race suicide of the aborigines, holding of skilled staff of entrants, all these points are conduit sine qua non for renaissance and crisis-free development of the Russian North.

New educational strategy is the major requirement and method for implementation of the above key social problem.

At present, all educational structures of the Russian North, these are comprehensive school and vocational school, are in crisis that results from lack of funding. At northern national schools 30,000 aborigines study. They live at the distance of 3 or more kilometres from school, that is why they have to study and live at boarding schools. As a result, the most important in the North the mechanisms for generations succession is broken out. It causes social infantilism of youth, loss of fathers' experience in traditional callings and trades, increase in potations and alcoholism.

The major directions for the reforming of educational system shall be as follows:

- the problems of financing shall be solved, the investments into education shall be advantageous for commercial banks, companies and private persons both native and foreign;
- development of the basis providing possibility for children to live and study in their families with the purpose of preservation of language and home medium that is quite necessary for children upbringing in the old folks traditions;
- co-ordination of activity of researchers, teachers, representatives of authorities, of all institutions interested in the education reform, in task-oriented development of training programmes and methods for upbringing and apprenticeship taking into the account national particularity on the peoples of the North and new educational technologies;
- supplementation of general comprehensive education by general vocational education;
- professional orientation towards traditional for North peoples specialities, such as fishery, reindeer breeding, hunting mastering etc.
- development of the system for continuous ecological education of children and adults;
- arrangement of the improved labour training with the purpose of making up the following specialities: cross-country vehicle driver, radio-operator and reindeer breeder, fur farmer, master for fur treatment, master for national fashion industry etc.;
- development of normative and legal basis for new educational policy for North.

In the Russian North the basis for educational system reforming is considered to be the combination of the educational methods and general and early supplying of comprehensive and vocational schools, the North villages and North aborigines families by the means for new information technologies. The educational process and methods should be improved, research centres shall be established, the system for continuous ecological education for adults and children.

Distance education development is desirable according to the "Centre - Northern territories" general scheme. With this purpose the use of conventional mass media means is necessary, especially such as radio, TV and video, and special video courses shall be developed for various groups of people.

In the same time, mass PC connection with Internet and other computer nets is very important under the conditions of North.

Ecological educational system can be highly intensified through connection to ICLIE (International Council of Local Initiatives for Environment Protection) programmes by means of Internet.

ICLIE is acting as a centre for well-balanced development, for environment policy, for development of local programmes and methods. It also co-operate with local authorities with the purpose of carrying out of mutual environmental campaigns. ICLIE also organizes distance learning courses on ecological management for the officers of local self-administration. This is also of great importance for the Russian North in view of the fact, that the educational method realizes the idea of collectivity of the students and co-ordinator on retention of the individual approach through interactive communications.

There is good possibility for participation of research and industrial institutions of the North in the «Esprit» European programme which contributes to improve technical knowledge and implement new technologies in the sphere of production and management.

With the purpose experience exchange in the field of new technologies mastering under the conditions of the North, it is desirable to establish communications and to carry out exchanges with arctic regions of Alaska, Canada and Scandinavian countries.

Of course, the implementation of the idea of overall computerization of the Russian North calls forth substantial funding. But with the account of its planetary importance, the Russian North can count on unequivocal financial and investment support of both the Government of Russian Federation and all interested institutions including the foreign ones.

Proposals

1. *To include into the text of the Second International UNESCO Congress Recommendations the clause on the necessity for reforming of the educational system for the Russian North on the basis of on-line and general implementation on the new information technologies.*
2. *To ask UNESCO to include the problem of reforming of the educational system for the Russian North into the priority chart. To develop and to launch the «Reforming of the Educational System for the Russian North on the basis of new information technologies» Programme.*

3. *To incorporate into the list of the developers of the Programme, the Russian public organization «Polar Russia» The Union for North Renaissance» which was established with the purpose of effective support of Russian policy.*
4. *To charge «Polar Russia» The Union for North Renaissance» with an important mission of presentation «The Reforming of the Educational System for the Russian North on the Basis of New Information Technologies» Programme to UNESCO by 01 October, 1996.*

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SOCIAL INFORMATICS IN THE SYSTEM OF HIGHER EDUCATION IN RUSSIA

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I. SOCIAL INFORMATICS AS A NEW SCIENTIFIC AND TEACHING DISCIPLINE

There are passed more than seven years since the moment, when in several russian higher schools a new discipline called *social informatics,* began to study. This direction appeared on the junction between informatics, phylosophy, sociology, economy and psychology as a result of necessity of complex study of society informatization process and its possible social consequences.

One ought to comprehence informatics as a system of knowledge about production, processing, storage and distribution of all kinds of information in the society, nature and technical systems.

However in the community opinion, not only in Russia, one can meet the idea according to which the term «Informatics» in concerned only with the last media - technical one. That is why there appeared a demand to «protect» the subject field of scientific investigation, dealing with informatic society problems, by a special term.

In modern comprehencion the *social informatics* is a science, which studies a problem complex, concerned the information processing passing in the society and its informatization.

It's well known, that concept postindustrial information society was proposed by the western scientists (D.Bell, J.Geebrate, J.Martin, I.Masuda, O.Toffler). However it obtains more and more acknowledgement in Russia (N.N.Moiseev, A.I.Rakitov, A.D.Ursul [1]). Hence, one should take into account, that social informatics as a new scientific direction and educational subject, appeared in Russia and has not analogs abroad.

Currently the educational course of social informatics is used in curriculum of the student and post-graduate preparation in the- leading russian universities - in Moscow, St.-Petersburg and Nijniy Novgorod. It is studied in the Lomonosov's Moscow State University (MSU), at all the departments of Moscow State Social University (MSSU), in the Institute of Youth and also Russian Academy of State service at the President of Russian Federation.

In the four Russian higher schools there have been created and successfully function the social informatic departments, while in 1994 there was created an Association of these departments to coordinate their scientific and educational-methodological activities.

Since 1989 in Russia annually the scientific-methodological seminars are carried out. They are concerned to actual problems of social informatics. The scientists from Russian Academy of Sciences, Russian Academy of Natural Sciences, Noosphere Academy and International Academy of Informatization take in active part in these seminars. Scientists from abroad, the teachers from higher and secondary schools, specialists from federal and municipal organs of the educational system are also invited to these seminars. The materials of mentioned seminars are published in the scientific press in the form of individual collections *«Social informatics»,* which are edited annually since 1990 [2,4]. Another collection - *«Problems of Social Informatics»* is edited by MSSU regularly since 1995 [5-7].

Fundamental and applied investigations are actively carried out in Russia on the actual problems of social informatics. Recently also the candidat's and doctor's degree thesises are also prepared. Moreover, a explanatory dictionary on main terms is also developed.

That is why one can surely consider that in russian scientific and education spheres there has been storaged a define experience of social informatics problems study and its teaching, which surely deserves some analysis and generalization. However, before starting to do it, it's advisable to characterize the *subject field of the social informatics* in brief, its main problems and directions of development.

2. THE STRUCTURE OF THE SUBJECT FIELD OF SOCIAL INFORMATICS AS A NEW SCIENTIFIC DIRECTION

The social informatics, as well as every aria of scientific knowledge, has a multilevel structure:

The first level - theoretical-methodological - includes main cathegories, ideas and low-governed nature of information processes in the society;

The second level - of informatizing sociology - present a social «cut» of economical, legal, psylological and other aspects of informatization;

The third level - empirical one - includes the social aspects of creation, introducing and adaptation of information technologies in the society.

The structure of the subject aria of the social informatics as a science may be presented by four large problems [2]:

1. Information resources of the society.
2. Information potential of the society.
3. Low-governed nature of information society formation, as regular historically inentable stage of civilization progress, changes of social structure of society in the conditions of informatization.
4. New possibilities and problems of person in the information society.

As of educational aspects of social informatics problems, one ought to stress the strategical importance of *informational culture society* increase, e.g. the increase of degree of it readiness to the effective social utilization of new information means, different types of information resources and producing of new knowledge.

At the same time during last years it became more and more evident, that the level of main part of society readiness for informational media utilization significantly lags behind the rate of it development. One of the main reason for this is *the inertia of the existing education system in the information field.* That is why now we need not only informatization of the whole education sphere, rather also the including into the permanent educational system of special curriculum on the fundamental, in particular - social, base of contempory informatics. These courses ought to be obligatory.

3. THE EXPERIENCE OF SOCIAL INFORMATICS TEACHING IN THE HIGHER SCHOOLS OF RUSSIA

In the National Report of the Russian Federation to the Second International Congress UNESCO «Education and informatics» [3] the problems of social informatics are considered in the form of one of the main part of prospective course *«Fundamental basis of informatics»*, which is proposed as a basic for the higher school system. In Russia there already exists an experience of teaching of a special course on social informatics as an independent discipline either in the universities, or in the system of retraining of the specialists with higher school diploma.

It's evident that current Russian student, future specialist of 21st century, most exactly known the low-governed nature of new information epoch development, to understand, that his own theoretical preparation may also influence on the possible consequences of informatization, either positive or negative.

The goals of the MSSU curriculum *«Fundamentals of social informatics»*, which is first in the practice of russian education obligatory course in the framework of the cycle of general humanitarian preparation and is dedicated to study of theoretical-methodological problems of information society, include:

- creation the basis of skills to orient properly in a new information reality;
- formation of representation about the necessary to master the computer literacy, without which the organic including of the person into information environment of the society and active support its progress is impossible;
- methodological preparation to father study, mastering and participation in the design of information technologies in the corresponding subject area: socioligy, psychology, economics, social work, jiriprudence.

In the condition of rapid modification of the informational technologies and development of the possibilities, providing by them, the question of upbringing of goal life settings of the individual person maintain actual.

The structure of the course *«Fundamentals of social informatics»* studied in MSSU, includes the following themes:

- social informatics; the subject and goals of the course;
- the main ideas of theoretical informatics;
- social communications;
- information resources and information potential of the society;
- informatization of the society: prerequisities and consequences;
- formation of information environment of the society;
- information style of life: the society and person in the informatization conditions;
- information society: social structure, specific features of labour activities.

Currently in several russian higher schools one can notice an active formation of social informatics as a whole complex of teaching subjects [4].

By combining of the theoretical informational methods and also social and informational approaches, the social informatics obtain new pulse for its future development in the condition of transformings in Russia. One ought to take into consideration that namely informatization allows to intensity mane processes in the society, while the social informatics, as a scientific basis of informatics, provides the opportunities of scientific analysis and predicting of future development of these processes.

All these factors underline *fundamental properties of social informatics* as a new sociological scientific direction and educational subject - its adapting, integrity, logical slenderness, reasonably.

As for *applied significance of social informatics*, it may be illustrated by the results of sociometrical investigation, which has been carried out on the Department of social informatics in the Institute of youth. The results of this investigation are presented in the table.

№	The title of the subject	Correlation coefficient	Rang
1.	Social modeling	0.9	1
2.	Social statistics	0.8	2.5
3.	Social predicting	0.8	2.5
4.	Social pasportisation	0.7	4
5.	Social diagnostics	0.6	5.5
6.	Sociometrics	0.6	5.5
7	Social planning	0.5	7
8.	Social administration	0.4	8.5
9.	Social management	0.4	8.5

Twenty eight respodents - specialists in social work - were proposed to evaluate the degree of correlation of «Social infprmatics». subject with other subjects of social profile. The results of the investigation have shown that social informatics provides sufficiently wide interdiscipline connection and, hence, may be used as *base discipline in preparation of experts for social sphere.*

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USE OF TELECOMMUNICATIONS IN EDUCATION AND SCIENCE IN THE REPUBLIC OF BELARUS

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Today information is one of the most important strategic resources of a society's development. It caused the inflow of tidy investments in the creation of information systems and technologies.

Computer telecommunications are the natural continuation of integration trends in the development of informational systems. The combination of computer techniques and means of communication emerge the new computer function — they become a means permitting to widen the scope of the information space of a given organization, to expand the opportunities of the information interaction up to the scope of a city, region, republic and, finally, to provide entering the world information space.

At present, a lot of global networks and informational centres are functioning on the Belarus territory. They have different organization and technique. The most significant among them are:

- ***BelPAK*** — The state network for data transmission. It has the national status. It is based on the application of the protocol X.25. This network, as the other analogical national networks for data transmission in other countries, offers a powerful technical foundation and a wide range of universal services.
- ***EUnet/Relcom*** — A commercial international network, offering the services of e-mail, teleconferences, access to Internet, Usenet, etc.
- ***GlasNet*** — A public non-commercial international network, offering, first of all, e-mail services.
- ***Sovarm Teleport*** — A powerful commercial network, offering rather expensive services of access to Internet and other networks, which are kept in with protocol X.25.
- ***CITEC*** — A commercial information system. In fact, it represents the enhanced electronic advertisement desk BBS.
- ***BASNET*** — The network of the Belarus Academy of Sciences. Besides servicing the Academy's organizations and institutes, it offers the services of e-mail and access to international networks.

At present, the mentioned networks do not offer the full size direct exit to global networks of Internet. This exit is realized ether through e-mail, which doesn't provide an opportunity to use the on-line regime in the work with information systems, or through protocol X.25, which emerges some technical problems, reduces throughput and increases the price.

One of the most developed computer networks of the Belarus Republic is the non-commercial network UNIBEL It integrates the leading educational and scientific organizations of the Republic, offers the wide range of correspondingly cheap services. The main aim of UNIBEL is to provide access to the global community of Internet networks for the organizations of social sphere on the non-commercial base.

The creation of UNIBEL network pursues the following objectives:

- the overcoming the disconnection between universities, institutes, scientific centres, laboratories, groups of researchers and separate scientists, teachers and students. To provide them with the opportunity of free informational exchange;
- the solution of the problems related to the dissemination of new ideas, scientific results and publications in the field of education;

- the following general technical policy in the field of information technologies introduction in the educational system of the Republic. It will allow to increase the efficiency of using the resource of an educational institution and of the concrete worker of education and science. It will provide the opportunity to use efficiently the national informational resources of the Republic;
- dissemination of information technologies; education and popularization of computer telecommunications in the field of education.

The development of the UNIBEL network is implemented in the following directions:

- the closer co-operation with the network of the administrative control system after the educational system of the Republic; the creation of an integral republic network on their base;
- promoting long term information programmes, first of all on the base of attaching to the network the largest libraries, archives, centres of scientific and technical information and the expert service of the Republic;
- the development of the connections and realization of mutual programmes with scientific and research organizations (branch and academical);
- gradual attaching to the network the system of secondary special education and secondary schools, non-state educational institutions;
- attaching (the direct and through BelPAK) governmental and public organizations, funds, etc.;
- the organization on the base of the central unit of the Centre for specialists training and an inter-HEI research laboratory of network technologies. Today, the number of foreign organizations and funds are promoting the creation and the development of the educational and scientific network of the Republic. The Institute of the Open Society (USA) gave Belarus a grant for the creation of an optical fibre ring around Minsk — *Minsk Internet Project.* The implementation of this project provides our educational institutions and scientific organizations with the full access to the global computer network Internet.

There was gained a grant from UNESCO for the attachment to the computer network of the educational departments of the Regional Executive Committees of the Belarus Republic. Our activity was promoted by NATO Scientific Committee of the informational filling of the creating network.

The creation of a real information infrastructure has only started in the Belarus Republic. However, people realize that information is an extremely valuable and perspective commodity, and the information market is one of the most dynamic and roomy. Nowadays, many governmental, commercial, scientific and public organizations are promoting their activity in the field of computer communications and information technologies on the whole.

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TRAINING OF SPECIALISTS IN TWO FIELDS: INFORMATICS AND ECONOMICS

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The efficiency of information systems is largely determined by their economic efficiency. As shows the global and domestic experience the economists and the specialists in informatics cannot independently solve this problem.

For this reason on the base of Branch of informatics in Russian Academy of Economics (RAE) at the support of the State Committee for Higher Education of the Russian Federation there was carried out the first stage (1986-1995) of two-profiles preparation of the specialists in informatics and economics.

The usually one second of specialty can be received as the second high education, as a rule in 2-3 years. Moreover in Russia specialization in given specialty is widely used. For example, on senior rates of education of an engineering specialty profound the studing of economic disciplines is carried out, and the high school lets out the engineer-economist usually for certain branch of a national economy.

In the experiment at RAE an in essence new problem is delivered: to prepare in five years of education the expert simultaneously on two base specialties.

Fulfilment of all programme permits trainee to receive two state diplomas:

1. On specialty *"Information systems in economy"* (qualification of the specialist is the informatist-economist, term of education - 5 years);
2. On specialty *"Economics"* (qualification of the specialist is bachelor on economics, term of education - 4 years).

The student during education receives three working specialties:

1. Programmer (1-4 category) - in two years of education;
2. Projector of automated information systems (1-3 category) - in 4 years;
3. Interpreter of English / German language - in 2-3 years.

The decision of the similar unique education problem has become possible on the base of program *"Sciencefull technologies of education (STE)"*, which is carried out under aegie of Direction of the scientific programs of the State Committee for Higher Education.

The main principles of education remains: an individualization, computerization, informatization, system organization of education, oriented to the probably complete account of problems of the subject area.

Peculiarities of educational process are flexible specialization, raised motivation of education, high level of independence of education under advisory management of the teacher, necessary computer and information maintenance of the student and other.

The first stage of experiment (1986 - 1995) has given rather high results: 30-35 % of the students in academic group (from 25 persons) ended the given program of education with distinction.

The second stage is now begun, which assumes increase of efficiency of preparation on main professional cycles of disciplines (computer, informatics, economics).

In the RAE there is the necessity to start the complex of the educational-methodical documents:

1. *The state educational standard of higher professional vocational education. The state requirements to minimum contents and level of preparation specialists-informatist on interbranch specialty 07.19.00 - Information systems (on areas of application). Is entered into action 05.07.1995.-M,: GOSKOMVUZ of Russia, 1995. -p. 28.*
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The large collective of tutors - informatists of a number Moscow higher schools has begun creation of twenty manuals on given specialty.

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INFORMATICS IN RUSSIAN SECONDARY SCHOOLS: THE STRUCTURE OF TEACHING

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Analysis of the ways the foundations of informatics are taught and a new perception of the goals to be achieved by the introduction of this subject at secondary schools shaped by more adequate understanding of the general educational and, if you will, philosophical potential of this subject point to the need to identify several stages in the learning of informatics and the shaping of information culture in the process of school education.

The first stage (forms I - VI) is an introductory one. The children learn to use the computer and shape the primary elements of information culture as they use educational games, the simplest training programs, etc.

The second stage (forms VII - IX) provides a basic course to ensure a mandatory general minimum volume of knowledge of informatics. During this stage, the children learn to use the methods and means of information technologies for problem solving, form the skills of conscious and rational use of the computer in their school work and later in their professional activity. Doing the basic course enables them to shape the idea of the process of obtaining, transforming, transmitting and storing information in living nature, society and the technical world.

Apart from the need to make an early broad application of the knowledge and skills given by informatics in the other subjects on the school curricula, it is desirable to begin a systematic study of this subject as early as in forms VII - IX also because, first, a study of informatics by children of this age has proved successful both in Russia and outside it and, second, in view of the important role of this subject in the advancement of thinking processes and the formation of a scientific world outlook in children belonging precisely to this age group.

The basic course could combine the three current trends in the study of informatics in the secondary school, the trends that reflect the major educationally significant aspects of this subject:

- the philosophical aspect - formation of a systemic-information approach to the analysis of the outside world, the role of information in management, the specifics of self-regulating systems, and the general laws of information processes in various systems;
- the user aspect associated with the urgent need for «computer literacy» and preparing schoolchildren for practical work in an environment determined by a wide use of information technologies;
- the «algorithmic» (programmer) aspect which is, at present, more strongly connected with the advancement of thinking processes in schoolchildren.

The third stage (forms X - XI) would continue education in the field of informatics as vocational training whose extent and substance would depend on the student's interests and professional preferences. Specifically, the schools and classes that emphasize mathematics could introduce extensive training in computer programming and the methods of computational mathematics; the schools with a stress on the natural sciences could provide a course in the use of the computer for modeling and processing experimental results; the schools teaching mainly the humanities could give the students an idea of the systemic approach in linguistics, philology and history; rural schools could teach the use of information technologies in the organization and economic management of agricultural production, etc.

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THE ROLE OF CLASSICAL UNIVERSITIES IN FORMATION AND DEVELOPMENT OF GLOBAL SCIENTIFIC AND EDUCATIONAL ENVIRONMENT

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The modem system of education is going through the period of rapid transformation conditioned by the revolution in information technologies and their expeditious penetration into all spheres of human activity.

In this connection it is the educational environment which is becoming a central area of applying new information technologies to give a new impulse to development of the society.

The classical universities, according to their definition, have always been the centres of science, education, and culture. That is why they played a leading role in the society development. During recent years the social status of universities is considerably changing for good. The reason for this is the constantly increasing social significance of education. A society in all its spheres: social and economic, scientific, technical, and cultural, depends upon the scientific discoveries, knowledge, and professionalism. That is why the involvement of classical universities into the informatization process will have a crucial importance in the further development of civilisation.

The disintegration tendencies observed in Russia and in the states of the former socialist system sector are fostered by a historically formed situation when the academic science, the higher education, the fundamental university education, and the applied industry-oriented education exist on their own not interacting and not co-ordinating their efforts. Only at the turn of the 20th century the system of higher education has started seeing some signs of moving from a single-purpose professional training of specialists to building up a personality, enhancing the fundamental background, education humanisation, and to rising the role of classical universities. This resulted in emerging of many technical, agrarian, pedagogical universities that forces us to give a definition to a university in a traditional sense of this word, namely a «classical university».

The role of a classical university in an educational system is reflected in the etymology of its name. The Latin term «classicus» means «pattern», «exemplary», while «universitas» means «aggregate» or «collection» and is based on another Latin word «universum» meaning «existence» or «the world in its unity». Therefore, a classical university can be defined as an institution dealing with patterns allowing to orient oneself in the existence. In this regard a university has to be a new educational philosophy medium.

The educational functions of a university within the framework of this philosophy lay, first of all, in developing creativity and constructivity of a well-prepared mentality as well as in supporting motivation for educating oneself during the entire life.

The outcome of the classical university education should be an individual whose becoming would be conditioned by external influences, interactions, and internal work.

It would be wrong to think that a graduate of a classical university should not be a professional; on the contrary, he or she has to be a professional, however, not a «narrow-subject specialists» but a «generalist», i.e. a specialist in generalisation.

The success of a university as an educational institution is a great deal determined by its activities as a scientific organisation. When deciding on the scientific status of a classical university in Russia it is necessary to consider its specific position in a science sphere which is different from that in other countries of the world. The major distinction is that there is the Russian Academy of Sciences which is almost the only institution expected to be a generator of new scientific ideas, knowledge, etc. This fact cannot but influences the status of a university as a major centre of reproduction of new knowledge about nature, individuals, and society and requires its close interaction with academic institutions.

The educational and scientific functions of a university are closely associated with another important purpose of a classical university - the purpose of being a centre of accumulating and dissemination of national cultures in all their diversity constituting the basis of the world culture. In a modem society this function of a classical university is not ceasing to be important but even becoming more critical.

To conclude it is necessary to state that a university playing the "role of a centre integrating science, education, and culture has a special status among the educational institutions, its importance is hard to overvalue, and its role in civilisation development is beyond the comparison.

The technological revolution and, in particular, the breakthrough in development of technologies for gathering, processing, and transferring the information offers new prospects for development of the educational system and for its escape at an absolutely different level.

This is primarily conditioned by the technical level of telecommunications development which is nowadays allows for access to any informational resources regardless of distance, while the utilisation of advanced information technologies essentially facilitates collecting necessary data provided they are available in electronic databases.

New information technologies employing multimedia are powerful educational tools as they are capable of visualising complicated abstract concepts.

The application of latest information technologies in education has resulted in creation of a principally new form of the training process - a distance teaching. The expansion of scientific and educational space in combination with unique qualities of distance teaching and learning affords grounds for considering the latter the most promising form of education in the 21st century.

The particularly attractive feature of such a form of education is the possibility for implementation of a concept of continuous education an individual consisting in strong needs in gaining knowledge, inherent to a human being and showing itself during the entire human life. A number of other features of distance teaching such as easy access to, openness to a wide range of customers, availability of various educational programmes, multi-level education, etc. allows to have the widest population clusters from different, sometimes very distant, regions, involved in the educational process. In doing so, together with educational tasks, enlightening and bringing up jobs as well as work on dissemination of cultural heritage, etc. can be approached.

Accordingly, the utilisation of up-to-date information technologies is the key line of classical university development that will allow them to accomplish its mission of being an aggregate of social institutions.

A critical outcome of applying information technologies in educational sphere is the increase in authority of classical universities and in their role in development of the entire world community. Nowadays it is the time when the status of a university as a centre of consolidation of science, education, and culture shows itself most evidently. Accomplishing their mission classical universities provide for creation of such a scientific and education environment that is now acquiring a global nature. Their influence is far beyond the borders of regions and countries and determined by value and historical role of each specific university. High scientific and pedagogical potential, rich spiritual traditions and scientific and cultural values accumulated over many centuries are becoming available to all members of the world community aiding in the natural process of the unity of the mankind and of the formation of a noosphere - the sphere of knowledge.

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SCIENTIFIC AND EDUCATIONAL NETWORK IN ALTAI AREA

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One of the most important trends observed in today's society is the creation of a single information environment. In the beginning of the nineties the international global computer network Internet made its start. The Internet information resources form the single world-wide information environment being supported by governments, universities, research centres, largest libraries all over the world.

Currently, Russia is also active in creating its own information environment to join the international one. Large projects are being implemented now: creation of the Federal University Computer Network (RUNNET) within the framework of the scientific programme «The Universities of Russia»; RELARN Project involving scientific and research universities of the Russian Academy of Sciences, universities and other higher education institutions; UNICOM Project initiated by the State Committee for Higher Education of the Russian Federation, and others.

The Altai region is one of the largest scientific, educational, industrial, agricultural, and cultural centres of the Western Siberia. The population of the Altai region numbers over 3 million people, about 700 thousand of whom live in Barnaul city. The Altai region accommodates several dozens of higher education and research institutes and hundreds of other educational, cultural, social, and medical organisations. The efficiency of their work and realisation of the accumulated informational potential require the information exchange that would employ the computer networks both within and outside the region, i.e. the single regional information environment.

The work is under way in the Altai region on the creation of a single information environment on the basis of the Altai regional scientific and educational network which is a segment of the Internet and serves to the needs of science, education, culture, public health care and social service of the Altai region. This network has to become the grounds for the integration of the regional information environment into the global one, for the development of the new information technologies.

The initiator and the main organiser of the network is a not-for-profit association uniting scientific, educational, cultural, health, and social institutions and organizations.

At the first stage those scientific, educational, cultural, health care, and social institutions and organizations having their own local networks and willing to combine their resources became the major information centres. These are higher education institutions of Barnaul city (classic, technical, pedagogical, and medical universities and the others), the regional administration, the regional employment centre, the Institute for Upgrading of Teachers, the Public Health Care Department, several schools - about 20 organisations in total.

The structure of the regional computer network is the combination of three-level blocks, which in future will be linked by means of digital communications.

Level 1. The central communication block located at the Inter-city Communication Centre Building (ALTAITELECOM Corporation) provides for external connections of the network members with other regions and the Internet users including international ones. Its another function is linking the information centres within the region.

Level 2. Strong points of the regional network located at the leading organizations of science, education, culture, public health care and social protection transfer the information from all the network users, situated at their territories, to the central communication block.

Level 3. The local network blocks or users's terminals provide transferring the information from the local network organizations or organization departments.

The proposed hierarchic principle of structuring the regional network is selected based on the following factors:

- clearly seen integration character of the network;
- geographic location of organisations - potential users of the network;
- minimization of expenses on communication means;
- possibilities for step-by-step launching the separate network segments;
- independence of building level 1 block and level 2 and 3 blocks connected with one another;
- available opportunities of creating regional data and knowledge bases;
- possibility for pursuing the single administration and routing policies.

For providing the network operations the association members employ the UNIX servers and the servers ensuring the operations of the local networks based on TCP/IP protocols.

At this stage the geographic, land-survey, and other information databases are being created containing the information about the entire region and some key organizations of the region.

The information database on the region contains historical and geographical information about the Altai region, the information on its scientific, educational, cultural, and industrial potential, etc. This database will be placed at the central telecommunication block in the form of the hypertext using WEB technology.

The information databases on project members will contain the brief information on each organization: historical background, description of activities, list of staff members, etc. Such databases will be placed at level 2 blocks. Thus, this information will be available all over the world that will assist in establishing closer and more fruitful international contacts.

The land-survey databases content the data on soil and climate of the Altai region districts.

In future, the members of the association will develop specialised databases on organizational, scientific, educational, cultural and other activities run by various regional organizations. In addition, the electronic catalogues of all regional libraries are planned to be compiled and included in the network information contents.

The information available in the network will be build in the form of hypertext distributed databases added with multimedia elements (graphic, photo, and video illustrations) placed at WWW-servers of the central communication block and the blocks of level 2.

The Altai region administration supports the development of the regional telecommunication environment.

All this will allow scientists, teachers, students of various educational institutions, and specialists of other organizations of the Altai region for direct access to numerous sources of knowledge and world culture, give an opportunity to introduce the region to the world community, and, in the long run, will make the Altai region a competent participant of the process of mankind's moving to the developed information society.

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NEW INFORMATION TECHNOLOGIES IN BULGARIAN EDUCATION

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1. NEW INFORMATION TECHNOLOGIES AND THEIR INFLUENCE ON EDUCATION

In the education system (universities *and* high schools), different technical teaching means have been used to aid the teaching process and to improve its efficiency for a long time. These technical means were corespondent to the level of scientific progress in Bulgaria, as follows:

- classical means in education as: overhead projectors, epidiascopes;

- educational television;
- computer means and systems in teaching;
- first steps in multimedia and hypermedia in class-rooms.

Gradually the education gets "Informatized", i. e. the reproductive form of teaching, based on the existing educational programs transforms into interactive, by offering the students not only concrete knowledge, but access to vast amount of information sources. These new forms give students opportunities like access to extra information, simulations of processes and many more. The obvious advantages of hypermedia means in education led to their widespread application in many countries. The essence of these means is hard to define. This is a wide definition that integrates elements from several aspects:

- technical aspect: new information carriers, magnetic and optical disks, interactive television, global computer networks;
- user's aspect: combination of vision, text and sound put together accordingly in a unified system and distributed on electronic carriers, possible of interacting with several human senses.

These new information technologies put some new problems for teachers to solve. Hypermedia environment has great didactic possibilities in demonstrations, visualisation, student's personal choice of learning sequence. On the other hand the teacher has to deal with new terminology, teaching technology, and technical means.

How to start? How to achieve optimal effect in teaching while using hypermedia means? At what age to start this 21-st century education and on what basis? - These are the questions that preceded the founding of fundamental research carried out by the Bulgarian Ministry of Education, Science and Technology.

Nowadays a number of workgroups conduct research in different areas, such as:

- experimental application of multimedia and hypermedia in universities and schools;
- development of appropriate educational software in Bulgarian language;
- perspective technical means;
- organising of production and distribution of educational software.

This activity is co-ordinated by a Special Experts Council to the Ministry of Education, Science and Technology.

In process of preparation is a National Program on the new informational technologies in education. At this point are defined the following divisions:

- founding of pilot educational centres on preparing and qualification of teachers from all levels of education;
- forming teams of teachers for development of the educational contents of multimedia and hypermedia applications;
- creation of new forms and methods of teaching as: distant, in service training;
- determining the efficiency of teaching while using new informational technologies;
- textbooks in the context of new informational technologies in education.

Teams of qualified teachers have already been founded at several schools and universities to complete some of these activities. The appropriate equipment, multimedia computer stations and others, are supplied for conducting the teaching process. In universities exist development groups for adaptation, localisation and creating of new educational software.

2. CONNECTIONS WITH INTERNATIONAL PROJECTS AND FOUNDATIONS

Specialists of the Bulgarian educational system have regular contacts with their colleagues abroad in the field of new informational technologies in education. A significant part of what has been achieved is a result of co-operative activity on projects like PHARE, TEMPUS and Copernicus. The following projects from TEMPUS are of great importance to our educational system:

- JEP+ - Establishment of a Computerised information Network for Bulgarian Higher Education Institutes. The main goal of this project is to set the foundation of an inter-university computer network. In this project participate three Bulgarian universities: Sofia University "St. Kliment Ohridski", Technical University - Sofia and University of National and World Economics. Main computer network, based on optical cable, is installed at each of the Bulgarian universities and the necessary computer equipment for the maintaining network is supplied. More information on this project can be found in Appendix 1.
- JEP Interuniversity Centre of Modern Educational Technologies. Five Bulgarian universities take part in it. These are: Sofia University "St. Kliment Ohridski", Technical University - Sofia, Technical University -Varna, Rouse University, New Bulgarian University. The other participants are: The University of Plymouth and Liverpool "J. Moor" University (England) and "St. Patrick" College (Ireland). The main goal of this project is to form conditions for a constant qualification of university lecturers on applying modern educational technologies including multimedia and hypermedia. Teaching plans and materials have been developed. Main centre and local filials at each university are organised with library and software. In close time the qualification courses will develop and will include teachers in professional education. More about this project is placed in Appendix 2.
- A package of projects on using new informational technologies in teaching: mathematics, mechanics, and multimedia in universities.
- Five high schools have been equipped with "a class room of the future" for application of modern informational technologies in education.
- The optical disk factory at Stara Zagora is equipped with development equipment and production .technology for multimedia educational software.

CONCLUSION

1. The new informational technologies put higher requirements to the qualification of teachers from schools and universities. Creating adequate conditions for improving teachers' qualification in new information technologies in education is necessary as a first step.

2. An appropriate form of spreading knowledge on new informational technologies in education are demonstration centres, for their building is acceptable an idea for typical equipment.

3. Application of a complex approach in teaching in the context of the new informational technologies is an important foreground of achieving the desired effect:

- methodical problems;
- new contents of textbooks;
- individual work with students.

4. The new informational technologies offer possibilities of new forms of teaching not only in high schools and universities, but also in company education. All this supposes serious attention of state institutions on

organising a system of constant education and qualification by means of distant teaching, satellite television, etc.

Appendix 1

Establishment of a Computerized Network for Bulgarian Higher Education Information Institutes

Background of the Project
Training Needs

The essential improvement of the Bulgarian higher education is impossible without a close collaboration and rapid integration of the Bulgarian universities into the European higher educational system. An important aspect of this integration is the development of information and communication infrastructure of the Bulgarian higher education, linked to the European and world-wide networks. This will greatly facilitate the cooperation between Bulgarian and European university lecturers and scientists, and wilt provide an easy access to the information, software and facilities developed and available from various European and world information sources. The introduction of a direct communication and information links with European universities will have significant impact on the level of the teaching process due to the use of modern educational methods, training material and library services.

The development of modern computer networking facilities linking the three largest universities in Bulgaria, and its successful use in the teaching process and. other related activities call for the development of personnel, capable of managing, upgrading and further enhancing the network services and shared resources.

In order to efficiently use the Novell network and communication facilities in the existing courses, and to provide for the development of new ones, based on advanced networking and information services, the teaching staff of the universities will have to undertake network-specific training. Help and assistance with the use of these facilities in the teaching process must be made available an-site.

In order to improve the efficiency of the teaching process based on modern communication media, the university students must be aware of the basic principles and the use of computer networks. Therefore there is a need for network-specific short courses for undergraduate and postgraduate students, which should be taught on a regular basis in each of the three Bulgarian universities.

Therefore, there exists a need for specific training in three clearly identified areas:

- Training of system and network administration personnel.
- Training of university teaching staff.
- Training of students and other academic users.

Considering the great necessity and importance of modern computer networking for the development of the Bulgarian higher education, the consortium of EC and Bulgarian partner organisations have decided to join their efforts in the establishment of such a network that will link the three largest Bulgarian universities to the European network, and provide a range of activities . to meet the training needs of the target universities.

Appendix 2

An Inter - University Centre for Modern Educational Technologies

Providing a Focus for Innovation, Training, Development and Demonstration

There is a strong demand for university education in Bulgaria both from young people and, more recently, from adults seeking retraining or returning to education. In order to stimulate and support innovative change, there is a considerable need for staff training and development in a wide range of methodologies for developing and delivering teaching and learning. This three year strategic Project will provide such training for over 450 lecturers from across Bulgaria and will therefore help re-orientate the higher educational system.

The Project will initiate, facilitate and support appropriate innovative change in Bulgarian universities through the provision of high quality academic staff and curriculum development and a range of activities to encourage the use of modern educational technologies.

Through the establishment of an inter-university Centre, it will provide a focus for staff training, educational innovation, discussion, demonstration and development of teaching/learning materials which, following the initial three year JEP. funding, should become self sustaining.

Staff development will be delivered to interdisciplinary groups. Curriculum development activities will be focused upon helping staff introduce humanities into technical curricula, information technologies into humanities curricula, and introducing more flexible and open delivery techniques, including the education and training of adults.

A long term aim is to create a self-supporting and self-perpetuating service to all Bulgarian university staff. It is anticipated that support and finance will be obtained through a variety of measures including:

- charges for training courses,
- charges for consultancy and development; work for companies, in particular SMEs,
- sale of "products" to Bulgaria and other countries.

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DEPARTMENT OF INFORMATICS AND COMPUTER ENGINEERING: VARIANT OF ORIENTATION

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Currently one of the main problems of Russian higher school is the fact, that old job placement system (distribution system) of the graduated dies not work anymore, while the new one is only in the stage of forming. This situation is only a consequence of the changes in the society, and in the first turn economical ones.

As a result each department (and further me shall consider only departments, as structures, which directly prepare the specialists) worrying about their future, ought to find the way out of the situation independently.

These general problems are actual today also for a lot of departments, whose professional field is *computing* [1] (or, according to more habitual terminology, informatics and computer engineering), in spite of their relative privilege state.

The field, where the passed changes are mot pronounced, is financial-credit, bank and exchange activities, which provide all the infrastructure of new market economy. It appears a lot of new firms and organization, working in this directions. Old ones also are changing (such as *SberBank)*. It's absolutely evident that their activities are impossible without contemporary computer engineering technique and corresponding software, the base of which, in their turn, are bank-financial information technologies. They utilize the most advanced means and methods of computer engineering techniques and programming. This high level is constantly supported due to stable and significant investments of financial-credit institutions namely into the field of financial informatics. Banks and exchanges, currently being one of the most rich national institutions and realizing the impossibility of its effective functioning without most wide introducing of corresponding information technologies, start to form their market and dictate their market and dictate their *requirements to it. This circumstances give the base to the* presence here of widespread field of activities for specialists in the field of computer engineering, programming and a set of adjacent fields.

Not less attractive might be the market of office programmes. Such programme environments are necessary also for industrial enterprises of all dimensions and ownership types, and for state institutions and departments, and for private firms in commerce, tourism, serving sphere, and for educational establishments. Currently this market concedes the above mentioned one, that is mainly connected with the difficult material situation of many of its subjects. However, when with time duration more and more number of them would obtain firm status, they would start to take care not only about their surviving , but also about prospects of normal progressive development. But it is also impossible without maximum introducing of information technologies, connected with system analysis and organizational management.

Apart from that it's important, that above mentioned software markets in Russia are practically non-filled (this concerns mainly to office programmes) or, at least, are much for from saturation. At the same time the unique character of the most of administrative-and organizing principles, accepted in our country, makes problematic the direct utilisation and adaptation of software of well know west firms, present in the market. This factor in combination with extremely high cost of such products, which for a long time would not be available to mass user in the Russian market, is one more argument towards our choice.

Let's try to classify the interests of persons, who touch in their professional activities with above mentioned programme systems.

To the first group one can refer the employers of banks and other financial-credit institutions, which in their work permanently ought to use personal computers and social applied software. Lets call these specialists professional users. Widespread distribution of financial information technologies has called out to life the appearance of great number of such users. This group of specialists gives extremely high requirements to the fulfilment of programme systems, which namely make them one of the most sophisticated and advanced types of software. The same group of specialists may be allotted in application to office programmes (management of different level, analytic, employees of provision and sale services etc. are entered into it).

To the second group one can refer the specialists in the field of management and analysis, modeling and creation of complicated systems. They are able to analyze complex systems in absolutely different subject fields, to develop their mathematical and information models, and to project and (may be in less degree) realise corresponding software. In the orientation process of this specialist's training towards financial field or management, we shall get the experts, who are able to formulate professionally the problem, which requires the programme realization, to develop corresponding project and to menage it. Let's call these specialists as problem producers. They are able to speak, using common language, either with professional users, arranging there practical requirements into their terms, or with the specialists of the third group, which one may call designers.

The designers in our case are high educated system programmers, who are able to work on the most modem level with the use of the most modern technologies of designing and following of software. By the way, they ought to be able to freely orient in the general questions of problem field and, thus are not simply coders of algorithms, developed by producers. They are able also to estimate the accepted decisions, and even participate in there design.

What is the way (and does it really exist) to combine the training of the whole three groups specialists? Is it able to perform it in the framework of one department? Probably it's possible in principle, but doubly that it is advisable. The fact is that the first category of specialists - economists - sufficiently greatly differs from others, due to their attitude to the considered subject field. Here we mean users, not designers. Correspondingly, the volume of knowledge, delivering to them in the field of computing ought to be significantly less, while their structure - absolutely different.

The students, getting their base economic education, must hear special courses, sufficient to get the representation, concerning construction of modern financial programme systems, presented requirements to them, about problems of interface organization with the and rational methods of their solution. And already on their base it's necessary to design one or two practical courses for getting of these systems use experience.

As a result the specialists are let out - managers, economists, accountants etc. - who, coming to work, exactly know, what instruments they need to effective functioning, are able to formulate and stand up their needs against the administration and are able to interact with those, who design and follow these software, consulting with them and presenting new requirements to modification and development of software, starting from their practical experience.

The specialists of the second and third groups, complementing each other in significant degree, might be advisable to train in the framework of one department. They may go out to the market individually. But it seems that more rationally - in the case of proper and active department administration policy - to train them as whole groups, rolling them on realisation of given projects during the studies. As a result after the end of study we get a complex collective of researchers and designers, who have passed test on compatibility, solidarity, able to interact with each other and to contact with clients (in wide sense of this work). Moreover these collectives may be trained even for certain organizations, carried out definite projects.

It's well known that the educational process ought to be carried out in the framework of one of stated governmental educational standards of high school professional education. Naturally, the department may choose its own way and try to base, develop and confirm new direction of bachelor training and corresponding curriculum. However the careful and detailed analysis of the curriculum contents of corresponding' directions show, that the most wide among them and the most close to our term «computing», is the group of 552800 «Informaitcs and computer engineering». In the process of study according to this direction it appears possible not only to give the student the whole volume of knowledge in the computer field, but even completely keep all the requirements, presented by the main authoritative in the world Standard ACM/IEEE (see [2, 3]). That is why the training of the third group of specialists (designers) is rational to carry out in the framework of namely this direction. Other interesting group of specialized fields is «System analysis and management» (553000). The analysis of its educational programme indicated, from one hand, extremely closeness of its contents to the requirements, presented to specialists of the second group (problem producers), while on the other hand - a great similarity with nomenclature and even filling of certain disciplines with 552800 standard.

Thus we can see the possibility to unite the students of both groups not only in one department, but even on a lot of specialized fields in common teaching group (while on the first two years the are not divided). The specifics of groups way be reveals in fool range in a set of special disciplines, proposed to students, and facultative disciplines, beginning from the third year of education.

It's necessary to understand that along going of Russian economy out crisis, surviving of industry and science, the quantity of possible educational directions, and, correspondingly, spheres of professional applications would permanently increase. One of the most significant functions of the department authorities is namely in the ability to predict beforehand the main development tendencies, perform in time steps on the base of short term and long term prognostics. The department ought to be alive, dynamic, and developing organism and to have sufficient freedom of maneuver for correction of its course - in the framework of the declared direction and specialized field.

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UNITY OF INFORMATION SPACE AND CONCEPTS OF INFORMATIZATION OF EDUCATION: REGIONAL EXPERIENCE

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The term «united informational space» currently is used in different publications so frequently, that this idea is percepted as something, standing to reason, which does not require any remarks. Along with this, the analysis shows, that this idea is system creative, and arbitrary, even not so much. from the first view, changes in its contents may lead to significant changes in the concept of informatization.

During several recent years on the Yaroslavl region territory there has been developed telecommunication network combining the institutions" of training and qualification upgrading of pedagogical staff, educational management's organs, a set of secondary education establishments. Each network user obtained the opportunity of e-mail service and participate in teleconferences of this network, the main purpose of which becomes the transfer of normative documents, delivery of letters, orders and methodic developments. The users of the network include school directors, teachers on informatics, experts of educational municipal management organs.

If one starts from comprehension of information space unity as a unity of communication capabilities, joint creative work and access to network resources, than the attachment to this network of all educational institutions may be considered as creation of united regional information space.

However widespread distribution of personal computers, development of global telecommunication networks, show-slip growth of number of scientific and educational network users, combined by Internet network, led to significant changes in understanding of opportunities to apply the computer engineering means and information process role in the society life. Currently united informational space my be presented as some public information media, into which a person gets from the early stage of his development and which follows him education, professional and any other type of activities.

Principal significance for regional informatization infrastructure development have the law of Yaroslavl region *«On the information provision of government authorities organs in Yaroslavl region»* and settlement of Governor on the policy in the informatization sphere corresponding to which it's foreseen: creation of united regional information space as a part of unite information space of the Russian Federation; widening and improvement of information infrastructure; promoting the local authorities in establishment of municipal information networks; informatization of government authority organs activities.

A significant stage of regional education was assignment of agreement between Yaroslavl region government and International Science Foundation *(Soros Foundation)* on carrying out of a project *«Yaroslavl base network»*, which foresees the creation of pilot territory computer network. This network presents libraries, schools, hospitals and high school institution all service types of information network Internet. In the framework of this project in order to deliver the access to the network for students and teachers, more than hundred computers were delivered to schools of Yaroslavl. The necessary condition, which was fulfilled during computer setting, attached in Internet, was an easy access for student's learning.

A significant addition in the project, initially oriented on urban network development, was the creation at Department of Education of new institution - Regional center of schoolchildren distance education (CDE). This center is supplied by modern technical equipment and is first of all oriented on the work with remote territories of region. This year about thousand schoolchildren would pass different types of training. The combination of distance education development and realisation of the programme *"Family computer"* ought to became a serious factor of education humanisation, significantly changing the tendencies of education sphere development.

In January 1996 the Board of the Department of Education has confirmed the main directions of regional education informatization, where as number one is set the creation of regional knots and infrastructure of telecommunication network.

A great significance for the united information space creation has delivering by Administration of informatization and technical means under Governor the possibilities of utilization of selected administration communication channels with regions about the connectiveness with Internet. If it would be possible to overcome the difficulties concerning technical equipment of regional knots, soon the schoolchildren and teachers of rural regions would obtain the access to all kinds of services of global information space.

The considered here structure of united information space should not at all be regarded as its amorphousness and structurelessness. For example, structure includes the following components of the information space:

- subsystem for information-reference service of population;
- subsystem of information-reference and analytic service of household subjects;
- subsystem of information-reference and analytic service of governmental authorities and local self-management.

In correspondence with this classification the information educational space might be regarded as combination of two tietly connected subspaces, which, however, have their own peculiarities:

- one of them combines the information resources of teaching process;
- the other one - the information about state of educational process, resources of management information.

The first of them may include either resources, created systematically for educational purposes, or any other information resources with open access. The main its feature accessibility and openness of information.

The information space of management information ought to include resources, which are created and actualised in a regular order by authorized for that optical persons, while the access to informational resources, which contain personal and confidential information, ought to be organic.

The idea of information space unity considered here renders the determining influence on the approach to education management informatization and allow to formulate the main principles of information streams and resources forming.

Forming of management information resources ought to be carried out with account of possibility to integrate multiaspect management information on each level - let it be educational institution or ministry - into united functional system, which allows to analyze the state and tendencies of educational sphere, corresponding to counter of management in interconnection of all its typical features. In context of information streams forming the unity providing means providing of programs, used the different management levels, to receive and deliver data of standard (or stated in normative-technical documents) formats.

These principles, though they seem to be evident, nevertheless not always are taken into account in contemporary practice of all russian arrangement carrying out, concerning informatization of education management. Currently into Russian education system there have been introduced and are introducing now into exploitation set of software, purposed for formation of three of formation streams:

- state and statistical account (designer of software is - Russian institute for pedagogical staff qualification upgrading);
- data, concerning children-orphans or children who have left without care of parents (designer is - Moscow State University);
- data about presentation to state rewards (designer is - Republic information-pedagogical center).

All the programs were fulfilled on good professional level, however in programs 1 and 2 the above mentioned requirements were not taken into account. This three programs, as well as data prepared using these programs can't be integrated into system of informational provision of arbitrary level.

The program *«Automated work station of chief of reword department»* may serve as an example of the problem realization, set and fulfilled with the account of above mentioned principles: it's based on widespread used data format and foresees the data enter from the file. As a result it was possible to integrate the program and data into the system of information provision of educational management of arbitrary level. The reason of formed situation is, evidently, the absence of normative documents, regulating the designs in this field and absence of coordinational center on management of informatization of education.

Currently in Yaroslavl region there are carried out active works, intended on regional system creation, for monitoring of educational sphere. This system includes information collection and analysis, gives social, demographic, phsyhological and economic characteristics of educational sphere.

The use of information systems in management would not only provide the quality of management activity increase due to operative provision by necessary information and means of its presentation, but also will give richest information about tendencies of education sphere development.

Taking into account the actuality of informational proceeding of educational management, it seems for us advisable and in proper time the creation of laboratory and opening of experimental ground for creating and including of information-analytic and modeling systems for secondary and pedagogical education. Evidently, as an experimental ground one ought to chouse a region with sufficiently developed infrastructure of informatization. Taking into account the attention, should by the informatization organs of state authorities in Yaroslavl region, constant readiness to collaboration of Analytic center and administration of informatization of regional Governor, presence of organization with high scientific potential, such as Yaroslavl State Pedagogical University, Institute of pedagogical staff qualification upgrading, Institute of Pedagogics and Psyhology, Regional center of new information technologies, opening in June 1996 of Internet Center, and also the presence of serious work already done in information system integration, our region may by chouse as an experimental ground for carrying out of works in this direction. The laboratory in the conditions of contemporary communication nets development, may present certain deversed structure with participation of experts either from Yaroslavl region, or from other regions.

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PERSPECTIVE DIRECTIONS OF INVESTIGATIONS IN INFORMATIZATION OF EDUCATION

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The informatization of education process developing on the base of the up-to-date information and communication technology possibility realization initiates the activity intellectualization of both the teaching and the learning, maintains the integration tendency of a process of the cognition of the appropriatenesses of object fields as well as the surroundings (social, ecological, information, telecommucation et al.) and provides with the pedagogical influence synergism combined the firsts with the advantages both of the education individualization and differentiation. From this the realization of the possibilities of up-to-date information and commucation technologies provides with the transition from the authoritative, illustrative-explanatory methods and the mechanical learning of the factological knoledges to the mastering of the ability to acquire independently the new knowledge using the modem methods of the knowledge presentation and extraction, the up-to-date technoligies of the information interaction with the models of objects, processes, phenomena presented in the objective media as well as with their imitations.

As shown the home and foreign experience the realization of the possibilities of the up-to-date information and commucation technologies involves the educational activity spectrum broadening, the perfection of up-to-date organizational forms and educational methods as well as the beginnings of the new ones, the object field appropriateness study broadening and deepining. It causes the educational material matter selection criteria. They base on the necessity of the intensification of the processes of the intellectual development and self- development teaching personality - the forming of the ability to formalize the knowledges about of the object world, to extract independently from the knowledges, to realize the «microdiscovery» in the appropriateness study process, to use the modern information technologies as the instrument of the measuring, representation and influence on the object world.

The development of the education technologies on the base of information and communication means is determined in a marked degree by the general appropriateness which reflect the technical, technological, psychological-pedagogical as well as physiological-hygienic features of their usage what, in one's turn, leads to the nesessity of the exposure of the pedagogical-ergonomical conditions of the safe and effective application of the computer engineering means, information technologies, telecommunications provided with the process of informatization of education development at the active usage of the science-pedagogical information banks.

From this the followings acquire the special significance:

• the development of the theoretical base of the process of the sertification hardware, informaion and communication means which applied in the educational purposes;

• the consideration of the psychological and physiological-hygienic features of the informatization of education;

• the problems of the perfection of the pedagogical technologies on the base of the modern means of the information and communication;

• the problems of the development of the matter and metodical system of the the informatics teaching in the general education school and the higher pedagogical education in the conditions of the many-profile education differentiation and humanisation;

• the development of the model of the integrational educational-methodical environment of the education informatization of the «school-pedagogical university - postgratuate course» system.

The above-stated determine the following perspective directions of the investigations in the education Information field which conduct in the Russian Academy of Education in the frames of the complex programme "Informatization of Education".

1. *The development of the scientific base of informatization.* This direction supposes the investigation of the philosophical aspects of informatics, the solution of the fundamental education problems in the theoretical information science field, the development of the education informatization level estimation methods, the realization of the high professional skill specialist training for the field of the informatization of education.

2. *The perfection of the educational technologies based on the modern information and communication means.* The features of the educational technologies based on the usage of the modern information and communication means possibilities are:

• the scientific character, trust worthiness and maximally possible accessibility for the any primary sources of the information including the educational one;

• the access to the archives and on-line information, the possibilities of its processing, transmission as well as interaction with the users of the word information medium;

• the guaranteeing of the information interaction with the models of the objects, processes and phenomena as well as their imitations presented in information-object media with the fitted teaching technology elements;

• the organization of the teaching process as much as approached to the experimental-research activity which is adequate to the process of the cognition of the corresponding object fields;

• the building into the educational. systems of the possibilities of the modem information and communication technologies.

The solution of the problems of this direction assumes the investigation of perspectives of the progress of the matter, means and methods of the general education, the development of the modern pedagogical technologies based on the up-to-date means of the information interaction (multimedia, "virtual reality", telecommunication).

3. The development of the informatics teaching matter and metodical system in the general educational school and higher pedagogical education in the conditions of the information and mass communication of modern society. In the frames of this direction the scientific-pedagogical bases of the development of the metodical information teaching system in the general educational school and the pedagogical universities in the multiprofile education differentiation conditions.
4. The perfection of the basic training matter of the informatics in the higher professional education system in the conditions of the informatization and mass communication of the modem society. This direction assumes the development of the scientific-pedagogical bases of the perfection of the basic informatics course component in the professional education system in the depending from the future specialist activity profile.
5. The psychological and physiological-hygienic features of informatization of the education. The development of the psychlogical-pedagogical supporting of the modern information technology usage in the education assumes the investigation of the questions of the ecology problems connected with usage of information and communications, the development of the psychological and physiological-hygienic features of the health breach prophylaxis (including the indexes of the vital functions of the organism), including the development of the psychological-pedagogical recommendations for the projecting of the telecommunication media of the scientific-practical orientation.
6. The pedagogical-ergonomical conditions of the effective usage of the computer technics means, information and communication technologies provided the development of the education informatization process. These problems are actual because in the general education establishment the non-quality technics which is damage for the health as well as with the truncated programm-technical possibilities is often used. In connection with that the necessity of the sertification of the computer technics, informatization and communication means which are used with the general education purposes has be appeared. The last determines the necessity of the development of the pedagogical-ergonomical requirements to the computer technics and the means of the information technologies on which base the selection of the technics used in the education sphere is occurred.
7. The development of the. integrated teaching-methodical education medium model of informatization in the «school - pedagogical university - postgratuate courses system. In the frames of this direction the conditions of the multicomputer organization of the distributed network of the teaching-methodical centres of informatization of education with different levels into the common pedagogical knowledge engineering centre are investigated, the methodolodgy of the teachers and methodologists for information teaching technologies as well as the diagnostical system for the testing of the teacher's and student's training level for usage of the information technologies in both the teaching process and professional activity are developed.
8. The formation of the matter and program-methodical guaranteeing of the self-education process in the field of the usage of the possibilities of the up-to-date information and communication technologies. This investigation direction assumes the making of the

scientific-methodical base of the self-education in the field of the usage of the possibilities of the up-to-date information and communication means (in particular, on the base of the distance education, in the conditions of the home personal computer complect usage).

9. The perfection of the scientific-pedagogical banks based on up-to-date information and communication technologies. In connection with the development of the information superhighways it is necessary to investigate the possibilities of the information networks with the purpose of the guaranteeing of the technology of the acces of the different user categories to the scientific-pedagogical information bank data files. The investigation perspective consists in the creation of the conditions for the information and library-bibliogaraphy supporting of the different specialist categories in the field of the pedagogical science and practics by means of the TV acces to the scientific-pedagogical information data files promoted the development and perfection of the information infrastructure of the educational space.

The prognosis of the development of the process of the informatization of the education. The process of the informatization of the modern society and its priority directions - the informatization of education - are continually determined by the scientific-technical progress achivements which growth at present days occures literally in the exponential rate. The swift perfection of the word information medium or «the network space» *(cyberspace)* which allows to form the information stream in accordance with the interests and preferences of the specifical information user, allows to forecast the development of the pedagogical technologies based not only on the receipt of the access to the information resources (for example, the largest word libraries, TV studios, data bases) or the copies of the real historical documents but on the firsthand information interaction with the colleagues on the mutual scientific investigations and educational problems.

The foregoing possibilities allow to develop in principle the new technologies of the information interaction between the information users and reorganizers what, in one's turn, determines in principle the making and development of the new pedagogical technologies of the teaching-informational interaction based on the possibilities of up-to-date information medium.

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COMPLEX INNOVATIVE SYSTEM OF ENSURING UNITED INFORMATION EDUCATIONAL SPACE IN PERM REGION

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The programme of informatization of education, accepted in 1994 by the Ministry of Education of the Russian Federation, has stated as one of the most significant element of this process the development, creation and realisation of regional informatization programmes. One of the first among them became the programme of informatization of education in Perm region.

The work, presented in this paper, has been carried out in the period 1992-1996 by Laboratory of informatization of education of Perm region, Perm State Pedagogical University and Institute of pedagogical staff qualification upgrading of Perm region. The Laboratory creation, has promoted in significant range coordinated complex decision of informatization problems in the general education system in the region.

Scientific-pedagogical development on the theme included either scientific-pedagogical or organizing-practical part.

Scientific-pedagogical part of the work is connected with the solution of the following problems:

- development of methodic and carrying out of the development of real state in process of informatization of education in the region;
- development of scientific-pedagogical principles and model of united regional information education space;
- development of the principles of creation of regional system of information provision in the educational system with the use of either traditional methods or contemporary technical means;
- development of the form and content of training and retraining system for different categories of pedagogical staff for solution of education informatization problems on the regional level;
- development of education contents conception on informatics and computer utilization at study of different general educational and special subjects in the schools and technical colleges with the account of real opportunities of the region;
- working of policy, theoretically justified and coordinated with real regional possibilities, for technical equipment of educational system.

During scientific-pedagogical developments there was necessary to find out the ways of the following contradictions decision:

• between the necessity to form informational culture of the trainees, which is significant for further life and work activities, and traditionally formed inertial training system, in which the information technologies are practically beyond the attention;

• between the necessity of constant qualification upgrading of the educational staff in general and informational technology questions in particular and increasing impediment of this process for most of educational workers (in particular, teachers) due to some organizational and financial reasons;

• between the necessity to bring the information streams, rolling in the educational sphere (first of the all in the teaching, teaching-methodical and scientific-methodical) into correspondence with time requirements and increasing difficulties in solution of this problem by traditional methods;

• between the necessity of most efficient technical equipment of education institution and limitations, connected with financial resources, staff training level-teachers and technical experts.

The organisational-practical (inculational) part of the work consists of the following:

- creation of united management system and organizing provision of works on informatization of education in the region;
- creation of informatization providing system of general and secondary special education in the region with the use of modern technical means, creation of regional bank of pedagogic information, telecommunication system of access to this bank;
- radical changes of training and retraining system of teachers, authorities of different level education organs, other categories of pedagogical staff on the problems of information technologies in education;
- bringing of training on «Informatics» subject into correspondence with the requirements of the basic curriculum, State Educational Standard, partly creation of corresponding teaching-methodical materials, computer software.

Among the documents, with which the authors at different stages of the work have coordinated their activities, the most important are:

- Federal purpose programme «Informatization of Russia in the period 1993-1995»;
- Federal programme of education development in Russian Federation;
- Programme of informatization of education in Russian Federation in the period 1994-1995 Decision of the Council of the Ministry of Education of the Russian Federation «Concerning course of Programme of informatization of education realization in Russian Federation in the period 1994-1995»;
- Plan of stabilization and development of education system in Perm region on the period up to 2000, Perm,1995;
- State education standard of higher professional education - the requirements to obligatory minimum of contents and level of bachelor training in the direction of higher school pedagogical education (stated in 1994);
- State educational standard of higher professional education - the requirements to obligatory minimum of contents and specialist training level on the specialties of higher pedagogical education (stated in 1995). In the result of works performed in Perm region, there has been fulfilled the following.

A united system of management, organization and scientific-methodical provision of works on informatization of education in the region has been created. This system has integrated the effort both of management organs and several higher schools. In the system of regional education there has been unrolled special subdivision for informatization problem solution:

- Regional center of pedagogical information (RCPI);
- Center of computer education training and informatization of education;
- Center of informatization of professional-technical education system;
- technical service.

On the base of RCPI there has been created and now is functioning a system of complex information providing of the regional education. It includes the regional bank of pedagogical information, central knot of telecommunication network of RCPI, more than 10 regional knots.

There has been found complex solution of the problem of training and retraining of specialists on the problems of informatization of education. In this programme Center of computer education training and informatization of education and Pedagogical University take part. Regularly there are carried out:

- training and retraining of teachers in informatics;
- training of subject teachers (expert for teachers in informatics), teachers of professional-technical colleges;
- training of management-administrational staff of education system;
- training of accountants and economists in the educational system;
- training of workers of pre-school and complementary education system.

As one of first the region began the teacher's training, for whom informatics is basic specialty. For this goal there have been developed special curriculum, new course contents.

It's realizing centralized and regional programme of step-by-step equipment of educational institutions and organs of educational management by computer technique, which includes:

- equipment of as much as possible secondary schools (general education and technical) in the region by complete sets of training computer technique for providing of the first order needs of teaching process, determined by obligatory state requirements (first of all - by providing of base course on informatics teaching);
- equipment of leading in the field of informatization educational institutions by most modern technique;
- equipment by computer technique of regional education management and schools for organization of contemporary system of production and administrative management and attaching to regional system of telecommunication connection.

There have been carried out several scientific-methodical works including:

- development of the concepts of united regional information educational space;
- development of the structure of regional bank of pedagogical information;
- development of the base course of informatics for 8-9 forms of general education schools (including creation of teaching-methodical complexes and programmes of this course for secondary professional-technical education on several specialties, mostly deversible in professional-technical colleges of Perm region.

The main organizing-practical activities on regional programme of informatization of education (planning, application) are present in an unrolled form in the following publications:

1. Programme of informatization of education in Perm region for 1992-1994. Perm, 1992.
2. Programme of second stage of informatization of education in Perm region for 1995-1998. Perm, 1995.

Concerning certain of above-mentioned questions the authors have published a lot of materials in central and local scientific-pedagogical editions.

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CONCEPT OF FUNDAMENTALIZATION AND INTELLECTUAL TECHNOLOGIES OF EDUCATION

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All over the world the search is carried out for new educational system, more democratic, diverse and resulted from the society interests position. The intention to overcome the professional isolation and cultural limitation, tendency towards all-round, harmonic persons, are typical for the whole world community.

In our country on the background of deep social transformations the educational system since the beginning of nineties also is at the stage of reforming. The necessity for reforms is caused, in particular, by the fact, that in our higher school in a lot of directions there has appeared a substantial gap between the global needs of the society and the educational results:
between the objective requirements of the modern times and all-over not sufficient level of education, between the professional orientation and personal needs in harmonic satisfaction of various educational requirements, between modern methodical approach and archaic style of the teaching.

The attempts of the higher school modernization in our country were carried out several times in sixties-eighties. However, none of them resulted in serious success, since none of them had touched conceptual base of the educational system. Realizing of this fact led recently to the crystallization of *new educational paradigm,* in the frameworks of which the reconsideration of directions and priorities took place: from primacy of pragmatic knowledge to the development of common culture and scientific forms of intellectual activities, from historical context of scientific knowledge formation to the modern representations, concerning structure and integrity content of scientific system.

The new educational paradigm in Russia was gradually formed during 1990-1994 in the course of development of major directions for higher school reforming. Its major elements are presented in the guiding documents of the State Committee for Higher Education of the Russian Federation and in the Memo of "Fundamental (natural science and humanitarian) University Education" (1994) UNESCO International Symposium. The new educational paradigm as high-school educational priority considers orientation towards personal interests as adequate to the modem tendencies of community development.

The education may be considered as *oriented towards personal development interests,* if the following tasks might be solved with its help. Firstly, it's necessary to harmonize the interrelations between the human being and nature trough mastering scientific pattern of the world. Secondly, one ought to stimulate the intellectual development and enrichment of thought through mastering of modern methods of scientific cognition. Thirdly, it's necessary to start from the fact that a person lives in the society. For his successful socialization it's necessary to deep into existing cultural, and, in particular, technogenic and computerized media. Fourthly, it's required to take into consideration, that contemporary person lives in the conditions of saturated and active information environment. That is why, the educational system task is to teach a person to live in its stream, to create the background and conceptions for permanent self-education.

Today a search of the way of transition to the new educational paradigm takes place. It by no means does not reduce to pure increase the volume of educational disciplines or to increase of the education duration. The idea concerns the reaching of principally new educational level of individual person, as well as the whole society. The new educational paradigm means a tendency towards competence, erudition, creative bases and culture of person, that is namely *educational paradigm.* This is the source of the main characteristic quality in comparison with former paradigm, which was mainly *paradigm of teaching,* the main slogans of which were knowledge, skills and education.

The main component of the new educational paradigm is the *conception of fundamentalization,* which treats fundamentality as a qualitative category of education and the person's educational level.

In correspondence with the proposed concept, the education may be considered as *fundamental in the case when it presents a process of non-linear interaction of the person with the intellectual environment at which the person precepts it for enrichment of his own internal world and due to it he matures for multiplication of the potential of the environment itself.*

As a base of fundamentalization, such educational system and structure is declared, the priorities of which are not pragmatic, narrow specialized knowledge, but rather methodologically important, long having invariant knowledge, performing integrated perception of scientific picture of surrounding world, knowledge, which accelerate the intellectual blossoming of the person, his adaptation in rapidly changing social-economical and technological conditions.

The fundamental education comprises the unity of ontological and gnoseological aspects of educational activities. Ontological aspect is connected with cognition of the surrounding world, while gnoseologic - with mastering of methodology and obtaining of cognition skills.

The fundamental education, being a tool for reaching of scientific competence, is oriented on obtaining of deep, essential base and connection between different process of entire world.

Fundamental education, being a tool of reaching of high erudition, is oriented on *widespread directions of scientific* knowledge (natural-scientific, technical, humanitarian), enclosing a significant complex of closely specialized field. At the same time the fundamental education supposes mastering of mutually complemented components of *integrated scientific* knowledge. For example, the idea of fundamental natural-scientific education includes the study of contemporary technological culture, humanitarian knowledge and culture research. The idea of fundamental humanitarian education includes the study of natural history, etc.

The fundamental education, being a catalyst of freedom for creation, based on cognition and critical perception of integrated human cognition experience, on obtaining of internal personal sureness in his opportunities to use creatively transform this experience, provides the conditions to stimulate and realize the creative roots of the person.

Fundamental education, being a tool of accessing to contemporary intellectual culture, promotes the reaching of qualitatively new level of rational thinking culture, which *appears to be fruitful not only for the problems of local field* of knowledge, but also in the whole sphere of cognition activities. It appears as a result of mastering of those significant shifts, which are produced by truly fundamental knowledge in comprehension of all the science as a whole.

That is why fundamental knowledge can not be at a periphery of informational massive, mechanically supplementing it. Fundamental knowledge is rod, system forming, methodically significant presentation, ascending to the roots of understanding, to the primary essences. In accordance with the above mentioned considerations, not all educational subjects may be referred to fundamental ones. This, however does not decrease their significance for the formation of a competent person.

Corresponding fundamental knowledges are contained in all natural-scientific and humanitarian fields of scientific knowledge. However, corresponding general educational disciplines are not fundamental *ex definitio.* The educational subjects become fundamental, if they, in common, reflect adequately the fundamental ideas and presentations, logic and structure of corresponding sciences from the contemporary position.

General process of the fundamentalization of education consist of special complex organization of the content on the base of combination of epistemological, ontological, *special scientific didactic ideas, which increase the status* of educational disciplines up to fundamental level.,

The fundamental education ought to be integrated, for what the individual subjects are considered not as a complex of traditional autonomous courses, but are integrated into unique cycles of fundamental disciplines, connected by common purpose function and inter-discipline connections.

This namely treatment of fundamental education, which was proposed by Russia in the "Fundamental university education" International project, has accepted significant resonance at 28th General conference of UNESCO and founds a wide support among the world community.

Accepted in 1993 the conception of informatization of Russian higher school education may be considered as one of the means for new educational paradigm realization. This is due to the fact that it is located in fairway of new strategic orientations of high-school education system. The main task of the informatization process comprises creation of the conditions for global rationalization of intellectual activities and staff training, processing new *cultural level of thinking. The main technical and* technological base for informatization of the educational process is universally recognised computer. However, from the point of view of anxiety for the further fate of fundamental education it's necessary to point out some warnings.

The purposeful development of *informatization of the education* must present mainly, not a reaction on penetration of computer technique into industry and every day life (user's education), but rather ability realization of deep influence of *«all-round computerization»* on the mentality of a person, who lives in such an environment. One ought to take into account, that this influence may have double consequence. On one hand, it may appear such a trust to computer, concerning some operation, which under other conditions results in the fact that an educated person is not able to make by himself some simple tasks (as for example fast approximate calculations, the use of dictionary, translation to a foreign language etc). There are clearly negative consequences. On the other hand, constant but properly organized contact with *computer may, on the contrary, influence creatively,* promote the formation of new physiological structures of the person, entering to resonance with the ideas of fundamentalization.

Thus, it's necessary to direct the educational informatization in constructive channel, preventing *making fetish of computer and khakering.* Unfortunately, not always this idea is taken into consideration. Very often computer is included into educational process as the end in itself and considering it use as a symbol of contemporary educational system. In real practice on this base a substitution of the informatization idea is often takes place and it reduces to computerization.

The utilization of computer in fundamental education must be pedagogically advisable, determined by the essence of subject tasks and demonstrate it principle functional advantages and non-replacement. It must be limited by those fields of educational process, where any other approach is doomed failure. In this context one ought not to increase artificially the scale of computer control of knowledge, especially, if these technologies carry out the same *functions as a teacher, possessing in comparison* with him only better memory and patience. It should be assumed that in nearest future (in the highlight of the informatization ideas) the teacher as a person, not as a appointment, has no computer or computerized *competitors.* His role would increase permanently.

Intellectual technologies of education may be utilized in connection to all subjects of fundamental level and substantially optimize the educational process in school. Hence, in it application one should distinguish at lest two levels.

The first level combines the *teaching* technologies and has the most wide distribution. It is directed on skill mastering and their autonomization. It includes the system of the trainer type with no dependence on the type of the training skills - from pure physiological (the speed and accuracy of reaction) up to intellectual (the speed and correctness of traditional task decision).

The other level concerns the *education*, considered in the spirit of new paradigm. It contains the intellectual systems, in which the tasks are generated, that require acceptation of decisions in non-typical situations and reflection. It did not obtain a proper wide spreading yet, though, according to opinion of experts, namely this level of intellectual technologies in the most prospective for modem higher school educational tasks.

Alhoritmization of the decision acceptation process and evaluation of it optimization may be carried out for great quantity of actual tasks in the conditions of dialog work regime with the computer. Here not the mastering of particular skills takes place, but mastering of cognition activity methods, that seems to present the main problem of fundamental education (contrary to teaching). Apart from that, in a real information stream the destructive noises (hindrances) are always present, which are often comparable with constructive signal. It's necessary to develop the skill to recognize and select the true message on the background of the «noisable» one, and also to stratificate (to build a hierarchy) of received information. On this way the most important function of fundamental education is realized through the orientation and adaptation of a person in entire environment, the development of initial information system and formation of independent activities. These problems does not meet adequate solution in the framework of traditional technologies and seem to be the main directions of the intellectual technology development in the fundamental education.

In conclusion, it's possible to mention the hope, that at the threshold of 21st century real prospects appear for the new type person formation in his essence («the person skilful» - «the person intellectual»), due to the new orientation of educational systems, the person would reach the next stage of his development, which one might call «the person educated». In the evolution the key role belongs to fundamental education, carried out on the basis of intellectual technologies.

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WHAT CAN THE COUNTRIES IN SOUTHERN AFRICA HOPE FOR WITH THE ADVENT OF THE ERA OF NEW INFORMATION TECHNOLOGIES? (THE SITUATION IN CAMEROON)

Alain Biloa Tsimi (Cameroon)

I. SUMMARY DATA

Cameroon is located in Central Africa, located between the 2nd and 3rd degrees of the Northern Latitude and the 9th and 16th degrees of the Eastern Longitude, and id bordered by the Gulf of Guinea.

In 1976, the Cameroon population numbered 7,663 million people, by 1990 it had increased to exceed 12 million, and is expected to reach 15,292 million by the year 2000. The annual population growth rate is 2.8 per cent; rural population comprises 55 per cent of the total population; population density is 27 inhabitants per 1 sq. km.

The Cameroon population is relatively young, with 46 per cent below 15 and only 3.1 per cent older than 65 years of age. We shall be concerned primarily with the younger population sections. Some data on these group is presented in a below.

Table 1

Pre-school Age Group of 4-5 Years (in thous)

Year	Boys	Girls	Total
1996	427	425	852
2000	467	463	930

Table 2

School Age Groups of 6-14 Years (in thous)

Year	Boys	Girls	Total
1996	1 713	1 690	3403
2000	1 814	1 833	3674

II. THE EDUCATIONAL SYSTEM OF CAMEROON

The 44th Session of the International Conference on Education (Geneva, 1994) published the official date which is cited and referred to below.

II.1. Problems

• No law on education - a basic document which would clearly formulate the general goals of education in respect of the individual and society, the specific goals of education and its various levels and forms,an answer to the question of what kind of citizen we should raise, the role of the participants in the educational process, etc.

• Inadequate differentiation of training types and trends at various levels of education against the great variety of the social and economic requirements, specifically as concerns such occupations as land and animal farming, ecology, the arts, computer science, and some others.

• Shortage and unsatisfactory quality of the educational facilities.

• Shortage of teachers in some disciplines, such as informatics, for example.

II.2. Perspectives

Several priority trends in the development of education are currently the topic of public discussion in our country. At the same time, even now when we are in the course of preparations for the convocation of the General States for National Education - seen as a "forum for discussion, exchanging opinions, and taking the decisions allowing Cameroon to accept the challenge of the future awaiting our society at the start of the third millennium and to provide proper education and training for our youth - we can still point to a total absence of any attempt to foresee this future, at least in the area if introduction and implementation of informatics in Cameroon's educational system.

The above remark is to help us understand the actual state of affairs with the satisfaction of the country's requirements in the area of new technologies - there is practically none to speak of.

It should also be noted here that the burden of economic crisis (described by the specialists in detail) and the consequences of inefficient administration of the educational system have done nothing to improve the situation.

On the whole, one might say that the countries of Southern Africa ridden by these problems will as before be incapable of surging for the future because of the lack of initiative and decisive action, which equally concerns the area under discussion here - the introduction of new technologies in management and teaching disciplines.

Now let us go back to Cameroon's education system and the informatics in Cameroon. How are they doing *in* this developing country?

Serious training in informatics is provided by only one specialised institute of higher education - Ecole Nationale Superiere Politechnique in the city of Yaoundé which boasts a high standard of the teaching programmes and quality. There are also three technical colleges, all of which are understaffed, and a few university education schemes which also experience the shortage of teaching personnel.

The private education centre is marked by the predomination of a purely time-serving approach and a great demand without adequate supply of guaranteed sound training.

Hence, we might say that the objective is large-scale and the demand is enormous.

II.3. Some Facts on the Educational System of Cameroon

We shall use here the patter of describing national educational systems offered by the International Enlightenment Bureau. Based on this, Cameroon's system of education could be broken down into formal and informal.

II.3.1. The formal educational system

The system is comprised of six levels: pre-school, primary, post-primary, normal, secondary, and higher education.

At each of the levels, and in everything pertaining to their competence, intention is displayed to combine the approaches characteristic of the two different educational systems: the English language system of the North-west and South-west provinces and the French language system, prevailing in nearly all of the other eight provinces of the country.

Below are cited some figures on all the education levels.

Summary data (supplied by the Ministry of National Education and the Ministry of Higher Education)

II.3.2. Non-formal Educational System

The system is designed to meet the requirements of specific population groups, such as, for example, those whose general education was not completed or those wishing to restore and update their training. They are educated in specialized educational institutions set up under field ministries.

This is a specific sector of education, which has also felt the impact of the general economic crisis, deserves a more detailed examination. However, as the problems of this sector of the educational system are similar to those of the formal sector, we shall confine ourselves to stating that the total number of learners in this sector is 215 160.

1. From pre-school to secondary education

Table 3

Number of Learners and Education Levels (1994-1995)

(Total number: 2 592 255)

Pre-school education		Primary education		Post-primary education		General secondary education		Vocational secondary education	
Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
54.977	37.015	143.219	502.262	11.157	0	295.966	163.734	47.015	49.083
91.992		1.937.458		11.157		459.650		90.998	

Table 4

The figures supplied in Table 4 indicate the resources of Cameroon's education system

Education level	Pre-school	Primary	Post-primary	Normal	General secondary	Vocational secondary
Teachers	3.755	7	1.954	123	19.649	6.814
Schools	851	6.763	162	33	709	315
Classes	1.985	37.645	597	133	10.517	3.073

2. Higher Education

Table 5

Enrolment in Higher Educational Institutions (1994)

(Total: 42,220)

	I Yaoundé University	II Yaoundé University	Dshang University	Douala University	Buéa University	Ngaundéré University
Number of students	17,000	15,000	2,500	5,000	2,020	700

Altogether, there are 23 faculties, 9 higher schools, and there university institutes of technology.

II.4. What Policies Underlay the Development of the Educational System of Cameroon?

Without going into the content of the teaching programmes and methods, we shall explain our view of the existing problems using the facts which were officially recognized by the Cameroon authorities in 1994 and which still figure today.

We can assert the following.

The Cameroon educational system, in the shape it has taken to our day, is still affected by the same factors which had caused the 1993 reform: the economic crisis, fast growth of the learners contingent, shortage of managerial and teaching personnel, inadequate correlation between the disciplines taught and the actual requirements of the labour market.

It should be admitted, though, that the country's authorities do display a political will and intention to improve the state of affairs in education and to introduce the computer science into the management and practice of training process. This intention has found expression, for example, in the currently implemented FAC Project of automated data on general education, as well as in the assistance rendered by Canada to the Technical High School in the city of Sangmelima. Besides, the integration of the Cameroon University computer network into the global French language network that has recently taken place as a start of the REFER Project implementation opens up some promising prospects for Cameroon's educational system.

As for the infrastructure designed for proliferation of the experience accumulated in the implementation of new technologies, we must stress the significant role of the existing packet data transfer network, CAMPAC (X25), which covers most of the country's provinces. Furthermore, despite the unfavourable natural conditions (dense tropical forests, vast areas, etc.), the telephone network extends to practically the entire territory of the country.

Despite all that. the situation still brings to mind the French saying" "The more of the change, the less things change."

The situation with the introduction of new information technologies at the level of higher education is, on the whole, still unsatisfactory - and this in spite of the Polytechnic School, mentioned earlier in this Report, distinguished by a high standard of training and application software. Thus, some educational institutions are obliged to give up computer science and related discipline for the entire academic year sometimes because of the shortage of teaching personnel, while the administration of human resources is left entirely in the hands of one, "non-computerized", person.

This state of affairs in the Cameroon educational system is further deteriorated by unfavourable geographical conditions, for vast territories of the country consist of densely forested plateau (in the east) or desert plains (in the north), which prevents the extension of school education to the entire contingent of school-age children. This to a considerable degree explains, also the significantly higher school attendance rate of the other territorial areas.

Finally, it is noteworthy that the government plans contain practically no provisions for the introduction of new information technologies at the pre-school to the secondary education levels, as concerns training management and the learning process alike, although some feeble and uncoordinated attempts of their application are registered at the level of local administrations (see the section "Perspectives" of the documents relating to the 1994 Geneva International Conference on Education).

There is no doubt that, on the one hand, is precisely the introduction of informational technologies that can promise solutions to the burning problems impeding the progress of the countries in the South of Africa. On the other hand, there exist no less burning problems connected with the costs involved in the implementation of information technologies and the poor infrastructure providing the proliferation and operation of these technologies (telephone networks, telecommunications, etc.). Unfortunately, these areonly some of the difficulties. Hence the enormous scale of the problems to be tackled.

III. SOME SOLUTIONS TO THE PROBLEMS INVOLVED IN THE INTRODUCTION OF COMPUTER SCIENCE IN EDUCATION

Difficult as the situation is, we should not lose hope of overcoming all the described difficulties. New technologies, while they give rise to problems, promise some solutions as well. It seems pertinent to undertake the following.

1. In order to achieve optimization of the economic, social and educational trends, schemes and developments at the national and regional levels, it is necessary to accept the need for mastering the computer science and to set up high-level informatics courses for top administrators, which courses should include training in the subject «Informatization of organizations» work of organisations", and would therefore instil in the administrators a clear notion of the "information system" as a resource for their activities, which, in turn, could become a key factor of changes for the better in the current situation. In our opinion, this could be achieved by using the IMI courses conducted in France, but in their somewhat simplified form.
2. To ensure a large-scale introduction of the computer science at the primary, secondary, and higher education levels, we should urgently arrange and conduct a trial course of training (within one or several pilot projects) in such subjects as informatics handling of documents and the proliferation of computer science for the purpose of its introduction in the economic, social and cultural areas of our country (or our countries).Such trial courses could be conducted on the basis of a primary school, high school, college, university or some other institute of education.
3. To be able to study and preserve our cultural heritage, we must urgently create data banks (including computer data banks) in such vital areas as:
   - music (for example, collection and description by computer means of all the existing musical instruments could of equal value for all mankind as a treasure-house of knowledge and a universal encyclopaedia;
   - special and unique forms of cultural heritage (such, for example, as the "so'o" philosophical system), whose preservation is a rather complicated problem at present. If would be interesting to know, whether there exists a standard archive of the "so'o" materials. The discussion of this problem by major researchers and/or teachers could undoubtedly be very useful.

Other problems and approaches to the matter could also be considered.

In conclusion, I would like to say that the success that all of us desire so much could be attained only if the following conditions are implemented.

Concerning the countries of the South, it is necessary to:
1) encourage the most bold and original approaches in the work of administrative agancies at all levels;
2) adopt the rational and objective aspects of all and every operational decisions taken in the conduct of daily activities as the yardstick for appreciating their efficiency;
3) instil in the consciousness of the workers at the higher and other levels the understanding that new technologies are today a factor of progress, and to cultivate this understanding;
4) display will and determination, and see them as the principal factor, in the way firmly taken toward the implementation of new information technologies.

As concerns the developed countries, it is necessary to:
1) do all in our power to make new informational technologies available to all;
2) set up a "financial stockpile" for facilitating the access to new information technologies for the countries of the South;
3) develop type training programmes (for various educational levels) and a system of interrelated .methods and facilities for the introduction of these programmes in the educational practices.

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EDUCATION IN THE FIELD OF HIGH TECHNOLOGY AND INFORMATIZATION. EXPERIENCE OF THE MOSCOW STATE INSTITUTE OF ELECTRONIC TECHNIQUE (TECHNICAL UNIVERSITY)

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The electronics, first and foremost, the microelectronics is not only the important constituent part of an industry but a base of the state in the whole. Obviously, the microelectronics must remain among the priority branches of Russian industry, and the reproduction of the personnel for the electronics must be one of the main purposes for Russian higher school.

The microelectronics feature is the providing with the rapid development of .new information technologies which gives the necessary impulse and creates material base for the information in all fields of the human activity including the education. At present time there is no speciality which is not included into this process. But conformably to the education in the field of high technologies, this process plays the specific role. This, on the one hand, is connected with high degree of the informatization of high technology branches that requires the adequate matter and level of the future specialist training.

On the other hand, the high technology branches are characterized by the exceptional dynamism expressed not only in the fast changing of the nomenclature of the manufactured articles, but in the fast changing of technological processes and equipment. The educational establishment with their strictly limited funding has no possibilities for upgrade of the technological base in proper time which is necessary for specialists training the in the field of high technologies.

Under these conditions it is possible to provide the required level of specialists training by means of either close collaboration with industrial works in the purpose of implementation of their technological possibilities for the education or the wide use of the programmes and multimedia means for studying the technological processes and technological equipment of the modern industry.

Thus, the wide informatization of education in the field of high technology is based upon the following factors:

1) The high degree of the informatization in high technology industry.
2) The absence in the universities of the sufficient means for technological equipment upgrade.
3) The high concentration of the qualified researchers in the higher school which allows to carry out the investigations in the field of new information technologies.

The Moscow State Institute of Electronic Technique (Technical University) has lasting many years successful experience of specialists training in the field of electronics and information science, the realization of scientific investigations in the field of high technologies. MSIET has the unique possibility for the specialists training because it is the only institute in Russian Federation which has in the its structure the State Scientific Centre of Russian

Federation, so called «Technological Centre» with the full cycle of BIS design and production technological process. In this connection, the MSIET experience on the informatization of education seems to be of some interest. The process of informatization is developed in the following directions:

- development of principles and methods of information technologies;
- development of electronic textbooks;
- assimilation of multimedia technologies;
- computerisation of libraries and publishing houses;
- development of distance education means and methods.

The implementation of information technologies in the educational process allows to individualize the teaching process, provides the accordance to the modern requirements, forms the new information culture of thinking.

In MSIET it is actively conducted the scientific-methodical works on the synthesis of the video-, audio-and text information, elaborated the computer textbooks on the course «Organic chemistry», the teaching programmes and teaching-metodical complexes with the usage of personal computers on the courses «Interactive graphical systems», *«Circuit engineering of impulse and digital devices», «General physics», «Higher mathematics», «Ecology», «Technology of instrument engineering and mechanical engineering», «Applied mechanics», «Engineering graphics», «Special materials of microelectronics», «Economics of Natural Resources», «Computer engineering»*. It is created the informative and methodical means for the distance education forms.

The upgrade of the technical informatization means in the University is carried out on the basis of the priority system that provides the highest efficiency of the limited University funding. In MSIET the following general scheme of the hardware use is accepted :

1) the pilot room of 5-6 places where the computer means it are; the above means are used for the introduction into the teaching process as well as for providing the necessary managerial aids for the preparation of teaching-methodical manuals by the lecturers;
2) the room of 12-20 places for final teaching of the students of 5-6 years;
3) the room/rooms for training of the students of the 3-4 years;
4) the rooms for training of the students of the 1-2 years.

The process of the hardware development is accompanied by its consequent displacement which is carried out as follows:

- the new pilot room is arranged with the use of some technical means (in general, managerial aids) from the working training room;
- the old pilot room is quantitatively completed up to the one for the training of specialists to the degree work;
- the old room for the training of the specialists to the degree work is passed to the students of middle courses et al.

High qualification of the MSIET personnel allows to develop the new unique education informatization means. Thus, for example, the *"Science-technology park" has* developed and now starts the production of the TV text decoders with the appropriate software that allows to realize in the short time period and with the small expenditures the information service accessible for the enormous number of user both in Russia and abroad. The service provides data transmission in TV text regime in the educational and commercial purposes directly to a personal computer or TV receiver.

The appreciable help in the education informatization process in MSIET renders the collaboration with the international societies, educational institutes and research organisations. Thus, in the University in the frames of the contract with UNESCO the special courses were organised in the field of electronics and information science, as well as the training programs *"Modern personal computer software", "Design of ordered and semiordered SBIS", "Implementation of intellectual technologies".*

As a whole, the Moscow State Institute of Electronic technology (Technical University) has the possibility for improving of the training quality of the specialists in the field of microelectronics by means of the wide informatization of the all educational process sides. Its experience my be also useful for the other universities specialized on the education in the field of high technologies.

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THE INFORMATIONAL INFRASTRUCTURE OF A HIGHER EDUCATIONAL ESTABLISHMENT AS THE BASIC FOR DEVELOPMENT OF HIGHER SCHOOL OF THE FUTURE

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Information is one of the most important resources of any society, which has a profound impact on social and economic development of any state, of any person. It also has a pronounced effect on the organization of educational and research process at higher schools. In this case, it is the information *environment* that has a determining effect on both the person and the society.

At the time when the educational process is based upon the traditional forms of curricula and programmes, the centralized unified transfer of knowledge from teacher to the students is provided. This makes the control of the teaching process easier, but even the search for the active training aids not always provides the formation of active purposeful person.

The creation of information infrastructure (US) is oriented towards the formation of all-round persons. It should help the students to realize their potential in speciality and to play their own individual role in the society. It should, also help the teachers in upgrading their professional quality. Il can also play an important role in optimization of educational and research process and in the development of researches made by students in higher schools.

Creation of US can become a basis for the development of such an allocated decentralised instrument and personnel environment as *techno-polyces* and *techno-parks*. US can provide the renewal and development of interaction between the higher school and the industry, it can also help to raise the level of innovation researches and to improve the students' research work.

On the basis of the above said we-can state that the information infrastructure of the higher school can become the foundation for the development of the new type of techno-polyces, which can be named the *noo-polyces*.

It is useful for the control of the US development to present it in the form of 4 levels:

Level 1. The communication level that comprises all information telecommunication, computing networks, other technical aids. Sometimes this communication level is named *Information super-highways*.

Level 2. The informational level that includes all the information that circulates in the .telecommunication nets and is saved in libraries, research and technical information departments, in automated factual and documentary data bases with the possibility for access in electoral information allocated regime, differentiated chief servicing, retrospect searching. The information level comprises all information knowledge from all document information as the traditional school books and manuals, training materials, research and technical information, normative regulations till factual information (including the statistic information about various aspects of high school activity), normative and reference information etc.

Level 3. The functional level comprises the set of services provided for users by various suppliers (the access to data bases and libraries, arrangement of TV conferences, electronic accounts and electronic purchasing, video after order etc., all services, provides by the infrastructure, including the access to curricula and programmes, to the quality standards on specialists etc.).

Level 4. The user's level consists of users indeed. It comprises formation of information needs (that is the most difficult problem) and the rules for interaction among the students, the teachers and the collaborators with IIS.

The above classification can help us to manage and control the projects and programmes on IIS development (proposed by teachers, students and collaborators). The management and control should be carried out on the basis of the special assessment aimed at allocation of the financial, material and staff funds. The method for assessment is being developed which takes into account the degree of influence of a project upon the University objectives.

For the above purpose we suggest to use the apparatus for system analysis, i. e. the methods for goals and functions structuring, the methods to carry out a of complicated examinations, the information approach by Denisov A.A. and the authors' developments.

The stratified representation is the basis for the proposed analyse of the IIS effect on the social and economical development of a higher school. In this case the functional levels of IIS and the society are determined as the "interface" levels, that links the IIS and higher school objectives; and its connection with research institutions s and enterprises.

The methods of goals and function structuring by V.N.Sagatovsky - F.I.Peregudov, R.Akorf - F.Emery are planned to be used for the analysis and development of the function level of higher school.

The intermediate assessment of elements significance for each model level should be done by the method of pair comparison in the Saaty T. modification. For the final assessment of reciprocal influence of marked level elements the idea should be used of the Pospelov G.S. method for deciding matrixes. The values of assessments itself should be produced by means of the information approach, that allows to register both degree of the effect and the probability the effect inception. The information approach also provides to simplify expert procedure through normalizing of expert estimates after and not at the time of the expertise.

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DIFFERENTIATION IN TEACHING INFORMATICS IN RUSSIAN SCHOOL

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The school informatics course is continually developed, its education objects, the course content, methods, organization forms are revised. Even recently the informatics was studied in the higher forms only, but at present a multistage system of this discipline study is formed:

- the stage I - the propaedeutic acquaintance with the informatics elements (the primary school);
- the stage II - the basic informatics cource (the 7-9 forms);
- the stage III - the profile informatics education (the 10-11 forms).

Let's stop in detail on the problem of the determination of the informatics teaching content in the higher stage of the general education school. For this let's refer to the general tendencies which are formed on the higher school education stage.

Recently the Russian school education system the idea of differetional approach obtains gradually increasing recognition.

Currently it is accepted to distinguish the level and profile differentiations of the education content.

The level differentiation in the education envisages the forming of the heightened levels of the material mastering based on the demands to the obligatory schoolboy training. This approach allows to take into account and develop the schoolchildren motivation, interest to the learning, creative thinking, selfdependency, efficiency, attentiveness etc.

The feature of the profile approach to the teaching differentiation is the study deepness differentiation of different education fields, that is revealed in the increase of the study time which is alloted for study of the profile school disciplines, as well as for usage of the different teaching organization forms.

This kind of the education differentiation receives the largest development for in the higher school stage. It is important to note, that in the profile teaching conditions the considerable role is also led to the level of differentiation, i.e. these are not separete forms but the mutually complementary ones.

One of the aspects of the profile education differentiation problem on the higher school stage is the criterion revealing for the determination of the quantity and orientation of the profile specialization.

The analysis of the teaching differentiation practice in the higher school education stage shaws that the main criterion for the profile differentiation at present is the structure and content of studied education field (a science or a group of sciences). Thus, one should allot the mathematical, natural science, humanities, engineering and other education profiles.

In the frames of each profile it occurs the deep study of the discipline (and number of ones closely related with it), leading for this profile, while other educational objects are studied on the minimum level allowed by the general education standard.

The profile informatics study in the secondary school has two characteristic features.

Firstly, its study in the frames of any specialization profile is obligatory for the study in higher school stage. Thus, for each specialization of school education its own profile informatics course (which may still differ by the level as well as the depth of the studied material) is created in the higher forms.

The necessity of the informatics study in the education profile conditions is substantiated by the fact, that the informatics methods and meanses are practically used in all fields of the human activity.

The informatics significance for the solution of the main school education problems, the forming of a number of the maior components of the schoolchildren personality, its contribution in the young people training to a work as well as to .the following professional education determines the necessity of the obligatory teaching to this object in the frames of the education differentiation in the higher school stage independently of the choosed specialization profile.

Secondly, it is advisably to conduct the informatics education content differentiation according to the criterion.

Proceeding from the established practics it should be developed the proper informatics cources of the mathematical, natural science, humanities, engineering and other profiles. However the content of these cources is very common from the point of view of information activity content and, on the other hand, in the frames of the same profile the training may be realized in different orientations and levels of the information technology usage. For example, in the profile pertaining to the humanities it is supposed the initial training of jurists, managers, painters, musicians, secretary-reviewers at all, which information activity has the principal distinctions.

The analysis of the information infrastructure provided with the human activity, reveals the necessity to base not on the traditional criterions of the education differentiation in this field according to the main scientific ones but on own specifical criterions of the informatics teaching differentiation.

From the point of view of informatics the main factor, that differs the kinds of human activity, is how as the information, presented in one or another forms, is organised in different computer systems, data bases and knowledge, modelling systems et al, as well as by the information processing techniques.

Thus, in our opinion, it is advisably to determined the orientations of the informatics education differentiation on the base of the information organization, presentation and processing techniques, which are used in the human activity.

We have marked out six main information structures which in that or other degree take place in all traditional profiles. On other hand, these structures are sufficiently distinguished from each other from point of view of the information activity in the frames of the same profile.

On this base we offer the system from six profile informatics cources for higher stage of the secondary school, the content of which is a further investigation.

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Theme 6

INTERNATIONAL CO-OPERATION

OFEK – ADVANCED TECHNOLOGY IN SERVICE OF HIGHER EDUCATION

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BACKGROUND

The Open University of Israel (OUI) is one of seven universities in Israel accredited or grant the B.A. degree. It operates on the basis of distance-learning (Appendix A provides a brief description of the Open University).

The OUI is currently engaged in a far-reaching process of integrating state-of-the-art technologies into its academic curriculum, which, until recently, has been based on textbooks specially designed for self-study. Enclosed is a brochure that outlines the current activities and projects of the Center for the Design of Distance Teaching Methods, a center that has been set up at the QUI aiming at integrating modem technologies into distance teaching.

Since 1995, the OUI has been successfully operating the OFEK project of interactive distance-learning via satellite. OFEK is one of the projects operating under the center mentioned above, and is a joint venture of the Open University, Gilat Communication Engineering and Arel - Communication and Software.

OFEK - INTERACTIVE DISTANCE LEARNING

The enclosed brochure contains a brief description of the system, which is essentially a private communication network, broadcasting by satellite, a compressed digital transmission addressed only to sites equipped to receive it.

Within one year since launching the project, the OUI has reached 100 hours of broadcasting per month. During the present academic year (1995/96), the OUI operates via OFEK nine teacher training programs and 10 tutorials in academic courses. Various organizations, including most of Israel's banks, the Postal Authority, car importers and others, are already testing the system with a view to using it for corporate training.

At present, the system broadcasts from one studio to 13 classrooms across the country, from Tel-Chai in the north to Eilat in the south. All classrooms are fitted with special equipment that includes a 1.8 meter antenna, a computerized lesson control system for two-way communication, a large screen television, and regular telephones for the two-way communication. Installation is simple and fast and does not require any communication infrastructure. The entire two-way communication is transmitted via satellite by VSAT (Very Small Aperture Terminal) and there is no additional expense for the use of public communication networks.

The OFEK system operation is closely monitored and continuously evaluated, mainly by means of its own data communication. Findings have shown that the response has been extremely favourable. The welcoming reactions highlight the advantages of the system in combining the best teacher (who is not generally available to appear everywhere) with the best lesson (because the system requires exacting and detailed preparation cut every component of the lesson) while using the best, most-advanced audio-visual aids (computerized displays, software, courseware, animation, internet surfing, video films, scanners, CD, etc.) This fine lesson is simultaneously transmitted to any number of sites and becomes a live lesson thanks to the two-way human interaction. Today interaction is based on voice communication and data communication - answers to multiple-choice questions and administrative information.

TRAINING THE LECTURERS

There are inevitable differences between a regular class and a televised interactive class. These differences must be addressed by the television teachers/lecturers, and therefore, before they start teaching they are trained to be able to do that.

The most obvious difference is that with point-to-multi-point. two-way audio one-way video broadcasting, the teacher is usually unable to see the students. Therefore, the teacher needs to know how to make the television class as immediate and personal as possible. Another major difference that a distance learning teacher must address is the emphasis that must be placed on visual learning in the television classroom. The more visual the distance learning teacher can make the lesson, the better he/she can keep the students' attention and convey the instruction. Use of photographs, graphs, charts, video, and other visual presentations enhance the television lesson immensely. In addition, to take advantage of the system's full capabilities, interaction with the class should be carefully planned ahead and monitored during the lesson.

OFEK IN 1997

The Open University and its partners will continue to broaden the range of OFEK applications and improve its capabilities. Next year we plan to set up a second studio and increase output to over 250 broadcasting hours a month. There will be some 20 teacher training programs, and more academic courses which use the system. In some cases OFEK lessons will replace the traditional textbooks and in others they will serve as tutorials.

The lessons will be received in 25 towns and villages where OFEK classrooms have been installed. In the larger towns there will be two classrooms for simultaneous reception of broadcasts from both studios.

The complementary techniques and facilities will include: a help-desk, a two-way video, individual stations whereby students can be reached at home, computerized classrooms. A brief description of these facilities is provided in Appendix B.

OFEK VERSATILITY

The OFEK system is suitable for any education or training system operating by distance learning. At the OUI OFEK serves as an effective, first-rate dissemina-tion tool. With leaning and training requirements developing all the time and the world in a state of "life-long learning," there is a drawing demand for immediate (here and now) provision of the best lessons at any location, whether nearby or remote. Lessons transmitted by OFEK can relate to any subject, at any level: teacher training, academic studies, vocational courses, corporate training, etc.

The use of satellite communication allows for the transmission of broadband broadcasts to an unlimited number of sites, without having to rely on existing communication facilities (telephones, cables, computers, etc.). The system is also characterized by its economy of scale. The initial investment, while considerable, is smaller than that required for similar systems. Once this investment has been made, more studios can be added to the central system. The installation of any number of additional classrooms involves a comparatively small outlay and the number of participants in each classroom does not entail any further expenditure.

In a world where education and training are the key to a better future, OFEK fits in as an important part of the best, most effective solution possible, one that offers the most advanced technologies as facilitators of the learning process.

OFEK IN SERVICE OF REGIONAL AND INTERNATIONAL COOPERATION

Since the OFEK system does not rely on local communication networks, its use can be extended beyond the confines of the local-national scene to two wider circles - the regional and the international.

On the regional scale, the distribution of receiving classrooms can be extended to include other countries covered by a satellite. Lessons broadcast within this periphery would be of common interest and in a language understood by all (e.g. upgrade programs in family medicine broadcast in English to Middle Eastern countries, academic courses in Spanish transmitted to Latin America, teacher training programs in English, French or Arabic for countries in Africa and the Middle East).

On the international level dissemination may reach even further and lessons would concern issues of world-wide interest. (For example, courses in international marketing, advanced courses in computer science, training programs for international corporations, etc.). Satellite coverage can be provided either through direct link-up, using the existing extensive satellite footprint, or by transferring from one satellite to another (double hop).

Both the regional and international spheres can accommodate several broadcasting centers located in different countries. Thus, one can take advantage of the best capabilities each partner in the network has to offer, for the benefit of the other partners. Such Cuper-tino is doubly advantageous: On the one hand - answers to needs shared by many are provided from outside the national boundaries; on the other - the potential target population is significantly increased. These technologies contribute towards the realization of a dream in which a student will be able to construct for him/herself a curriculum made up of the finest programs offered by major universities around the world, each a leader in its field? without ever having to budge from his/her home town or place of work. The world will become a still greater global village.

Appendix A

THE OPEN UNIVERSITY OF ISRAEL

The Open University of Israel (OUI) was established in 1974 as a distance teaching university and is accredited to award the B.A. degree. The teaching method is based on study material which replaces face-to-face lectures, on tutorials that consist of discussion, repetition and expansion of the studied material, on assignments and common final examinations in a course held at the same time for all students. The course units are written by leading scalars and experts and adapted for self-study by teams of assistants, editors and graphic artists. Tutorials take place in small groups of up to 20 students, at 110 study centers across the country. Students can choose between two types of tutorial - one based mainly on self-study and a tutorial meeting every 3 to 4 weeks; the other model is based on intensive tutoring of up to three weekly hours.

In order to earn credits for a course (usually six), students must submit a minimum number of assignments and pass the final examination which takes place at the end of the semester for all students of a given course. A bachelor's degree requires 108 credits (generally this means some 20 courses). The OUI grants degrees in Life Sciences, Natural Sciences, Mathematics, Computer Studies, Humanities and Social Sciences. In Social Sciences there are dual-discipline programs which sometimes require more credits (up to 115). Students may enrol in one or more courses (3-4) per semester; they may thus graduate after three to four years.

The bulk of OUI study material is presented today mainly in book form. However, the University is currently exploring a variety of new technologies which it may integrate into its curriculum.

Telecourses - courses in which video films are the main component.

Multimedia - a combination of audio, video, data banks and animation, with a personal computer, for interactive study.

CMC (computer-mediated communication) - allowing for contact between student and tutor or between a student and his peers, for the purpose of discussions, team work, queries etc.

Informatics - learning through the exploration of data banks with the most advanced tools of retrieval.

Satellite communication - allowing for interactive distance learning.

Some 23000 students are currently enrolled in 400 OUI courses every semester - a figure equivalent to 10000 FTE students. Thanks to an accederable rate of development –17 %, annually during the last eight years - the OUI has grown more than threefold (250 %) during that time. This rate of expansion becomes even more remarkable when we consider that it occurred without an increase in governmental support (which is about 22 % of the OUI budget), and was entirely funded by tuition fees which are the same as in all other universities in Israel.

Appendix B

ADDITIONAL CAPABILITIES OF THE OFEK SYSTEM AS OF 1996/97

1. Help-Desk

A support center located near the lecturer at the studio and operated by assistants who can dispatch immediate answers to any question. The help-desk will be put into action whenever the number of participants exceeds 200, or at the teacher's discretion. Participants can address the center either by phone (directly or through voice-mail), by electronic mail (using a special PC installed in every classroom) or by fax. All communications with the center will be via satellite, at no extra cost.

2. Two-Way Video

The ability to see participants in the remote classrooms and show their picture in the other classrooms. The return picture will be of the quality known in video conferences. Thus, a teacher can be better informed of what is happening in the classrooms. This facility will be installed in some of the classrooms (the economic and operational reasons).

3. Individual

Now that the satellite "Amos" has been launched, the system may be converted to the advanced DBS (Direct Broadcasting Satellite) technology. This technology makes it possible to install individualized reception stations at a very low cost. Such stations could be established at schools, community centers and even in students' homes.

The same lesson delivered to all regular classes will appear on a TV screen or the personal computer. Return communication will be to the help desk via the public networks (telephone or E-mail) at the caller's expense. Thanks to this technology, the number of participants can be increased and most of the target populations can be served at their own locations, including their homes. They will be able to take part in the same lesson that is transmitted in the classrooms, although in their case interaction with the teacher will be somewhat restricted and involve paying for the communication.

The technology also opens up other options: communication with the "learning teachers' rooms", programmes for handicapped children, programs - including academic studies - for particularly gifted students, programs for designated sectors.

4. Computerized classrooms

The possibility of linking up with computer classes that teach computer literacy, applications and courseware, with full interaction, either by using existing means or through the computer. This system will also allow for access to the internet from all.

i *The Open University of Israel*

Original is presented in English

CONTRIBUTION AEGEE-EUROPE TO ICEI

Reinout Dekhuijzen,
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THE EXPERIENCES OF AEGEE: GLOBAL NETWORKING PUT IN PRACTICE

AEGEE, an independent student network active in 170 university cities in Europe has actively experienced the progress of the information society in it's association. As most members are university students, they were amongst the first to have access to the new facilities like e-mail and Internet. The network quickly discovered the opportunities these new communication technologies offered. The establishment of listservers and www-pages has improved the internal communication and external PR substantially. Today the network maintains about 450 www-pages and several mailing lists. A www-search on the keyword AEGEE gives about 30.000 hits.

Especially the listservers have greatly enhanced internal communication, since they are used for the preparation of meetings. Thanks to the listservers the general discussion is not only limited to the four annual meetings of our association, but it is continuing on a day to day basis. The coordination of the European bodies of our association has been enhanced substantially. Physical meetings are due to financial constraints only possible once every two months. The emergence of new technologies has allowed us to communicate on a day to day basis about on going projects and activities.

The biggest problem, however, is that certain parts of our network are excluded from Internet access. Some universities do not allow network access to their students, and this limits the progression of our network into a truly virtual society. The parts of the network that are excluded from Internet access miss out on most of the news and discussion. They are probably amongst the first victims of the long announced class difference between the information-rich and the information-poor.

This problem is partly solved autonomously over time since sooner or later most universities allow Internet access to students. The information society develops at a large pace, which leaves certain universities behind.

UNIVERSAL ACCESS

The previous example shows opportunities and challenges the development of the information society may offer the educational system. If universities start cooperating in global networks, the universities with the worst access will loose out in the global society. Therefore the issue of universal access is an issue of the utmost importance. We consider an *independent study on the minimum access requirements* that allow universities to stay in touch with the recent developments of great importance. These minimum requirements could be defined in the sense of what is required to allow regional differences to diminish instead of to increase as a result of the introduction of new information technologies.

However, these minimum requirements are not static and this would complicates this study. Nevertheless, we consider the definition of some kind of minimum standard of access as useful, since it can identify the real problem areas.

These problem areas are not limited to the usual underdeveloped areas. Some areas of the most advanced nations are deprived from network access. In our network, for example, most mailing list are run from Estonia, whereas most of our French network is still deprived from even the most simple Internet access. This illustrates that the division between information-poor and -rich is not necessarily bound to the traditional boundaries of rich and poor.

SCALE INCREASE

The new possibilities for scale increase in higher education can lower the cost of education substantially. This will allow less developed areas to offer world standard higher education via the use of distance education systems. Since the marginal cost of education will be only bound to the cost of the technical equipment, the use of distance education systems will widen the scope of high quality education. This does not necessarily mean a loss of diversity, since a lot of fields of study were to small to be carried out on a local scale. These become feasible on a global scale, thanks to the scale increase reached by new technical means. This may allow students in smaller education institutions a greater possibilities to specialize.

Original is presented in English

INTERNATIONAL HEURISTIC OLYMPIADS AS A WAY OF DISTANCE CREATIVITY TEACHING

A.V. Khutorskoy, E. M. Nikolayeva (Russia)

The main objective of our school is development of personally-oriented heuristic type of teaching. It comprises the realization of internal teaching potential of pupils through generating of an individual education trajectory in all educational areas.

The level of creative capacity realization depends upon the scale and the character of an information environment and the way of activity within this environment. We believe that the most productive educational environment is the phenomenon which is made by the children themselves in the form of their personal creative achievements. In this case an educational technology is presented by heuristic teaching in various manifestations.

The priority feature of heuristic teaching is its capacity to transform the traditional conception of education. According to generally accepted didactic scheme the learner first assimilates the past experience, "gets knowledge" and only afterwards applies them (including those obtained in a creative way). It is accepted that the "knowledge increment" can take place only after recognition of what is known. At the same time, knowledge from manuals and text-books is just accepted as non-personal, dependant of voluntary author's opinion or ideology, dominating in the society. At the heuristic approach the "extracted" knowledge is essentially personal, as a learner creates it anew on the investigated field of reality.

Meanwhile, the explored or extracted knowledge is not the only result of the learner's education. With the help of a teacher the educational product which was •obtained by a pupil (e.g. idea, question, definition, rule, problem, hypothesis, experiment, text, handicraft, drawing etc.) is then compared with culture and history analogues and, as a result, this product is reconsidered or completed. The knowledge and experience increments remain personally-oriented in this case.

Sometimes this increment is of wider significance as it is principally new or can be compared anyway with existing generally accepted knowledge. Our experience of heuristic methods application in teaching shows that approximately 7 percents of creative works performed by pupils of average level are 'worth considering by specialists in corresponding fields. One of the efficient forms of the elaborated teaching type is an heuristic Olympiad (Contest). It is aimed to give to the pupils an opportunity for maximum creative self-realisation with regard to their individual capacities. The pupils' achievements at these Contests are the stimulus for their further creative activity, both individually and in co-operation with the pupils from other schools and countries. Let's consider some aspects of development of programmes and organizing of the heuristic Contests that we have revealed from our own pedagogical experience.

1. Every Contest task includes a "meta-object" primary sense e.g. key concept, category, phenomenon or other object which concentrates rather wide area of cognized being and comes out of the frames of common school discipline. This primary sense gives an opportunity for every pupil to realise the cognition process in his (her) own way and to create the original educational product. The examples of such contents: space, time, movement category, concepts of number, letter, pitch, elements, world of nature.

2. Accomplishment of such Contest task includes an application of a "meta-way", e.g. some universal heuristic cognition method or problem solving, for instance: revealing of some regularity; imagery representation of the object, creating of actions algorithm. Every Contest task is carried out on the basis of leading types of activity, i.e. logical, imagery, construction or others. With the purpose of providing maximum revealing of pupils individual capacities all the Contest tasks set covers the main types of teaching activity.

3. Concerning the contents of the heuristic Contest the priority tasks are those connected with creativity of the personal educational by a learner (and not just giving a predicted answer or getting of already known solution). Thus, at the Contest the quality of the product is estimated but not the correctness of task accomplishment.

4. On the basis of the established "primary senses" and "meta-ways" the main nominations are formulated for the Contest: *"Idea"*, *"Image"*, *"Challenge" "Regularity"*, *"Law"*, *"Sign"*, *"Symbol"*, *"Experiment" "Construction"*, *"Handicraft"*, *"Composition"*, *"Algorithm"*, *"Programme"*. The diversity of objects and themes is considered as a necessary component of the Contest tasks. For example, the "Image" nomination task may contain both mathematics type of question (drawing image of number "5") and nature sciences question (picturing the image of *Spring*).

5. The participants results are estimated according to a total mark that is gained in every age category. Separately the totals on every nomination for all participants are summarised. In this case, the maximum mark for every nomination should be equal for all age categories of participants.

The heuristic Contest consists of several stages. Pupils from various schools work within their own schools and in distant communication way with pupils from other schools and countries. The heuristic Contest stages are as follows:

- Inner-school heuristic Contest on the basis of tasks made up by teachers.
- The same Contest through electronic mail is offered for the pupils of another school.
- At this stage heuristic tasks are elaborated by the pupils. Then they offer these tasks to other pupils, i.e. first inside their school, then for the pupils of the school they communicate with.
- On the basis of heuristic Contest results the participants define for themselves the most interesting themes and problems. Every pupil chooses one or few essential themes together with partners or opponents to incorporate them into his further activity.
- The heuristic activity of pupils and teachers then continues at the stage of the joint educational projects development and accomplishment. As a result of this work one more heuristic Contest is conducted. The tasks of this Contest are determined by the previous experience.

We have only preliminary experience of leading the heuristic Contests in our own school and the experience of joint Contests together with US Perry L. Dreu School (Highstown, N.J, USA). In future we are planning to continue organizing the heuristic Contests in Russia and abroad. We are inviting for co-operation schools and organizations, which take an interest in this project.

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Original is presented in Russian

NEW INFORMATION TECHNOLOGIES IN CONTINUOUS ECOLOGICAL EDUCATION

L. A. Kokhanova (Russia)

Development of computer technology in Russia resulted in necessity of its implementation within the system of continuous ecological education. Real possibility arose for carrying out appropriate pilot research within the frames of international project.

The basic premises of the programme. There are some important peculiarities in the process of information product creation starting from the basic idea to its real implementation. We present here the training course of ecological management for municipality officers of Russia and Ukraine and in the future of other countries. The basic form of the above course is distance learning, and this is the first peculiarity of the presented course. The second one is as follows: the process of learning is intended to adults who need special knowledge.

The course is organized by International Council of Local Environment Initiatives (ICLEI) together with Russian partners. «EcoInform» co-ordination group is arranged under the Institute of World Literature of Academy of science of Russia and the Union of Russian cities. The programme is established by European commission (DG-1 - General Directorate for International Political Communications, TACIS) and supported by Ministry of Environment Protection of Russian Federation.

ICLEI as international organization is not far-famed in Russia. This ecological organization is lately established. It is associated member of International Union of Administrations. Now this organization has more than 200 members being representatives of local public authorities and its associations all around the world. In Europe 87 cities and regions and 8 associations are the members of the ICLEI. The Union of Russian cities and some towns are also the members of this Council.

The ICLEI objectives are as follows:

- Carrying out the functions of international centre for steady progress, development of both ecological policy and local ecological programmes;
- Arrangement of researches and development of new methods for ecological problems solving together with local authorities and their associations and carrying out appropriate campaigns;
- Guarding of interests of local authorities in the sphere of ecology, supporting their activity in the direction of steady progress and environment protection.

This international organization carries out the following interesting programmes:

«Climate protection» (development of the project for decrease of carbon dioxide content in the air of cities), «The problem of ozone layer», « Local agenda for XXI age and steady progress» (modelling of steady communities), the «Town protects climate» campaign is carried out; the meetings of local authorities representatives are organised, the conference on development problems of cities and towns is carried out.

Through ICLEI activity International Training Centre is established for development 'of reference books, manuals, guides and methods, for organizing training courses and for carrying out seminars, workshops, conferences and exchange of experience. ICLEI and its divisions create principally new communication field through computer networks.

«ECOINFORM» is the Russian partner of ICLEI. It developed ecological databank which is widely used by the specialists in the field of environment protection.

The pilot project distance teaching ecological management is one of directions of ICLEI co-operation with Russian partners. The main objective of the project is development of the method for distance teaching, investigation of its peculiarities and priority features, assessment of its social value.

Programme contents. The presented course includes lectures (in Russian) on ecology planning, on institution structures, on financial mechanisms of ecological management, on methods and means for cooperation with environment, on methods and means for economic and administrative control which is used for ecological policy implementation and on the issues of population partnership in the process of ecological management. The course is intended for training of adults. Its material is based upon issued by ICLEI reference book on improved experience of ecological problems solving the countries of Central and East Europe .

The listeners use the programme material according to the local conditions and carry out practical exercises on practical implementation of each theme. The material is composed in such a way that during the study the trainee must analyse environment conditions in his region, town, to study it through both popular publications and official documents and write his own essay on the above item. Not only the analyse of the problem is of great importance but also the process of finding the ways for its solving by each trainee.

How the training process is carried out? The trainees are working persons and during the training they go on working. The training materials are sent to them by means of e-mail and it provides possibility for training at a work place, to organize constant experience exchange and co-operation.

The idea of community of the trainees accompanied by individual approach to a trainee is the major one for the course. Half the battle of each individual training comprises constant communication and co-operation of trainees.

Each of 8 themes consist of 40-70 pages of training text and practical examples. Each training material includes the following divisions: main text, list of additional literature, specific examples of problems solutions, specific material on Russian and Ukrainian ecological problems; control tests on the theme.

The training materials on the given theme is sent to the trainees by e-mail once in three weeks.

Who are the participants of the programme? The programme was firstly intended to administration officers and officers of local authorities. The members of the programme are the representatives of Vladimir, Ekaterinburg, Kazan. Korolev (Moscow region), Krasnodar, Kursk, Neftekamsk, Nizhni Novgorod and other Russian cities. The chief managers of local authorities of various levels, representatives of non-governmental organization, journalists and scientists and other specialists who are interested in the environmental protection take part in the extension training course.

When choosing the members for pilot team the preferences were given to those trainees who has already graduated from universities, who has skills and possibility of work with PC and modem connection (or can connect to modem). The terms of training are stipulated in the contract on the training signed by the trainees and programme management.

The knowledge of English is desirable for participation in the above programme as it can help both the trainees and the programme managers. Language barrier is one of the most essential obstacle on the way of development of analogue programmes and courses.

Expenses and financial support. The training is free of payment for those trainees who passed selection exams. Nevertheless, municipal and regional authorities sponsor expenses connected with work time liberation, travelling allowance transportation, computer hardware and telephone payments. The fact that a lot of managers supported both the programme and its participants suggests the increase of attention to eco-logical problems and growth of understanding of necessity for continuous education. Local authorities take proper account of the fact that some trainees cannot afford monthly e-mail subscription. In some cases the trainees are supplied by modem and computer programme.

Completion of training programme. The ecological management programme will be brought to completion by the exam in Moscow. Those trainees who successfully complete the course will receive the diplomas, and the most advanced pupils will be awarded by the bonus allowing to afford the participation in International Conference in Western Europe.

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COMPUTER-AIDED LEARNING OF NEW CIVILIAN PROFESSIONS FOR RUSSIAN OFFICERS DISCHARGED FROM THE ARMED FORCES

Jan Paolo Marello (TACIS bureau)

Over the past two and a half years, almost 16,000 former active duty Officers of the Russian Armed Forces have been re-trained by Russian Universities, where they learnt to draw up business plans and forecasts, so as to better fit expectations of potential employers, but also to become able to set up and duly run their own business. These forecasts, including information on expected sources of income, business financial costs as well as of servicing loans, should help them to demonstrate how do they intend to make an enterprise viable.

This Project, run by the Russian State Committee for Higher Education of the Russian Federation, with the support of EU TACIS Programme, is widely based on the use of modern teaching techniques, such as Personal Computers, in order to reach the optimum learning ratio, and also to provide discharged Officers with a precious working tool, surely indispensable for today's business operators: the Programme's goal is to enhance the former Officers' employment opportunities by providing them with new management skills that are still relatively rare at the moment.

In order to reach such a goal, a wide use has been done of PC and modern learning techniques for the Officers' courses, as it had been previously done during the initial upgrading and the following specialization of up-to 600 Russian University teachers, which took place mainly in Western Europe, at venues across Italy, France, Germany and Greece and provided them with the necessary know-how to become course instructors, methodological course developers and career counsellors.

For the implementation of this Project a number of leading West-European Companies were involved, such as Elea-Olivetti and Isvor-FIAT (Italy), Sodeteg-Thomson (France), GOPA Consult (Germany) and Infogroup (Greece), having a great experience in the field of human resources training and re-training.

After upgrading, Russian teachers went back to the 15 Regional Centers, located all-over Russia, whose roster and curricula have been drawn up to meet both servicemen discharging plans by the MoD and regional development criteria, and started running courses for Officers, duly adapting them to the concrete scenarios of every single area. This originated an important re-configuration of the didactic programmes, which is still now ongoing, so as to continuously fit real needs, which are changing together with the Country economic situation. In order to allow Centers to perform teaching activity in the best way, all of them were duly equipped with modem PC techniques, computer classes suitable for implementing business games, and multi-media techniques as well.

Now, when a greater number of Officers has undergone re-training directly at the Centers and at their subsidiaries, the experience of these Centers is being focused on the development of a more advanced teaching pattern, namely distance learning based on mobile teaching units: this system allows Centers to reach those remote military garrisons where both Officers and the members of their families experience more difficult an outplacement, and which are not in a position to send their cadres to undergo a re-training process based on traditional classroom lessons at the Center venues, also due to the great distance and to service needs in the military units.

Someone's of the Centers already have a good experience in this kind of teaching: just to quote a significant example, the main Center, located at the Moscow State Aviation Technology University (MAGTU) already in 1994 implemented a similar mobile teaching system for the Officers of the Russian 14-the Army in Tiraspol'-Moldova (the relevant Agreement was signed with today's Chief of the National Security Council, General Alexander Lebed, who was at that time the Commander of that military unit).

Nowadays those Centers which already have some experience in this newest teaching technique are putting their skills at disposal of all the other Centers, so as to achieve better results in the overall Project implementation activity. Such an exchange of experience and skills is being done in the frameworks of a joint methodological group together with experts of the European Union.

Last but not least, the Project activity is aimed, especially in this third year, at establishing an effective link between every Center and the relevant surrounding economical and entrepreneurial network, so as to facilitate the civilian reemployment of Reserve Officers, formerly belonging to the permanent cadre, particularly in small and medium-scale enterprises; by achieving this goal the Project will contribute to sustainable economic development in the different regions of the Russian Federation by providing economic life with a new wave of managers, having both the reliability of servicemen and a basic knowledge of market economy topics.

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Original is presented in English

EUROPEAN INFORMATION WEB ON INTERNATIONAL RELATIONSHIPS AND REGIONAL RESEARCHES

V. G. Mashlykin (Russia)

At the third International Forum of the International Academy of Informatization in Moscow (November 1994) the supposition was expressed that the unsatisfactory use of the « in formation weapons and unjustified escalation of conventional means of warfare were the strategic reasons of the defeat of the USSR in the «cold war» with the West. The way out of the information isolation is the thought out policy of informatization, and in particular the creation of «information bridges» with Western countries. This can be regarded as one of the means of solution of the problem of the security of Russia. One of such «information bridges» is the European Information Web on International Relations and Regional Research (EIWIR). This is a large multiple-objective system, including in particular the most important field, that is education.

The project of the Web is being carried out by a large group of international and national European organizations: UNO, European Union, research centres in Germany, France, Italy, England, Switzerland, Holland, Greece, Sweden, Finland, Czech Republic, Poland, Hungary and, certainly, Russia.

The creation of the Web has two objectives - strategic and practical. The latter is realized in everyday activities.

THE STRATEGIC OBJECTIVE

It is known that in the West of Europe the active integration processes in economics, politics, in the solution of security problems and in other socially important fields are under way. Eastern European countries are being involved in these processes. It is also known difficult or even sometimes impossible to make reasonable decision in economics, politics, especially in security, if there is no authentic and timely information. To solve the problem all-European integration on a large scale is essential. That is the strategic objective of EIWIR. It should be emphasised that what I have in mind is the integration of Western and Eastern European countries. By the way, the integration in techno-field is easier to realize in comparison with more politisized fields of integration, i.e. in economics, politics, security, etc. Various intellectual, technical and monetary resources of the participants of the project are integrated in the process.

The practical objective of the all-European integration is the regular exchange of information in two-sided and multilateral international relations. In this case not only modem automated access is made use of, but also the exchange of traditional printed materials. Automated means include access by telephone on-line and e-mail, the exchange of magnetic and compact disks (CD-ROM).

It is important that the project of the Web stipulates the exchange of information on a noncommercial basis although paid services are not excluded in the future, at least in some sections of EIWIR.

In descriptions of automated information systems four main components are usually singled out, that is "information filling" hardware and software, linguistics and at least orgware.

INFORMATION FILLING

The basics of the given system consists of automated data banks (ADB) or data base (DB) both facto-graphic and documentary or bibliographic. Facto-graphic DB includes factual information about organizations, meetings, conferences, various macroparameters and also personal data about political figures and scientists. Bibliographic descriptions of printed publications predominant in DB of EIWIR remain.

HARDWARE

Working complexes of existing technical means are accepted as its basis. These are various computers, large computers are used in information centres, personal computer as a rule by personal users. There are international and national telecommunications webs, means of e-mail. Typical examples are international webs Internet, German Into-netz, French Minitel.

SOFTWARE

In EIWIR it is recommended to use the widespread packages of the software MS-DOS, Word 5. 5, Word 6. 0, protocol X-25, etc.

LINGUISTICS

The developers and the participants of the Web should talk whenever possible in the unified "machine" language, that makes it necessary to use unified labels, the rules of construction (organization) of machine arrays of information, the rules how to exchange these arrays. For the purpose multilingual thesauruses are being developed and certain accepted standards are applied.

ORGWARE

Orgware acquires great significance in the development of a complicated international system including many European countries. The Workgroup including the representatives of all the countries participating in the Web and subsidiary technological workgroups were set up for the development of EIWIR.

Russia is represented in the Workgroup by the author of the given message from the Institute of Europe (Russian Academy of Sciences). The Institute plays the role of co-ordinating organization. The Workgroup determines the partnership in EIWIR, the structure of the Web, discusses and makes basic decisions as far as technical, financial, personal and other problems are concerned. The Workgroup holds regular conferences (in 1992 - in Italy, Aricha and in Germany, Ebenhausen; in 1994 - in Sweden, Stockholm. The conferences are also scheduled in France, Greece and Russia).

Under the project the users of the Web can be educational establishments (universities, academies, colleges, etc.) Ministries of foreign affairs, parliamentary and governmental structures, international organizations, research institutes, mass media, various associations, for example, the Russian Association of European Research whose activities are co-ordinated by the Institute of Europe.

The Web of EIW1R was developed in stages from 1993 till 1998, further work is carried out when required. In spite of the fact that the Web is not completed yet, its separate sections are already operating. For example, there is an established exchange of information between the Institute of Europe and some of the partners in the Web: The Council of Europe in Strasburg, France; The Information Center of NATO in Brussels, Belgium; The Fund of Science and Politics of Germany; The Institute of International Relations of the Ministry of Foreign Affairs in Italy and some others. The Institute of Europe regulary receives by e-mail the information on security issues from NATO's headquarters center, exchange printed publications with other partners mentioned above.

There appear regular issues of «The reports of the Institute of Europe» and other materials on various European problems, including economy, politics and security.

The development of the EIWIR Project and the material maintenance of the accompanying organizational measures is carried out mainly at the expense of the budgetary funds of the organizations-participants. The necessary additional financing has been made so far by the Council of Europe, The Fund of Science and Politics (Germany), The Institute of International Relations of the Ministry of Foreign Affairs (Italy) and the SIPRI Institute in Sweden. In 1993 - 1994 the total expenses were approximately 0,5 million ECU annually. One can feel that further additional material investment is necessary as the work goes on. For this purpose the Workgroup has accepted a special resolution asking the acting and potential partners to provide additional financial support for the EIWIR Project.

Many aspects of the EIWIR System are dealt with in retail in the brochure by V.G. Mashlykin «The European Information Web on International Relations» published in the serial «The Reports of the Institute of Europe», Moscow, 1994, and also in the working materials on the given project which are available in English in the Institute of Europe.

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LEARNING NETWORKS AND INTERNATIONAL CO-OPERATION IN LATIN AMERICA

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1. NEW TECHNOLOGIES AND LEARNING SITUATIONS

Learning implies transforming data and information from various sources into knowledge. These sources include: information reservoirs where information is stored (libraries and institutions that are accessible to the learner), other people (professors, students, friends), and experiences and personal encounters of the learner. There are two types of learning situations: an isolated individual consults sources of information and performs different tasks based on his/her experience and personal encounters and 2) an individual communicates with other people and groups for the purpose of learning. Both of these situations have occurred repeatedly for centuries in human history, and learners have used various means of learning, ranging from the most rudimentary ones to the most sophisticated.

What happens when informatics enter the scene? The learner finds a means of extending, multiplying and diversifying his/her learning capacity through a more effective and quicker mechanism that takes over those burdensome and routine tasks and creates conditions that encourage creativity. The ability to reproduce and simulate reality allows the learner to diversify his/her personal involvement and experiences. What happens when telematics enter the scene? The individual broadens, multiplies and diversifies his/her learning capabilities by communicating with others, on one hand, and by using various different sources of information from many geographical locations, on the other hand. At the same time, the individual multiplies and diversifies his/her possibilities of exchanging experiences and realizing personal encounters on a virtual space that extends the boundaries of reality. The development of Internet, as virtual space for the exchange of information, knowledge and communication, has brought new dimensions and challenges to traditional systems of education. It offers new alternatives, on the one hand, but seriously threatens to destroy their bases and the meaning itself of the learning process, its conditions and contexts, on the other.

2. COMPUTER NETWORKS AS LEARNING TOOLS AND LEARNING SPACES

Learning through communication naturally brings us to networks, particularly telematic ones. There are two aspects of learning and networks that constitute two sides of the same coin: network mediated learning and learning networks. Network mediated learning entails action taken By an individual or group of individuals to transform data and information into knowledge via services and resources provided by a network. An individual can take part in network mediated learning without the existence of a learning network. He/she can rely on the sources of information and communication available through Internet, for instance, to design a personalized learning program. Learning networks are comprised of people who communicate with each other and with electronic information reservoirs. Here, both information and communications services and resources have been especially created and designed for educational and learning purposes and are backed by an entire community of educators and learners. Such is the case with communities established on the basis of electronic mailing lists, newsgroups and information reservoirs offered on Gopher and World Wide Web services. But, learning network requires people who are willing and anxious to learn. This is why, in order to optimize learning network potential, it is important to develop skills needed for network mediated learning in individuals.

Learning networks have developed rather significantly on Internet over a short period of time, specially throughout the United States where 47 networks of this type exist (Harasim, 1995). A significant role is also played by some other 24 community networks, generally represented by the Freenets. While these may be more general than the aforementioned and may attempt to simulate the entire spectrum of community life to include each and all of its activities, they do include educational activities, offer learning resources and have even developed organized programs to facilitate learning in some cases. The Open University in the United Kingdom recently established a teaching-learning network based on its experience in distance education; the Fern University of Berlin has also developed similar resources. Sweden and other Scandinavian countries have had comparable experiences, but none of them as comprehensive as networks in the United States. Internet's rapid growth has provided the necessary infrastructure and made it possible for these networks to blossom, along with other social networks aimed at different purposes in other areas of social life. However, the situation in so-called "Third World" countries is different. While Internet has experienced significant growth in these countries, it has not had the same impact as in developed countries (Bournellis, 1995). Internet has embedded itself in the framework of already existing and unevenly distributed telecommunications structures and resources world-wide, which are but a true reflection of the virtual world.

3. THE ROLE OF INTERNATIONAL CO-OPERATION

International co-operation acts as an integrating element of network mediated learning situations, and its action can be further optimized through telematics. Co-operation is also a factor in formulating and incorporating policies, technology, educators, learners and socio-economic and cultural development factors linked to the teaching-learning process. Policies provide the general framework for action. Technology establishes the means and methodologies needed to solve problems and bring about change. The actors involved apply methodologies and implement policies. Co-operation, in fact, implies working through networks and combining efforts to share resources and complementary expertise. Co-operation also helps channel the socio-economic and cultural consequences of policies. People and organizations involved in networking have a natural tendency towards establishing relationships based on co-operation and benefiting network members through mutual exchange.

UNESCO has been involved in two recent and important initiatives which could be very relevant in terms of learning networks development. The first of these is the UNITWIN Program, aimed at promoting cooperation among scientists and academics for educational and research purposes. The second is the "Learning without Frontiers" Program, more specifically linked to learning networks and distance education. The UNITWIN Program began in 1992, and its objectives include the development of co-operative networks for teaching, research, and the exchange of information and knowledge in every scientific and academic field. While these networks were not really conceived as telematic networks for communication and information management, they are potential candidates to become virtual communicates of researchers and teachers, if electronic information and knowledge management and communication is introduced (UNESCO, 1995). As of 1992, an Interdisciplinary Co-ordination Unit, under UNESCO's Division for Higher Education and Research, was established for this Program, and a decentralized action throughout the world has been undertaken for the implementation of several projects, involving several regional offices and centers, like CRESALC in Latin America. The "Learning without Frontiers" Program hopes "to establish a world-wide distance education system with dissemination in every language and discipline and access to all possible communications networks. Radio, TV by Cable or Satellite, electronic mail, etc., shall offer uninterrupted transmission of formative programs in all languages and disciplines" (UNESCO, 1993). A Co-ordination Unit for this project was created at UNESCO Headquarters in February, 1996.

4. EXPERIENCES IN LATIN AMERICA

In the Latin American context, UNESCO began an initiative in 1993 through its Regional Centre for Higher Education in Latin America and the Caribbean (CRESALC) that brings together the objectives of the UNITWIN and Learning without Frontiers Programs. With the co-operation of the Universidad National Abierta (UNA) in Venezuela, UNESCO formulated a Distance Higher Education Innovation Project, whose principle objective is to evaluate, promote and introduce the rational use of new information and communications technology in distance higher education, to train facilitators, and to generate pilot experiences based on the application of this technology (UNA, 1995). The multiple aspects of this objective gave rise to six subprojects aimed at:

1) creating and developing an Innovation Network for Distance Higher Education (RIESAD);

2) training facilitators and innovators;

3) publishing material on excellence in distance education;

4) conducting research;

5) supporting the project designed to detect distance education needs in Central America, and co-ordinating the project.

The RIESAD network ties all of the activities included under each subproject together. Universities in Argentina, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Mexico and Venezuela comprise the network, as co-ordinated by the Universidad Nacional Abierta in Venezuela. The network's computer center connects all of its founding institutions with each other and has contributed to progressively developing various information and communications resources, such as mailing lists and a World Wide Web server providing information on both the network and distance education throughout the Latin American region. Nationwide activities have been conducted in different countries, and institutions representing countries other than its founding members have been incorporated thanks to the network. The network has been used to organize various events, research and evaluation projects in new distance education technologies, and multimedia distance courses through Internet. The most noteworthy aspect of the network is its potential use as a resource for learning, research and the promotion of international co-operation (Chacon and Gonzalez, 1996).

Another initiative worth mentioning is the liberoamerican Network for Informatics and Education (RIBIE), which is not sponsored by UNESCO, but has co-operated closely with the RIESAD Network in various projects and activities and has been supported by UNESCO through its Intergovernmental Informatics Program (PII). RIBIE was conserved as an idea and strategic area of the CYTED (Science and Technology for Development) Program of the liberoamerican Cooperation Institute (ICI) in co-operation with national agencies from each Member State (throughout Latin America and the Iberian Peninsula). Its objective is to improve education within the liberoamerican context using new information *and communications technology. It was formally* established in 1990, and since then it has concentrated on fostering projects for multilateral co-operation in educational informatics to meet the needs of each participating country and on using this area as a strategic element to assist in the educational and social development of these countries. It likewise promotes scientific, technical and methodological training by enabling promotion and organization of events and courses aimed at disseminating results, experience and products of research on information and communications technology applied to education. Given their scope, one should mention the role played by RIBIE in organizing two *liberoamerican Congresses on Educational Informatics*, the first of which was held in the Dominican Republic (1992) and the second which took place in Portugal (1994). A third Congress is scheduled for July, 1996 in Colombia (RIBIE, 1996). RIBIE is currently comprised of experts and institutions from 12 countries, namely: Argentina, Brazil, Chile, Costa Rica, Dominican Republic, Guatemala, Mexico, Nicaragua, Panama, Peru, Spain and Venezuela. RIBIE's basic communications resource is its electronic mailing list called RIBIE-L, which provides a vehicle for all of its members to communicate and schedule activities. RIBIE-L has become a of specialized discussion forum where informatics applied to education is concerned.

On an Interamerican *scale, mention should also be* made of the Regional Consortium for Distance Education (CREAD), which was created in 1990 and whose main headquarters are at Pennsylvania State University in the United States. It is backed by the Canadian International Development Agency (CIDA), the OAS, and the Interamerican University Organization (OUI). This Consortium functions as a network for all practical purposes and was created to foster and facilitate exchange between institutions and programs involved in distance education in the Americas. International conferences and courses on the topic of distance education, attended by representatives from 50 institutions and 100 experts, have been organized through CREAD. CREAD has co-operated closely with RIESAD and has participated in jointly organizing several training courses on distance education.

These three networks complement one another. RIBIE is broader than RIESAD and CREAD in coverage of educational levels and methods, but more specific where learning contexts are concerned. RIBIE centers more on applying informatics directly to education, regardless of level and method, and RIESAD and CREAD on telematic applications given their expertise in distance education. In other words, RIBIE provides learning elements to individuals in a context involving interaction with computers, while RIESAD and CREAD function within a communications context through Internet. RIBIE constitutes an example of a network using Internet to manage and co-ordinate international co-operation projects aimed at promoting learning through computers. RIESAD is a multiple-function (learning, research and management) network dedicated specifically to the field of distance education, just like CREAD.

Through its UNITWIN and Learning without Frontiers Programs, UNESCO is conducting activities in Africa and Asia similar to those already mentioned, but they have not yet become as extensive as those in Latin America. The latter could very well serve as a source of inspiration to other regions of the world.

5. CONCLUSION: STRATEGIES FOR NETWORK MEDIATED LEARNING AND LEARNING NETWORKS

International co-operation in this area, on a more general scale, must work towards defining and fulfilling its principal objective of developing strategies to promote adequate integration of policies, technology, and teaching agents involved in the educational process and the socioeconomic and cultural impact of the new information and communications technologies (NTICs). On a more specific level, international co-operation must conveniently situate itself in Cyberspace and help bring people together to develop learning networks with participation from numerous organizations that will make learning available to anyone, anywhere, at any time, and at any age, and thereby emphasize the value of active and collaborative learning and the ability of Computer Mediated Learning (CML) systems to support the full range of human cognition and social relationships based on the principle that the improvement of society is tied to the Concept of lifelong learning (Harasim et al., 1995, p. 241). The basic electronic media of learning networks should include electronic mail, bulletin boards, mailing lists and Internet Relay Chat facilities, given their potential use as vehicles of communication between people; as World Wide Web service providers; as multifunctional services providing access to other unifunctional telematic services, and as information resource co-ordinators of the vast virtual library constituted by the Internet network of networks.

Furthermore, international co-operation must provide a proactive environment for teachers and students to master NTICs needed for people to communicate with each other and with information reservoirs, and for teachers to develop learning capabilities by communicating with other people and social groups and seeking out and transforming data into information and knowledge contained in Internet's vast and extensive information reservoirs known as virtual libraries. This should be another function of learning networks in Cyberspace. However, one should note that the presence of international organizations in Cyberspace has been rather timid compared to that of other nongovermental and business organizations' involved in education. Thus, emphasis should be given to encouraging any initiatives on the part of these organizations geared towards their incorporation in Cyberspace within the framework of learning networks, as well as to efforts on the part of other organizations and people, especially from Third World countries, who are clearly at a disadvantage in terms of developing those so-called information superhighways now servicing the new information and knowledge society.

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TRAINING OF PERSONNEL IN ELECTRONICS AND INFORMATICS AT THE INTERNATIONAL UNESCO COURSES IN MOSCOW STATE INSTITUTE OF ELECTRONIC TECHNIQUE (TECHNICAL UNIVERSITY)

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Moscow State Institute of Electronic Technique (Technical University) (MSIET), founded in 1965, is located in the city of Zelenograd which is the largest center of electronic industry of Russia. MSIET is an educational institution, specialized on the preparation of the specialists in the field of electronics and informatics.

With the purpose of maintenance of opportunities of professional growth of the teachers, science officers, specialists and students on the basis of contract UNESCO and MSIET within the framework of Intergovernmental programme on informatics in MSIET are organized courses on preparation and retraining of the staff in such areas as electronics, system programming, computer technologies, artificial intelligence, CAD LSIC (Computer-aided design of Large-scale integrated circuit).

Using the financial support of UNESCO, the own material and personnel resources, teachers were developed the curricula of preparation and retraining of the specialists on following directions:

- Designing of FC-LSIC (full-custom large-scale integrated circuit) and SC-LSIC (semi-custom large-scale integrated circuit);
- Information systems in management;
- Modem software of personal computers;
- Application of intelligent technologies, but also programme of courses:
- Designing of FC-LSIC and SC-LSIC;
- Information systems in management;
- Modem software of personal computers;
- Basis of the theory illegible multitudes;
- Introduction in genetic algorithms;
- Neuron network and neirocomputers.

These curricula provide a high modern level of preparation of the specialists in the field of electronics, informatics and communications. At half-year of activity on International UNESCO courses on computer science and electronics more than 60 specialists have passed the training. The special popularity courses *"Designing of specialised LSIC on the basis of base matrix crystals"* used, the purpose of which is study of area of application and methods of designing specialized LSIC on the base of base matrix crystals (MC), main types of their designs and library elements, but also practical mastering of a technique, route and means of BIS design. The contents of a rate is oriented to students of the senior rates, post-graduate students, teachers and engineers-developers, specialized in the field of application of element base of modern microelectronics for designing of the microelectronics equipment. The training under this programme will be carried out on the base of unique research-and-production complex - State Scientific «Technological center» with complete cycle of technological process of designing and manufacture of CCMOS (Clocked complementary metal-oxide-semiconductor integrated circuit).

Besides the traditional forms of education on the courses is practiced of the making of short-term seminars with the purpose of acquainting of a wide sections of the interested persons, including representatives of an industry, with modern achievement in the field of new information technologies. So together with representative of firm IBM East Europe/Asia Ltd. a seminar «*Advanced information technologies and modem computer architecture*» with presentation of the newest models of computers of firm IBM carried out.

With the purpose of assistance to an exchange of achievement in th e field of nformation the International courses UNESCO had organized section «*pplication of information technologies*» within the framework of All-Russia conference «Electronics and Informatics-95» (on November 15-17, 1995, Moscow).

As the humanitarian education is one of urgent directions of modern education, with the courses of assistance of International UNESCO on electronics and informatics in June 1996 an International scientific conference *"Urgent problems of humanitarian education on threshold of 21st century»* was carried out, within the framework of which work of special section *«Humanitarian problems of information technologies»* was organized.

The further co-operation MSIET and UNESCO in sphere of information will be developed in following directions:

- strengthening and development of educational center on training of the specialists;
- stimulation of work in the field of new information technologies;
- assistance to development of the new modern educational programmes and methods (including use of technologies multimedia and virtual reality) with further duplicating them in national higher school;
- development of joint international educational programmes;
- development of information system on educational services in Russia and abroad;
- development of consulting system in the field of international educational projects;
- assistance to development of co-operation in scientific researches of CIS countries, EC and developed countries.

Developing successful experience of work, the International courses of UNESCO on electronics and informatics direct activity on making mutual understanding, partnership and co-operation between Russia and representatives of international community with the purpose of expansion of opportunities of professional growth of the specialists of different countries, promoting of realization of the right on freedom and development of the person of the students of Russia and abroad.

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THE INFORMATION TECHNOLOGIES IN AESTHETIC AND HUMANITARIAN EDUCATION: RUSSIAN EXPERIENCE AND PERSPECTIVES OF INTERNATIONAL CO-OPERATION

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On the eve of the third Millennium, along with hard transition of human world to post-industrial society the key factor becomes a continuous education on the basis of new information technologies, being extremely important for humanitarian and aesthetic education. This principle statement can be confirmed by several arguments.

1). The post-industrial civilization bears a *humanitarian and informing character* and composes an educational society. A highly-educated Man-creator, continuously filling and renovating his knowledge and skills . and with quick adaptation to impetuously changing world is moving in the forefront of society. The turnpike way of overcoming the keen contradictions of transition period is a formation 21st century generations on the basis of continuous training grounded on creative pedagogy information technologies.

2). In a period of formation of post-industrial society a *structure of training* and its priorities are changing. The paramount significance acquires humanitarian and aesthetic education, promoting the understanding of conformities of society development, the accepting the multinational cultural heritage, skills, habits of democratic communications. As a displacement of «a man of economics» of 21st century and «a computerized man» of 21st century goes «a humanitarian man» of 21st century. A new Renaissance.of Art [4] is explicating, an interest to high culture is surviving on the basis of its synthesis with high technologies and civilized economics. The role of adult's education is of great importance for their adaptation to changing life and labour conditions.

3). In the sphere of international relations this is *humanitarian co-operation,* that acquires major significance, especially in the area of education and informatics. This is caused by both formation of global cultural, educational and information space and acuteness of the main contradictions of a transitional epoch: a rapidly growing gap between a minority of rich and a majority of poor countries (from 1987 to 1993 the gap in production of GNP per capita in 10 most rich and 10 most poor countries had increased from 37 to 44 times). It's impossible to overcome this nearly critical gap without radical raise of educational level for people in poor countries on the basis of information-humanitarian co-operation.

In Russia during one and a half decade the intensive search of efficient ways of information technologies utilization in education is underway. Let us consider some results of this search.

1. The concept of *continuous-cycling training* (with its wide informatization) as most important feature of modern global revolution in education is formed. A key role is defined for continuous education training and informatization in formation of post-industrial society, in educational and information revolutions and in transfer of the cultural and educational inheritance on the basis of cycles-genetic conformities to the following generations.

2. There was elaborated the *purposeful programme* «The modern information technologies in art and education», aimed at realization of the above mentioned concept according to Russian conditions and formation of post-industrial society. This Programme includes the sets of Projects on the following trends (sub-programmes):

«Art production» comprises the production of video-movies, multimedia discs CD-ROM, laser videodiscs, holography on the art, museum, cities, history and other subjects;

«Electronic galleries» comprises the creation of a network of education, museum, travelling and other centres for showing, purchasing, leasing of art production, servicing of training process, organizing of aesthetic education of children, youths and adults;

«Arttelecosmos» comprises the elaboration of TV-programmes and information networks on Art and Education; the arranging of TV bridges and teleconferences;

«Art education» comprises the organizing of regional systems of continuous aesthetic training on the basis of a network of electronic galleries and cycles of TV-transmissions;

«Art ecological monitoring» comprises the development and use of monitoring technologies, protection and preservation of museum values and architectural memorials;

«Art economics» comprises the arranging of organizing economical realization of projects and programmes, arranging of conferences, seminars, exhibitions, personnel training.

3. In October 1991 *«Art Masterpieces» International Consortium* was established by the Decree of Council of Ministers of the USSR, dated 14.01.1991, for development and carring out the programme. The participants of the Consortium are as follows: The State Tretiakov Gallery, The Museums of Moscow Kremlin, The Academy of National Economy under RF Government, Mosbusinessbank, Ural electromechanical plant, «Quart» JSC, «Olivetti», and others.

The Consortium rendered a vital service in receiving an exempted loan in the amount of roubles 3.5 billions (according to the price of 1993-1994) for fulfilment of the projects by means of conversion military experiences. The Consortium organized a number of international exhibitions and conferences. It co-ordinates the activity of electronic publishing houses on marketing, art products selling, it takes part in international cooperation.

4. Under the Consortium support several Projects were accomplished in the area of informatization of Art and Education:

- the CD-ROM discs «Hermitage», «Russian Treasures» («Intersoft»), «Moscow Kremlin», «Faberge», «Petergoff» and others («Cominfo»), «Museums of Russia» («AIR»), «Modern Art» («Artinfo») and others are issued;
- the laser discs "Menshikoy Palace», «Russian Icon», «Child's portrait» ("Russian Video», «Avangard» and other);
- the series of video-movies over museums, cities, histories and other training subjects («Quart-0»), palaces and suburbs of Petersburg («AVN», «Positron»), Moscow Kremlin (Museums of Moscow Kremlin, «Artvideointernational») and others are issued;
- the electronic galleries were elaborated in the Academy of People's Economics under RF Government (1993), Kirov City (1994), in the House of Russian Science and Culture (Berlin, 1995), in All-Russian Show-Centre (1996);
- the exhibition were held in Geneva «Columb-92» (Russian pavilion), in Petersburg, april 1993, «Information technologies in Art and Education» (Session EBRD); in Moscow, November 1994, STG, «Museum-94», at information conferences, in April 1995, in Geneva, 1996 «Eurotech-96», in Brussels, 1996;
- the International conferences and seminars «Information technologies in Art» (November 1993), «Multimedia in Art and Education» (October 1994), «Ecology, Conversion and Cultural Heritage» (November 1994), an International Children's Holiday «Art and Ecology - for generation of 21st century» (01.06.1996) were held.

5. In co-operation with involved organizations, the Consortium proposed a number of projects in the field of Art and Education, for which the investors are under search:

- the preparation and production of multimedia cycles «History of Civilization» and «Bolshoi Theatre Ballet» (Projects were awarded by Diplomas of Winners and premiums of venture projects Competitions in April, 1996);
- the establishing of a network of training electronic galleries in Russia and abroad;
- the establishment of International TV-Academy of Art and Education (on the basis of TV-channel and several companies from Petersburg);
- the provision of technical base for modern electronic publishing house for humanitarian and aesthetic education.

The accumulated experience allows to make the following perspective recommendations:

1. Taking into account the key role of education on the basis of information technologies in overcoming of contradictions along with formation of post-industrial society to recommend to UNO and UNESCO to declare a *World Decade of Education and Informatics*, and to prepare the long-term national and international programmes for this direction, attracting the peculiar attention to international support for educational programmes in poor countries.

2. To elaborate in a framework of UNESCO the long-term international programme «Information technologies» in a system of continuous humanitarian and aesthetic education, using therewith an accumulate in Russia and other countries experience. This programme would include the following:

- the elaboration of a concept of continuous humanitarian and aesthetic education in a period of formation of post-industrial society;
- the determination of subjects sets; draw up curricula and methods of utilization of information technologies in pedagogy;
- the manufacturing, translation and multiplication of art production series (multimedia discs, laser videodiscs, video-movies, holograms and so on) according to selected subjects and themes;
- the formation of a network of educational electronic galleries, national and international centres for their establishment; providing the art production and service;
- the establishment of International TV-Academy of Art and Education, accompanying with a network of national TV-studios; propagation of TV-programme cycles and their international exchange; arranging of TV-bridges (of a type of «excursion» through space); introducing to Internet, national and local information network of information flows in humanitarian and aesthetic education;
- personnel training: teachers:producers for manufacturing of art production and TV-programmes, managers of electronic galleries;
- providing the support of UNO, UNESCO, international charity and. educational foundations for peoples of poor countries in realization of projects.

The International Consortium «Art Masterpieces» is ready to participate feasible in elaboration and realization of indicated programme and its separate projects, beginning from the concept preparation.

The Second International Congress «Education and Informatics» may cause a mighty pulse for formation of national and global systems of continuous training on the basis of creative pedagogy and information technologies, a development of international co-operation in this area, that will promote the formation of 21st-generations, adapted to the conditions of humanitarian-information post-industrial civilization.

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Workshop

LOGICS, INFORMATICS and EDUCATION

ANALYTICAL CLASSIFICATION IN LOGICS AND INFORMATICS

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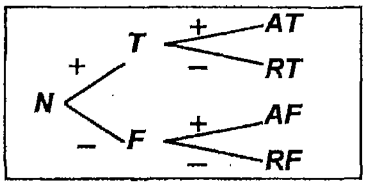
The problem of classification arises along with drawing up of ordinary and computer catalogues, in patterns recognition and technical diagnostics. The common features of those problems brought to origination of questionnaire theory, the fonder of which became a French mathematician K. Pekar [1]. Most completely a questionnaire **can** be presented by matrix description. The majority of familiar methods are the methods of directed enumeration, where the number of subsets under consideration appeared to be greater than the number of elements of initial set. In general case a labour intensity of methods depend on a dimension of problem exponentially, while in case of effective algorithms - polynominally [2].

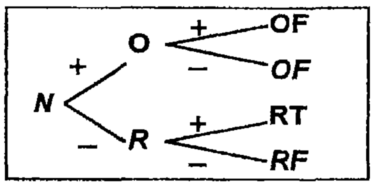
Exclusively tree-like structures are used along with informatics catalogues creation. The management in majority of companies is also organized in tree-like manner. The tree as-structured reflects the particularities of systems of subordinate links *(subordination)* in hierarchy of structure levels. On dichotomous classification the element of upper level of subordination is connected with two elements of lower level.

One can build up a tree of *theoretical* classification, in which the concept of the first level *truth* (*T*) and *false (F)* is partitioned concept of the second level. However, an investigator usually does now known the values of truth, but possesses only with their estimations: *accepted (A)* or *rejected* (*R*). Therefore, from a *practical* standpoint another type of tree is more preferable:

Theoretical classification



Practical classification



The concept *uncertain (U)* can not be at the same level of hierarchy with *truth* (*T*) and false (*F*) , that would be a logical mistake, known by the name «jump and division» The situation of uncertainty correspond to *ignorance T or F* and is a concept of zero level, which is divided by concepts of the first level. A situation («a *cat in a sack»)* corresponds to expression of *«heads or tails»*, but not assumes the existence of the third state - *«a coin is at an edge»*. The next level of hierarchy is composed by: *AT*- accepted truth, *RT* - rejected truth, *AF* - accepted false, *RF* - rejected false.

The simplicity of hierarchy systems returns with the significant drawback. The first inconvenience consist of necessity to go consequently through all levels of hierarchy for reaching the highest level. The second inconvenience of subordinations is that in replacement of hierarchy system it needs to be restructured. The transition from theoretical to practical classification it is required to break the former hierarchy and substitute it by a new one. To provide the simple and direct access between any system components it is necessary instead of different systems of *subordination* to pass to a single system of *co-ordination.*

Let us present it in a form of table with two inputs:

Estimation/truth	*truth*	*false*
accepted	*AT* - accepted truth	*A F* - accepted false
rejected	*RT* - rejected truth	*RF* - rejected false

The formation of a new knowledge passes consequently through four stages: *RT, AT, AF, RF* (clockwise index). In the theory of errors *RT* and *AF* are called, accordingly, error of the first kind and error of the second kind.

As a unique example of the whole book with the specially introduced table-structure was the «Non-formal Introduction to Algol-68» by Ch. Lindsy and van der Mujelen, published over 20 years ago (Russian publication of 1973). The book my be read «along the lines» and «along the columns» of matrix *(l,f)* depending on intents. Yu. I. Manin has named this as *«the great enterprise»* [3].

The writer A.Bitov had composed the table of content for the book «The teacher of symmetry" in a form of a table of English verbs tenses. Following his example we try to compose the catalogue of our latest works:

	Perfect	*Indefinite*	*Continuous*
PAST	The logical game of L.Carroll for computers	The paradoxical efficiency of mathematics	A universal characteristics
PRESENT	The cycles and mass data in logic from informatics standpoint	In the nets of paradoxes: an output search	A model of perpetuity
FUTURE	Interactive Carroll's diagrams	A vector approach in quasi-array logic	The analytical classification in logic and informatics

The first two articles were published in the newspaper «*Informatics*» (1995, [1] 23, 36). The name of the book is precipitated by the bold-face type, including all (published and unpublished) articles of this cycle.

An example of the relations system of co-ordination type can see a system of direct access (a recording on a magnetic disc in a computer), which had replaced the system of sequential access (a recording on a magnetic tape). The physical time is a system of sequential access, while perpetuity is a system of direct access. The co-ordination net is a visually exhibited in a form of geometrical diagrams, but this method is not applicable for the cases of more, than four aspects. That is why L. Carroll used for resolution of poly-sillogisms the method of tress (that was not published at author's life, and there is no Russian version till now). It was issued in the second volume «The symbolic logic» (L. Carroll - N. Y., 1977). In recently issued book of V. Svetlov the trees are used for resolution of syllogisms. For this, one needs, first of all, to find a mean term of premise of syllogism (incoming to both premises), and then to provide the following requirement: «The obligatory term for a proper structuring of syllogical tree is the mean position of excluding term, approving to be a linking chain» [4]. The analytical presentation of radical inference in the form of many-dimensional logic vectors allows to get rid of fulfilment of limiting terms.

To provide the direct access to any components of the system it is necessary to pass from different systems of subordination to single system of co-ordination. Such are logic diagrams, on which L. Carroll had demonstrated clearly the ties of logic problems with a problem of classification. The striking efficiency of Carroll's diagrams in comparison with Euler's circles is based apart from positive and negative cells on the use of blanked cells. It is natural to designate by zero this situation of uncertainty and the lack of information. Logic is a qualitative theory, and therefore, apart from the value 0 (lack of information) there are two another basic values: an assertion is called by integer +1, a detail is coded by integer -1. False is minus-truth, that is less than simply nothing. In this case only a computer will accept on default *«do not know»*, but not false (that would be equal to presumption of quilt). The introduction of logic vectors would allow to reduce the accomplishing of conclusions to arithmetic operations with their components and to realise a computer analogue of Carroll's logic game [5].

The premises and conclusion we shall denote by vectors, consisting of triples *(x, y, z)*, where the first number concepts a term x, the second number - a term y, the third number - a term z. Then the obtaining of a logic conclusion reduces to exclusion of term-agent *«y»* (an average term of syllogism). The positive vector *(«reality»)* corresponds to partially-affirmative inference, but negative vector *(«chimera»)* corresponds to generally-denial inference. If it's denoted: x = scientists, y = people, z = mortals, then a positive vector +(1,0,1) will concept a partially-affirmative inference *I x z* = "some scientists are mortal", but a negative vector-(1, 0,-1) - generally-denial inference *Ex z'*= "none of scientists is immortal". The two these vectors add up to generally-affirmative inference *A xz*= «all scientists are mortal".

The vector approach allows to reduce conclusions to operations with components of logical vectors. In vector concepts the syllogism *Barbara* will put down as:

«All people (y) are mortal (z)» = Ayz = Iyz & Eyz = +(0,1,1) -(0.1,-1)

«AII scientists (x) are people (y)» = Axy = Ixy & Exy = +(1,1,0) -(1,-1,0)

«AII scientists (x) are mortal (z)» = Axz = Ixz & Exz = +(1,0,1) -(1,0,-1).

In conclusion, we obtain a positive vector as a remainder (1,1,0) - (0,1,-1) = (1,0,1), but a negative vector -as a sign of sum of components of negative vector -(0,1,-1) - (1,-1,0) = -(1,0,-1). On solving the problem of decidability of syllogisms the decide role plays the *principal of annihilation* - the conclusion succeeds from premises, providing only nulling on adding or subtraction of vectors. Note, that unlike Aristotle, at Carroll *at the expense of including the negative syllogistics* the 624 modules can be derived. In particular, we obtain syllogism *Cumestres* (where U z y = E z y):

«There are no Pegasus (z) without wings (-y)» = U z y = -(0,-1, 1)

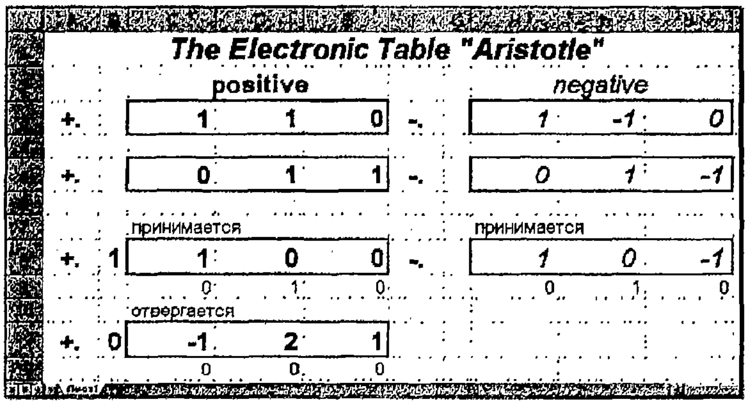
«There are no Centaurs (x) with wings» = E x y = -(1, 1, 0)

«There are no Centaurus-Pegasus (xz)» = Ex z = -(1, 0, 1)

The conclusion can be obtain by the first Carroll's figure: out of two Chimeras with excluded terms of different signs follows Chimera, in which the left terms remain their signs.

The proposed algorithm permitted to realise the solution of syllogisms in a form of electronic tables *Excel* [6]. This was realised by the author in an electronic table *Aristotle.xis:*

The components of *positive vector* in an electronic table *Aristotle.xis are* computing as the remainders of: C8 = C3 - H5, D8 = D3 - 15, E8 = E3 - J5 and parallel the control figures are found: C9 = IF(ABS(C3 + H5) = 2; 1; 0), D9 = IF(ABS(D3 + 15) = 2; 1; 0), E9 = IF(ABS(E3 + J5) = 2; 1; 0), and a sum is calculated B8 =SUMM(C9 : E9), according to which a vector is accepted or rejected: C7 = IF(B8 = 1, «accepted»; «rejected»). Similarly, the components of *other positive vector* is computed: C11 = C5 - H3, D11 = D5 - 13, E11 = E5 - J3 and control figures



are found: C12 = IF(ABS(C5 + H3) = 2; 1; 0), D12 = IF(ABS(D5 + 13) = 2; 1;0), E12= IF(ABS(E5 + J3) = 2; 1; 0) and the sum is amounted B11 = SUMM(C12 : E12), according which the vector is accepted or rejected: C10 = IF(B11 = 1, "accepted"; "rejected"). The components *of negative vector* are computing as sum signs: H8 = SIGN(H3 + H5), I8 = SIGN(I3 + I5), J8 = SIGN(J3 + J5) and the appropriate control figures are found: H9 = IF(ABS(H3 - H5) = 2; 1; 0), I9 = IF(ABS(I3 - I5) = 2; 1; 0), J9 = IF(ABS(J3 - J5) = 2; 1; 0), and the sum is computing G8 = SUMM(H9:J9), according which the vector is accepted or rejected: H7 = IF(G8 =1, "accepted"; "rejected"). The change of component values of the first couple of positive and negative vectors in cells C3, D3, E3 and H3, I3, J3 and also of the second couple of positive and negative vectors in cells C5, D5, E5 and H5, I5, J5 of electronic table leads to its automatic recounting. *Computing results are being read in sells:* C8, D8, E8 (for a positive vector of conclusion) and H8, I8, J8 (for a negative vector of conclusion) and also C11, D11, E11 (for a second positive vector of conclusion).

The method was reported at 8-th International Logic Congress [7] and at 1-st International Conference on fundamentals of artificial Intelligence in Paris in 1991 [8].

Many-aspects method is an analytical method, which is applicable for logic mass data of *any dimension*. It would rather instructive to consider poly-syllogism from Carroll's *«Symbolic Logic»:*

«1. No one out of met in the sea things, being remained unnoticed, are not the water-nymph. 2. The things, met in the sea, and which are recorder in a log book, are worth to be remembered. 3. Along with my travels I saw nothing to be remembered. 4. The things met and noticed in the sea are registered in a log book".

Let as put down it through five-dimensions vectors of a form $(x_1, x_2, x_3, x_4, x_5) = (x, y, z, u, v)$:

No one y *is not* u = +(0, 0, 0, 0, 0) - (0, 1, 0, -1, 0)

All x essence v = +(1, 0, 0, 0, 1) - (1, 0, 0, 0, -1)

No one z is not v = +(0, 0, 0, 0, 0) - (0, 0, 1 ,0, 1)

All u essence x = + (1, 0, 0, 1, 0) - (-1, 0, 0, 1, 0)

Not one y is *not* x = + (0, 0, 0, 0; 0) - (0, 1, 1, 0, 0)

The conclusion: «I never saw a water-nymph». By means of Carroll's diagrams the resolution of this poly-syllogisms can not be obtained, because the increase of dimension makes the geometrical method unworthy. The traditional ways of solution are applicable exclusively to syllogisms with tree terms. They are grounded on modus classification for 4 figures and are required the memory of mnemonic Latin words.

To make it easy afterwards to get the solution of *any* syllogisms it is better to master the analytical method first.

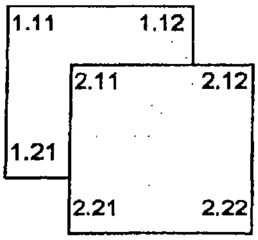
In dichotomous classification 1 shall value *the first outlet* («need»), 2 - *the second outlet* («tail»). Therewith 0 values *«do not known»* ("nead and tail»), but not the third outlet. The tops of logic cube: 2.11 and 2.12 are linked by horizontal edge 2.10. The idempotent adding is produced modulo 3. Making this component-by-component for *x*: 2 + 2 = 2, for *y*: 1 + 1 = 1 and for *z*: 1 + 2 = 0, we obtain 2.11 + 2.12 = 2.10. Note, that 2 = -1 (*modulo* 3).

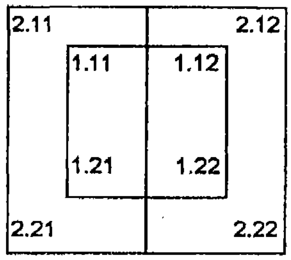
While writing down the address code, we shall miss parenthesis and comas, and the first aspect we separate by point. The vector (*x, y, z*) denotes a set of aspects: [1] *of sheet*, [1] *of line*, [1] *of column*. As an example, we input a classification, where for universe 0.00 the following values are taken:

> *«I'd like to charge this with your debt*
> *The logic courses to attend...*
> *In brain, just like on a fabric*
> *There are the threads and crossing-links.*
> *The premises, of not this shape,*
> *Will threaten shuttles implicate.»*
> *Goethe, «Faust» (trans. B. Pasternac)*

1.00 concrete values	2.00 abstract values
1.10 concrete algebraic values 1.11 *concrete algebraic scalars* 1.12 *concrete algebraic vectors*	2.10 abstract algebraic values 2.11 *abstract algebraic scalars* 2.12 *abstract algebraic vectors*
1.20 concrete logic values 1.21 *concrete logic scalars* 1.22 *concrete logic vectors*	2.20 abstract logic values 2.21 *abstract logic scalars* 2.22 *abstract logic vectors*

The concrete values 1.00 are represented by the first sheet of card-file from the left, and from the right - by square of diagram of Carroll. The operations are fulfil component-by-component. For logic vectors the indemponent addicting is produced modulo 3. For example, 1.11 + 1.12 = 1.10, that means: *concrete algebraic scalars + concrete algebraic vectors = concrete algebraic values.* Similarly, 1.21 + 1.22 = 1.20, that means: *concrete logic scalars + concrete logic vectors = concrete logic values.* Non-concrete (abstract) values 2.00 are presented by the second sheet of a card-file from





the left, and by the external square of Carroll's diagram - from the right.

The most not-simple things are appeared to be the exactly «simple» meanings («not simple simplicity»). Not in vain one says: «Just don't put the simple questions». Even *«simple»* numbers are abstract (non-concrete) numbers, which are obtained through abstracting from object's names. In real life a *simple* number is zero only (not without reason it was not known in Ancient Greece). For example, one can't say, that a fisherman caught 0 crucial (but from where it is known that not pieces?). This is a situation of uncertainty, which is used to be denoted in logic by zero.

To think abstractly-means to eliminate all object's features, which are considered unessential for define examination. A classical example may be taken from an article of Hegel «Who thinks abstractly?» with its market woman with rotten eggs. She thinks abstractly, because she is seeking only for negative features of buyer woman to offend her.

The solution of practical tasks requires to pass from non-concrete (abstract) numbers to arithmetical operations with concrete numbers. The difficulties along with introducing the vectors at the end of the last century on Maxwell's electromagnetic theory acceptance can, in many ways, be explained by a necessity to overcome the psychological barrier. It has been known, now vector writing down had been rejecting, and we are obliged to Maxwell and Heavyside for its introduction in subject, and the latter lovely called his predecessor as *«aven-sent Maxwell»*. Heavyside did afraid of descriptive explanations: «Mathematician, willing to develop the vector approach, should better learn, how a laundry-women *put together the* shirts - separately, the sheets - separately».

The logic tasks, from the standpoint of concrete approach, lead to a necessity of named vectors use. The named logic variables appeared in index method of Carroll They go back to Bool's constituent, which can be considered as a prototype of logic vector. The *algebra of Boole* (developed by Boole himself) is often confused with Boolean algebra, that was constructed by his successors - Jevanson and Shreder, which lost the meaning of constituent many other things. In paper [8] the index method of Carroll and algebra of Boole are examined. Note, that coefficients for Boole's constituent had taken the four values. Therefore, Boole is a precursor of multi-valued logic.

The computer catalogues *Windows* are composed in form of trees, that are extremely awkward. For instance, the restructuring of catalogue in a way of ideology of *Windows 95* required the substitution of catalogue C:\windows\system\docum\cross.doc for catalogue D:\work\doc\cross.doc. The more convenient way of classification are the dialogue windows, which in *WinWord6* gained a new form - a set of cards in a card-file [9]. The version *Excel 5.0* also uses three-dimension dialogues in a form of boxes with card-imbedding [10].

The tables of content in a form of double-letters and triple-letters diagrams of Carroll are descriptive and do not require any restructuring on priorities replacement, but they are ineligible for many-dimensional case. *The methods of analytical classification* by means of many-subjects logic vectors allows to use adding and subtraction of vectors, while it is impossible to do this with a pattern in a form of asterisk sign*, which is used as a symbol of uncertainty for computer classification [11].

The use of address codes allows to obtain a many-dimensional system of classification. There with the *algebra of logic vectors* permits to have a simple instrument for operation with catalogues, in which it is easy to realise the combinations according to any selected feature. Therefore it would be better to take advantage of logic vectors for computer catalogues.

The transition from one-dimensional representation allows to reveal the latent periodicity. In similar approach in theory of numbers one can literally *see a* number of known theorems and obtain the new results [12]. The well-known example of this kind is a table-calendar, in which a seven days-rhythm is visualised. The horizontals in the table-calendar form the days of current week, and the week's Sundays rhythm sets forth along a vertical column.

Unlike the one-dimension physical time *(time) the grammatical time (tense)* is a single two-dimensional mass data of past, present and future, in which the tenses are built up in one above other, as in a stack, but are not stretched along one line. The generalisation of concept of two-dimensional time leads to a method, revealing the characteristic cycles [13].

On linear reading the network of mass data becomes realised into a thread of time - the "ganglions" of structural network collapse (because of break of natural vertical ties). Here we have an analogy with a transmission of image by telefax, where a vertical is unrolling in rhythmical signal interchange, while on receiving of phototelegramm the dotted line of rhythm again roll up into a vertical, perpendicular to the lines of raster. The method of analytical classification *(project «CrossWord »)* is the firs step on a path of overcoming the *one-dimensional* thinking. The term of *CrossWord* sounds as an appeal to table-form of representation.

The conception of many-subjects approach in logic has originated 20 years ago, when the author had proposed a *matrix model of* paradox [14], but only 10 years afterward the *logic vectors* of Carroll has been gained in discern. *The many-aspects approach* became a methodological basis of logic analysis of complex logic situations. The problem of paradoxes testifies, that the *logic many-dimensionality* is hard to realise.

For majority of logic paradoxes it is sufficient to use the two-dimensional logic vectors arises, for example, in paradox of voting. Carroll wrote several articles about elections in Oxford University and a paradox of voting («effect of Kondorse»). He formulated the essence of paradox like this: «A majority can be "cyclic", that is, it can be a majority *A* over *B*, *B* over C and C over *A» (paradox of non-transitivity)*. The preference patterns can be written (on aspects *A, B, C)* by means of logic vector: $V_A = (+1, 0, -1)$, $V_B = (-1, +1, 0)$, $V_C = (0, -1, +1)$ for *A*, *B* and *C*, accordingly. The component can accept three values: +1, -1 and 0 for voting results: *«pro»*, *«con»*, *«abstain»*.

An example of paradoxical object exists in a *double dictionary* including Russian-English and English-Russian dictionaries, placed under one cover. If it is Russian, then it is English, but if it is English, then it is Russian. In article [15] the matrix models of paradoxes are given, which are based on mathematical theory of representations. The paradox is generated by an attempt to reduce a complex logic situation, described by the matrix, to a unit element. That is why the new representations are accepted firstly as «delirium» (paradox), and then as an «evidence» (the resolution of paradox). Ekkerman in «Talks with Goethe» cites the expression «square circle» as a reference of contradictive meaning. But once you pull apart the square and the circle towards different projections, the paradox the resolved. And we are surprised by dullness of two-dimensionists, described in «Flatland» of E. Ebbott, which can not imagine a «square circle» (*cylinder*).

However, one ought to warn about a rode mistake of seining the reason in geometrical evidence. In fact, although one can't image visually a «cubic sphere», but the paradox is resolved through pulling apart the cube and the sphere into different projections. Note, that a «cubic cube» is a four-dimensional cube, having cubes in different projections (it even is succeeded to be sketched). Similar to this the expression "*guilty without guilt*" is paradoxical, but the paradox can be resolved when *«not guilty»* (de-facto) and *«guilty»* (de-jure) are pulled apart toward the different logic projections (aspects). The repression ***«sparkle of wit»;*** meaning a superposition of incompatible things, alludes the physical effect of «stereo-glitter». The same is for idiomatic expressions: ***«how - no how», «was - never was», «visible - invisible», «willing - unwilling», «self - not himself».***

Jeaque de Leuse wrote: « We cannot save ourselves from paradoxes implying that the sense is always taken into account in two senses-directions simultaneously [16]. All modem paradoxes are in close relation with the «Liar» ancient paradox. Even those school children who never heard about logic know the above paradox by heart. Its presentation during the lessons provokes the interest aimed at logic learning with the purpose of mastering of how to think correctly. The Crete philosopher Epimenid (sixth century A.D.) is said to state «all Crete inhabitants are liars». Let us assume that the above Epimenid statement is a truth. Then, according to its sense and the fact that Epimenid himself is a Crete inhabitant, this statement is a lie.

The identification of truth and its estimation brings to a paradox. In reality «estimated as falsehood » *(rejected)* can be both a truth, and falsehood. If the evaluation is authentic, the it is a ***rejected falsehood,*** but if the evaluation is not authentic, then is ***rejected truth.*** We than have a table:

	truth	evaluation	authenticity
Option 1	falsehood	rejected	authentic
Option 2	truth	rejected	non-authentic

The evaluations are the labels, attaching to truths being authentic (on their coincidence) or non-authentic (on their not coincidence). V. Quine suggested to distinguish a falsehood and quotation-marked «falsehood» [16]. The logic vector $\{x, y\}$ has two aspects; x – ***truth and*** y - ***evaluation.*** The selection of various aspects allows to show, that in paradox of «Liar» there are two different situations, since a quotation-marked «falsehood» (*rejected*) can be reality both a truth and a falsehood:

«F» = T (rejected truth),

«F» = F (rejected falsehood).

Here the quotation-marked evaluations are the labels, attached to truth.

A multi-level cognition is a typical human feature. The parallel levels are connected between each other by a metaphor, without which there would be no glossary of «invisible worlds» (internal human existence). If a «soul depth» would be accepted by our sight as, for example, clearly as red colour, we, no doubt, would use for its notation the direct and only to it belonging name. Nonradomly, one of the important obstacle on the way of creation of artificial intelligence is a problem of assimilation of metaphorical thinking by a computer.

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«PROOVER» FOR NATURAL CLASSIC CALCULUS OF STATEMENT

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The idea of searching algorithm for natural calculus of classic logic statement are represented hereto. The peculiarity of this algorithm, realized in language C for IBM PC, lies in the fact, that the authors were succeeded to formalize heuristics, which are used along with natural reasoning. This allow to find an effective procedure for realizing the subordination deductions. The specific peculiarity of proover in the fact, that it allows not only simple checking of general validity (provability) of classic logic propositions, but to structure a deduction itself in an ordinary traditional sense of this word.

The system, laid in a basis for this, composes a natural calculus of propositions, presented in a textbook «The fundaments of logic» of V. Bocharov and V. Markin. An idea of algorithm is that it forms two sequences of formulas according to some prescribed deducibility. The first sequence comprises the formulas of deduction, the second - formulas-aims. Initially these two sequences are formed as follows:

- it is necessary to realize a deduction of some formula W from a set of premises W_1, ..., W_k, then the formulas W_1, ..., W_k are the original list of deduction formulas, and the formula W is considered as a main aim, and if this aim is achieved, the deduction is held to be completed;
- it is necessary to realize a deduction W from empty set of premises, the list of deduction is empty, and formula W is placed in the list of aims. Naturally, this formula is the main aim.

An algorithm means, that the following procedures are realized according to deduction formulas:

1. The sequence of formulas deduction is formed.
2. The new aims, which are the subaims of the main aim, is formed.
3. The test of attainability of the last aim in the aim list is accomplished.
4. From the other side, the following procedures are performed according to ***formulas-aims:***
5. The subaims, placed in sequences of aims, are formed.
6. The new supplementary premises, placed under next number into a deduction, are choused.
7. The necessity of automatic utilization of appropriate rules in a deduction, is signalized.

The Procedure 1 consists of one or two exclusions of logic connectives. If such formulas are discovered, then the deduction is added by the result of this rule application.

The Procedure 2. This Procedure is performed in the case when all possible rules, indicated in Procedure 1, were applied, and the last aim of sequence is «F» (contradiction), but there with this aim is not achieved (see the Procedure 3). What precise aims are introduced, are determined by the forms of deduction formulas contained:

2.1. If a deduction includes an implicate formula of the form $W_1 \supset \Box W_k$, so W_1 is taken as a subaim.

2.2. If a deduction includes a disjunctive formula of the form $W_1 \vee W_k$, so $\neg W_1$ is taken as a subaim.

2.3. If a deduction contains includes a formula of the form $\neg(W_1 \vee W_k)$, so $W_1 \vee W_k$ is taken as a subaim.

2.4. If a formula $\neg$ (W_1 & W_k) is occurred in a deduction, so W_1 & W_k is taken as a subaim.

2.5. If a formula $\neg$ ($W_1 \supset \Box W_k$) is occurred in a deduction, so $W_1 \supset \Box W_k$ is taken as a subaim.

No other formulas serve as a source of new aims, since the Procedure 1 is applied to them automatically.

Procedure 3. If the last aim is held to be some formula, so it is believed to be achievable simply through the fact of existence of graphically equal to it formula. If, however, the last aim if F, so it is considered as achieved, it a deduction contains the formulas of the form A and $\neg$A. The achieved aim is excluded from aims list, and the next aim become the previous one.

The Procedures 4 and 5 we describe together, because in some cases they are used simultaneously. The present Procedures are coming into use in the case, when the Procedure 1 is applied already, the aim is some formula, and it is reached. In this case depending on a form of the next (last) aim we are acting as follows.

4-5.1. If the aim is a formula of the form $W_1 \supset W_j$, so W_j becomes a new aim, and W_1 is taken as a premise.

4-5.2. If a formula of the form W_1 & W_k is the aim, so W_1 and W_k becomes a new aims. Therewith it is obligatory, at first, to achieve the aim W_1, and only after its achievement, to reach the aim W_k.

4-5.3. If the aim is a formula of the form $W_1 \vee W_k$, so W_1 or W_k become a subaim. If none of these subaims is not achieved, then a formula $\neg$ ($W_1 \vee W_k$) is taken as a new premise, and F becomes a new subaim, while the aims W_1 and W_k are being taken away.

4-5.4. If a prepositional variable p is an aim, then its denial $-\neg$ p is a new premise, and F becomes an aim.

4-5.5. If a formula of the form $\neg$ A, where A is an arbitrary formula, is the aim, the formula A is taken as a new premise, and F becomes a new aim.

The Procedure 6. Each case of some aim's achievement signalized about a necessity to fulfil some stages of deduction. In most cases it is required to perform in automatic regime the appropriate rule of introducing of logic connectives. In more details it is described as follows:

6.1. If a formula of the form W_1 & W_k is a direct superaim, and the last in a list of aims are the formulas W_1 and W_k, being the direct subaims of this formula, and if formula W_1 is achieved, then it serves as signal about the necessity to pass for achieving the aim W_k. In this case, when the W_k is achieved, that is, the both subaims are reached, then it serves as a signal to realize in deduction the rule «$\&_B$» and to obtain by this, in consequence of deduction, the formula W_1 & W_k. Note, that this means the achievement of the aim W_1 & W_k.

6.2. If a formula of the form $W_1 \vee W_k$ is a direct superaim, and the last in a list of aims are the formulas W_1, W_k, and if one (any) of these aims is reached, then this is a signal to realize in deduction the rule «$\vee_B$», that is, to include in consequence of deduction the formulas $W_1 \vee W_k$. By this the $W_1 \vee W_k$ is reached too.

6.3. If a formula of the form $W_1 \supset \Box W_k$ is a direct superaim, and the last in a list of aims is a formulas W_k as it direct subaim, and it is reached, then it serves as a signal to realize the rule «$\supset_B$», that is, to include in consequence of deduction the formulas $W_1 \supset \Box W_k$. By this the aim $W_1 \supset \Box W_k$ is achieved.

6.4. If a formula W is a direct superaim, where W is a formula of arbitrary form, and F is the last direct its subaim, and if the aim F is reached, then it serves as a signal of application of the rule «$\neg_B$» in a deduction. This either leads to obtaining of formula W in deduction at once, of it is obtained after application of a rule «$\neg_{and}$». In any of these cases the aim W is reached.

The proof of the Pierse law, carried out by a computer in automatic regime on the basis of described algorithm, is given below.

The present theorem is taken from a set of examples, by means of which the present software was adjusted.

It is required to be proved $((p \supset q) \supset p) \supset p$

0	$(p \supset q) \supset p$,	Premise
1	$\sim p$,	premise
2	p,	premise
3	$\sim q$,	premise
4	$\sim\sim q$,	~ in out of 1,2
5	q,	~ and, from 4
6	$p \supset q$,	⊃ in 2 to 5
7	p, ⊃and,	from 0, 6
8	$\sim\sim p$,	~in out of 1, 7
9	p,	~ and, from 8
10	$((p \supset q) \supset p) \supset p$	⊃in 0 to 9

The program, realizing the described algorithm, was written in a high level language «C» for computers of a type IBM PC AT. The program occupies 140 Kbytes on a disk, an operation time for tested theorems proof does not exceed 4 sec for a personal computer on the basis of a processor INTEL-386-DX with a rate of 40 MHz. The program has a user's interface and can read previously prepared formulas from a file. The testing was carried out for a lot of formulas, selected out of the textbooks on mathematical logic and, in particular, from the A. Church «The introduction to mathematical logic» This set (of about one hundred theorems of classical logic) is a representative enough, and allows to consider the proposed algorithm of searching the deduction for natural calculus of statements as an efficient procedure of subordination deduction realizing.

The elaborated by the author algorithm of structuring of deduction and proof for propositions of classical logic and its computer realization if of great importance for educational objectives.

For the first place, right now on a basis of presented algorithm (after its detailed presentation) there is a possibility to train the students with procedures of deduction and proof-procedures, which are well known to everybody, who taught logic, and are rather difficult for understanding. The experience of teaching the logic on philosophical faculty of Moscow State University shows, that students are quickly mastering this algorithm, and therefore the procedures of deduction search and proof in classical logic become not difficult for them.

For the second place, on the basis of computer realization of the considered algorithm it is assumed to develop in a nearest future a computer program, which would independently train the student with procedures of deductive inference, which would control this process, would provide the prompts at required cases, and also would carry out testing of students on their mastering the subject and would make an estimate of students. In this case the process of training of deductive procedures would be automized completely.

For the third place, the present computer program should be used by logic-specialists as a slight support in these studies. In those or other cases the investigator can realize by means of a computer the required with it deduction, and so obtained the results to transfer into the text of his article or book.

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THE EXPERIENCE OF LOGIC TEACHING BY MEANS OF A COMPUTER PROGRAM «DEDUCTIO»

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The computer programme *DEDUCTIO* (the authors - A. Srnrnov, A. Novodvorsky, edited by V. Smirnov) was used in the course "Foundation of Logic", which was read to students of philosophical faculty under Humanitarian College in the Institute of Philosophy of Russian Academy of Science. This programme contains a wide choice of logical systems, however, according to training themes only two of them were attracted: axiomatic system for logic of statement and natural deduction for logic of propositions and logic of predicates.

The key objective of the course "Foundation of Logic" is a mastering of basic concepts and methods of modem logic inside its philosophical orientations. It is supposed, that students, having mastered the concept of logical form, the basic formalized languages, with most important modes of proof, will be able to approach to the main, from the informative point of view, part of this course: the acquaintance with ideas of logical semantic, the theory of logical succession, with modal, temporary and other nonclassical logics, interesting either for logic or other philosophical disciplines (ontology, epistemology, methodology of science, philosophy of language). However, while grammatical forms and mathematical relations are studied in secondary school, logical form and logical relations become familiar for the first time only in higher school. Even the elements of classical logic require a lot of time for successful understanding - nearly the whole two-terms course.

Therefore, the wide use of computer training programmes spares time, for sure, and causes the conditions for realization of key creative ideas of a teachers. The following objectives, which were put ahead along with logic training by means of program *DEDUCTIO*, can be singled out:

- to learn the variants of proof by means of axiomatic method;
- to master the technique of natural deduction in logic of propositions and logic of predicates;
- to learn making differences between proof and proof search;
- to be able to distinguish the analytical and synthetic methods of proof search;
- to master the basic ways of direct and indirect proofs;
- to master the most important principles of classical logic not by mechanical learning, but through a search of proof by means of a computer. The students should meet the following demands:
- for the first place, to be able to form a proof both with a computer and without it;
- for the second place, to be able to transform the procedure of proof searching into the resulting proof.

The collection of rules of natural deduction (rules of introduction and extraction of logical symbols), accepted by a computer program, differs slightly from standard sets of axioms of natural calculus. These differences are caused by a necessity of correlation of rules of natural deduction and the applied procedures (rules) of proof searching. At the same time, the suggested systems of natural deduction are deductively equivalent to classical calculus of propositions and predicates.

The rules of searching can be partitioned on analytical and synthetic. The analytic rules lead a task solution to a solution of sub-task - to building up the auxiliary sub-deductions. The synthetic rules allows to solve the given task without reducing it to sub-tasks.

The analysis of results concerning to application of searching rules are presented automatically, while a student fulfills the choice of a rule itself. In the event of a mistake a computer sends a message: "This rule is not applicable". After the complexion of deduction searching process it is summarized: «The deduction is completed». The additional commands remove the extra steps, while renumbering takes place. The analysis of a ready deduction is formulated along with indexation of application of natural system rule.

To the end of the 1 term practically all the students had mastered the skills of operation with computer program *DEDUCTIO*, and had been able to prove the basic theorems of classic logic propositions. In reality the students, which studied the informatics in a secondary school, required much less time for mastering the proofs and deductions with a computer. At the same time some students, being able to operate with a computer, could not show this without a computer. This testifies that understanding the material occurred mechanically, not consciously. However, basically, the group solved its problems.

The study of logical science requires, surely, the permanent solving of problems, therefore, the development of computer systems, like the program *DEDUCTIO*, promotes the success in training process significantly.

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QUASIMATRIXES AND SEMANTICS OF BOUNDED DESCRIPTION SETS OF STATES AS THE MEANS OF COMPUTERIZATION OF MODAL REASONING

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In the last few years a series of electronic textbooks on define subjects of the general logic course, as well as on classical symbolic logic, were created. The problem of preparation of manuals of this type faces the modal logic, since the reasoning, being described in this logic, are realized both in humanitarian and natural sciences, and the training of students in modal logic without using the technical means does not always reach the prescribed goal.

The algorithmic methods of analysis are required for modeling of modal reasonings by means of a computer instrument. Presented here are the two of such methods.

Quasimatrixes. As it is known, the matrix is the set $<K,M,\varphi^1,...,\varphi^n>$, where K– set of matrix elements; M - set of separated elements, $\varphi^1,...,\varphi^n$ — a function, having a range of possible values and arguments in a set of K. Quasimatrix is the set $<K,M,\delta^1,...,\delta^n>$, where K and M – the same as above, and $\delta^1,...,\delta^n$ - quasifunctions. Quasifunction is a congruence, by virtue of which some object (unknown) out of define subset correlates with some object (unknown) out of define subset of the same or another set.

On example of quasimatrix: $<\{t, f\}, \{t\}, \delta^1, \delta^2>$. Here t and f are values of truthness «truth» and «false» accordingly, and δ^1, δ^2 are the quasifunctions, determined by tables: $\delta^1 A$, $\delta^2 A$.

t/f	t	t	t
f	t	t/f	f

The notation *t/f* is regarded as an uncertainty, is read *«whether truth or false»* and does not mean the independent value. By means of quasifunctions the δ^1 and δ^2 are interpreted as modal operators □ (necessary) and ◊ (probably), accordingly, that allow to disprove the statement of Ya. Lukasevich about impossibility to identify them in terms of truth and false.

Let us consider the formulas: $\Box A \supset A$ и $A \supset \Diamond A$. It is evident, that if A has the value t, then the second of those formulas has the value t. Let us treat the remained cases: $\Box A \supset A$, $A \supset \Diamond A$.

t/f tt tf t/f f

Since an uncertainty t/f does not convey the independent value, one should treat subcases, taken two at a time:

$\Box A \supset A$ и $A \supset \Diamond A$

1. tttt fttf

2. fttt ftff

The formulas are truth logically. The quasimatrix, presented as an example, is adequate to calculus S_{min}, the schemes of axioms of which are the given above formulas, and the single rule for deduction in modus ponens.

An uncertainty t/f arises on assigning some values to formula $\Box$ A with value t for formula A. Therewith we argue in a following manner: the situation, described by statement A, takes place on necessity or occasionally. In first case we assign to indicated formula the value t, and in the second case - f. In fact, we initiate from the fact, that a statement, taking the value t, can be estimated, additionally, as necessary (ontologically) or occasionally (ontologically). The last values we designate by letters *n* and *c*, accordingly. The composed values «A necessary truth», «a random truth», «necessary false» («false and impossible»), «a random false» we designed as: t^n, t^c, f^i, f^c. accordingly. Let us bring one of the system of four-valued quasimatrix logic - S_a^+. The distinguished values are t^n and t^c, the letters t and f are used as abbreviations of expressions t^n / t^c and f^i / f^c accordingly.

A	¬A	□A	◊A
t^n	f^i	t	t
t^c	f^c	f	t
f^i	t^n	f	f
f^c	t^c	f	t

$\supset$	t^n	t^c	f^i	f^c
t^n	t^n	t^c	f^i	f^c
t^c	t^n	t	f^c	f^c
f^i	t^n	t^n	t^n	t^n
f^c	t^n	t^c	t^c	t

The calculus S_a^+.

1. The schemes of axioms of classical calculus of statements.

2. The supplementary schemes of axioms: $\Box A \supset A$; $\neg \Box \neg A \supset \Diamond A$; $\Diamond A \supset \neg \Box \neg A$; $\neg \Diamond A \supset \Box (A \supset B)$; $\Box B \supset \Box (A \supset B)$; $\Box (A \supset B) \supset (\Box A \supset \Box B)$; $\Box (A \supset B) \supset (\Diamond A \supset \Diamond B)$; $\Diamond (A \supset B) \supset (\Box A \supset \Diamond B)$; $\Diamond B \supset \Diamond (A \supset B)$; $\Diamond \neg A \supset \Diamond (A \supset B)$.

The rules of deduction are *modus ponens* and the rule of substitution of arbitrary quantity of entering of formula ¬¬ A on A and vice versa.

Semantics of bounded sets for the description of states. In modern logic a principle, according to which the value of complex proposition is determined by constituted in simple statements (elementary or atomic), is widely used. In classical logic these values are «truth» (t) and «false» (f). In a logic, describing the logic modality «necessary» (□) and «probable» (◊), these values are «a logic truth", "a logic false" and "a logic non-determination". The last values are designed as : *N, I, C*.

Let a formula $\Box (p \supset q) \supset (\Box p \supset \Box q)$ is given suppose, that the variables p and q has the values of *N* and *C*, accordingly, that is, the first of them is interpreted as a logically truth proposition, and the second - as logically non-determinated one. The whole number of state descriptions for mentioned formula equals to four: $\alpha 1 = (p \& q)$; $\alpha 2 = (p \& \neg q)$; $\alpha 3 = (\neg p \& q)$; $\alpha 4 = (\neg p \& \neg q)$. Since the elementary propositions are interpreted trough above mentioned way, that is, *p* can not be false, then α3 and α4 are eliminated out of a set of possible state descriptions. The obtained set of state description $\{\alpha 1, \alpha 2\}$ is called a bounded set of state description. A set of possible state descriptions for formula we designate by letter *W*, and the bounded set of descriptions as (OMOC) – *W'*. If the two or more elementary propositions are interpreted as logically non-determined, then the conjunction of these propositions (the conjunction of denial of these propositions), in turn, is interpreted as a logically possible proposition or as a logically false proposition. That is, the subsets, named subOMOC, can be formed for OMOC. SubOMOC is denoted by letter *W"*. All possible sublets of original set *W* of state description are formed as a result of presented interpretation of elementary propositions. The value in state descriptions, incoming to subOMOC, as assigned to formulas. The elementary proposition is truth in state description, if and only, if it is involved in this state description without the sign of denial. The formula A&B is truth in state description, if and only, in this state description the formulas A and B are truth, and so on for other nonmodal logical terms. The formula □ A is truth in state description of subOMOC, if and only, if the formula A is truth in each state description of this subOMOC.

The formula ◊ A is truth in state description of subOMOC, if and only, if the formula A is truth in some state description of this subOMOC. The formula is logically feasible, if and only, if it is truth in some state description of some subOMOC. The formula is generally valid, if and only, if it A is truth in each state description of each subOMOC.

Of generally valid are these and only those formulas, which are probable is calculus S5 of Lewis. Now the essence of model structures of relational semantics is apparent for this calculus. The model structure is one of the interpretation of prepositional variables, entering in formula (in formulas), by means of above mentioned values, and, also, the interpretation is conjunctive of prepositional variables (in front of some of them may be a sign of denial), interpreted as logically non-determined propositions, as a logically possible or logically impossible statement.

Let now the subOMOS is a set **< *OΓ'*, *W"*>**, where ***OΓ'*** - the indicated interpretation of prepositional variables and described above conjunction, denoted by means of formulas as follows: if a value ***N*** is assigned to prepositional variables ***a***, then the formula $\neg\Diamond\neg a \in O\Gamma'$, if - ***I***, so - $\neg\Diamond a \in O\Gamma'$, if ***C***, then - $\Diamond a \;\&\; \Diamond\neg a \in O\Gamma'$, if indicated above conjunction was interpreted as possible, then in ***OΓ'*** this conjunction is included with a proceeding operator of possibility, and if as impossible - then with prefix ¬◊. After this the following lemma can be formulated, and its proof is necessary for proovement of methatheorem about semantic completeness.

Lemma. Let D is a formula; **<*OΓ'*, *W"*>** is a subOMOC; $a_1,\dots,a_n$ — all various variables, involving in ***D***, $b_1^\alpha,\dots,b_n^\alpha$ - truth values of these variables in state description α such, that $\alpha \in W'$, A_i^α is α_i, if b_i^α is t, and also $\neg\alpha_i$, if b_i^α is f. Let D^α is ***D*** or $\neg D$ depending on whether ***D*** accepts a value t or f in *a*. Then $O\Gamma' \cup \{A_1^\alpha,\dots,A_n^\alpha\} \vdash D^\alpha$ (we write further as $O\Gamma', A_1^\alpha,\dots,A_n^\alpha \vdash D^\alpha$).

The lemma is proved by reciprocal induction, according the number of logical terms entering in formula ***D***. A set ***< OГ', W", D>*** is the subOMOC in semantics of predicated, where ***W"*** - a set of state descriptions (regarded not as conjunctions, but as sets), the admissible interpretations ***OГ'***; ***OГ'*** - the complete interpretation of atomic prepositions, that is, statements and their (finite) conjunctions; ***D*** - not empty area. The atomic formula in state description without independed variables accepts the value t or f in ordinary way. The values in state descriptions are assigned in ordinary manner to formulas of the form $\neg A$, $A \& B$, $A \vee B$, $A \supset B$, $\forall \sigma A(\sigma)$ and so on.

The formula $\Box$ A takes the value t in state description $\alpha(\alpha \in W'')$ on values distribution over independent variables S, if and only if for this description the formula A accept the value t in each state description from ***W''***.

The predicative extension of predicative modal logic. The adequacy to this calculus of semantically preassigned system is proved.

Thus, the semantics is obtained, reveally the essence of logic modalities, that gives grounds to argue about developing the theory of these modalities.

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A COURSE OF DEDUCTIVE LOGICS IN A SUPPORT OF THE PROGRAMME FOR INTERACTIVE SEARCH FOR PROOF

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In 1991 A.V. Smirnov, A.A. Fokin and A.E. Novodvorsky have developed the first version of the *DEDUCTIO* programme of interactive search for proof. The programme permitted describing at the level of data some logical calculi and supported working with them. The program was demonstrated at a seminar of the Logical Center, Institute of Philosophy, Russian Academy of Sciences, and subsequently in the Stanford University. Prof. V.A. Smirnov proposed using *DEDUCTIO* for the teaching of logics and initiated development of a course of logics integrated with a computer program. In the course of that work V.A. Smirnov and V.I. Markin prepared and read study courses at the Faculty of Philosophy, Moscow University (1992 - 1996), in the Salzburg University (1993) and in the Humanitarian College of the Institute of Philosophy, Russian Academy of Sciences (1995 - 1996). A.V. Smirnov and A.E. Novodvorsky authored a new version of the *DEDUCTION* programme, taking into account the peculiarities of the study process.

The course of deductive logics was based on a theoretical-proof approach. The focus was on the basic notions of symbolic logics as deduction and proof, the methods for search of deduction in different logic calculi.

The course is permeated by the concept that the meaning of logical constants can be set not with syntactic rules of operations with certain formulas rather than conventional semantic definitions (e.g., truth tables). In fact, in natural calculi, the above role is played by the rules of entry and elimination of prepositional connectives and quantors. For instance the meaning of the conjunction (&) can be defined by the following deduction rules:

$$\frac{A, B}{A \& B}, \quad \frac{A \& B}{A}, \quad \frac{A \& B}{B}.$$

There are two definite questions: (1) what is a correct logical deduction (proof) and (2) how to search for the needed deduction effectively. The focus is on the consideration of the second problem, which is of great practical importance. To ensure the maximal illustrativeness and "naturalness" of consideration, the problem for the search for deduction is initially investigated with special reference to natural logical calculi—the classic prepositional calculus, the classic predicate calculus, predicate calculus with equality.

The methods and heuristic methods for obtaining deductions are stated as a some system of precise rules, i.e., *the rules for the search for deduction*. These should be distinguished from the rules of deduction of the logic system itself,, which rigidly define the relationship between the formulas in the resultant deduction. As to the search rules, they set admissible modifications of the deduction search tree.

There are two varieties of search rules: *analytical* and *synthetic*.

The synthetic rules permit adding some new formulas to the current deduction in the course of solving of the search problem. For instance, the synthetic rule of implication elimination (c) in the presence in the deduction of the A⊂B type formula, and A connects the B formula to it.

The application of an analytical rule reduces the problem for the search of some deduction to one or several subproblems of search for auxiliary deductions. For instance, when the purpose of the current subdeduction is obtaining of the $A \supset B$ type formula, the analytical entry rule ⊃ transforms the problem concerned into the problem of an auxiliary deduction of the B formula from the A assumption.

The possibility of the application and selection of the needed search rules are determined by the logical structure of the formulas contained in the current subdeduction being constructed and also in the form of the required conclusion of the given subdeduction.

Upon mastering the technique of natural deduction the greatest difficulty is normally caused by the selection of the needed additional assumptions, the knowledge and the priorities of the related goals, and also the selection of the formulas to which the rules of deduction can be applied in each particular case. The given problem is solved in the following way: when the analytical search procedure is used the required inferences of the subdeducations that arose and all the formulas that can be used in solving of each of the subproblems concerned are clearly stated.

The *DEDUCTIO* programme permits implementation in the dialogue regime the procedure for the search for deduction is an efficient teaching tool, developing the skills of correct reasoning. The program controls the conformity of all the changes of the tree for search for deduction to the system of search rules and, thereby, guarantees the correctness of the deduction constructed. Concurrently with the construction of the deduction, analysis is generated that is demonstrated on what basis each of the formulas was entered. The program permits distinguishing particular subproblems in the course of search providing accessibility of the formulas inherited from other older deductions.

Particularly noteworthy is the specificity of quantor rules for the deduction search. For the synthetic rule of the elimination of the generality quantor (∀) and the analytical rule of the entry of the existence quantor (∃), the idea of *temporal variables* is used, which permits putting off of the choice of suitable terms for their substitution instead of object variables. For that purpose term unification is introduced. The Program ensures the introduction of a new temporal variable with each application of the above rules.

Another idea is associated with the use at intermediate stages of the deduction of the formulas containing *ε-terms*. Due to that no problems arise associated with the varying of the variables and the unambiguity of the selection of the formulas introduced by the synthetic rule of the elimination of ∃ and the analytical rule of the introduction of ∀. The first rule permits adding to it of the A(εαA) formula. The second rule reduces the problem of the search for the formula of the ∀αA type to a subproblem for the search of an auxiliary deduction of the formula A(ε–A).

The *DEDUCTIO* can also be used to teach the technique of the construction of analytical tables. The analytical-table procedure is stated as a special variety of subordinate deduction with a specific system of search rules conforming to the standard reduction rules.

A basic principle of the development of the logics course is demonstration of the variety of pure and applied logic systems. In addition to natural and analytical-table calculi, the axiomatic calculus of predicates and syllogistics are also represented. As an example of applied first-order theories the theory of relative is considered and also the «direct sequence theory» (including the mathematical induction rule) and the theory of Abel groups. As a logical basis of applied theories a technique of natural deduction is used an their natural axioms play the role of unreducible premises accessible at every step of the deduction search.

The *DEDUCTIO* programme is a sufficiently universal tool for the work with logical deductions. It is set up for work with different calculi by means of their description in the original language [1]. The program set includes descriptions of all systems used in the course and also a number of other, including three nonclassic. Along with that, the program is open, permitting a qualified user to modify the available description and create new ones.

The Program supports a single interface working with different calculi, which considerably facilitates the user a transition from one system to another. The visualization regimes demonstrate the entire search tree, a separate subproblem or the skeleton of the tree of deduction search. The substitution of logical and nonlogical symbols of the formalized language by symbol sentences is supported, which permits constructing a deduction consisting of not formulas but rather propositions close to a natural language.

Numerous operations on the modification of the deduction search tree are automatic. Among them are filtration, minimization, generalization, search for the unifier and renumbering of the formulas.

The filtration of the rules for deduction search permits distinguishing only those of them that are applicable in the given context.

Minimization eliminates all the formulas on which the deduction is dependent to simplify the deduction. It also eliminates the subdeductions without allowances to incorporate the formulas belonging to them to the subordinating deduction.

When the regime of formula generalization is on, the rules obtained as a result of the application of the synthetic rule are added immediately after the last of its premise. That renders the added formula available in the maximal number of subdeductions.

When the global substitution of the terms is done instead of temporal variables, a system of substitution may be required, whose performance results in binding of all the subdeductions, or at least the current sudeduction. When the unification regime is on, a search for such a system is done automatically. If the found subsystem permits binding all the branches oaf the deduction search tree, the global substation is performed and also the construction of the deduction is completed. *DEDUCTIO* applies an original algorithm of unification search [1].

All the user actions are protocolled, which makes it possible to run the deduction search step by step or up to the established control points. Thus, one can analyze the work of the students or create demonstration «rollers» provided with commentary.

The Program service also includes saving of both the final and intermediate results of the search, returning to an unlimited number of steps and saving of the deduction in the TeX format, printout of the deduction, etc.

DEDUCTIO is adapted by the authors for the course of deductive logics delivered to the students of faculties of philosophy, including those specialized in logics. At the same time there some experience of using it in other courses. At the faculty of Computational Mathematics and Cybernetics, Moscow University it has been used since 1994 in logics practical classes by I. Gorskaya, using logical systems that are different from those proposed by us. Since 1994 *DEDUCTIO* has been used in the Debrezen Unviersity (Hungary) by A.G. Dragalin. The Program is proposed by the authors and also to the departments of the Izhevsk, Tomsk and Novosibirks Unviersities.

A book by V.A. Smirnov has appeared [2), which can be used as a manual on deductive logics supported by *DEDUCTIO.*

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THE MATRIX CLASSIFICATION OF IMPLICATIVE LOGICS THROUGH PROGRAMS MaGIFL4

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Among computer training programs the logic program MaGIFL4 is designated for classification of implicative logics.

In logic language the falsity FL4 [2,3] can be defined by 944784 of different implications. For classification 419904 out of these implications in multi-implicative logic FL4 the method of implicative logics, suggested by A.Karpenko [1], was used. It is performed by means of boolean arrays, which can be presented in a form of seven-dimensional hypercube, the tops of which are the subsets of original set of axioms {IBCWK$_1$XN}.

The calculations were carried out by means of elaborated by the author program MaGIFL4 (Matrix Generator for Implication in FL4).

One of the results of the given research consists of a fact, that in logic language FL4 it is possible to conduct proposition correctly and make the logic deductions by 419904 various ways.

Let us show a new formula of by logic complexity, differed from the previous one by absence of supplementary subclass of T.F.-formulas.

The initial profound statements for logic complexity FL4:

1. The concept of complexity is considered and is used only in propositions of the following form: «The suggestion «S» isfalse» (symbolically (-S)).
2. The concept of falsity is considered as original, uncertain concept, which plays a role of logic operator in a formal system. The proposition of truthness of suggestion S is considered as shortening for a statement about the falsity of denial of suggestion S and is written as follows: «The suggestion «S» is truth» (symbolically (|S)).
3. The statement (-S) about a falsity of suggestion S is two-valued, which not each suggestion S must be either truth or false.
4. The truthness and falsity of suggestions with implications are assigned traditionally. The proposition «if S$_1$, so S$_2$» we write symbolically ($S_1 \to S_2$).

<u>*The language of calculus of FL4*</u>

Alphabet: s, s_1, s_2, ... sentential variables;

–, → logic constants;

(,) technical symbols.

The rules of formation of p. p. f. (prepositional forms).

1.1. Any sentential variable is *p. p. f.*

1.2. If A, B is p. p. f., then (–A), (A → B) is p. p. f.

Metavariables: A, B, C, ... for p. p. f. assume the standard agreement regarding to brackets.

Let's introduce the following abbreviations:

D1.1	$f(A) =_{df} -(-s \to -s)$	(a constant «false»)
D1.2	$\sim A =_{df} (A \to f)$	(denial)
D1.3	$\mid A =_{df} - \sim A$	(| an operator of truthness)
D1.4	$\ulcorner A =_{df} -(\mid A \to -A)$	("$\ulcorner$" is read «Truth and not false»)
D1.5	$(A \supset B) =_{df} (\ulcorner A \to \ulcorner B)$	(D - implication)
D1.1	$0(A) =_{df} \sim (A \to \ulcorner A)$	(a constant «zero»)
D1.2	$\neg A =_{df} (A \supset 0)$	(DI - denial)
D2.1	$(A \wedge B) =_{df} \neg(A \supset \neg B)$	
D2.2	$(A \vee B) =_{df} (\neg A \supset B)$	
D2.3	$(A \equiv B) =_{df} (A \supset B) \wedge (B \supset A)$	

Axiom schemes

I.	A1.1	$(A \supset A)$
B.	A1.2	$(B \supset C) \supset ((A \supset B) \supset (A \supset C))$
C.	A1.3	$(A \supset (B \supset C)) \supset (B \supset (A \supset C))$
W.	A1.4	$(A \supset (A \supset B)) \supset (A \supset B)$
K_1.	A1.5	$(A \supset B) \supset (C \supset (A \supset B))$
X.	A1.6	$(A \supset ((B \supset B) \supset A)) \supset (((A \supset B) \supset B) \supset$ $\supset ((B \supset A) \supset A))$
N.	A1.7	$(0 \supset A)$

We add to scheme of classical logic the following ones:

A2.1	$\mid -A \equiv -A$	(reduction of truth operator)
A2.2	$--A \equiv \neg -A$	(reduction of false operator)
A3.1	$\mid(A \to B) \equiv -A \vee \mid B$	(reduction of truth implication)
A3.2	$-(A \to B) \equiv \mid A \wedge -B$	(reduction of false implication)

The rule of deduction:

$$\frac{A,\ (A \supset B)}{B}$$

From this formula of FL4 it is seen that both classical logics and non-classical logics take place over all set of p. p. f. Therewith the operators of classical logics $\neg, \supset$ are the derivatives of original non-classical operators of which are contained in its language, and which takes place over all p. p. f. set, as super classical.

Note, that FL4 is a four-valued generalization of three-valued logics of Lukasevich, distinguished from generalisation of Lukasevich.

The classification of implications.

In order to structure an implicative logic for some implications $\to_{\mid}$ with axioms A_m $(m \leq 7)$ from a set of {I, B, C, W, K_1, X, N} in such a way, that formulas A_m would be the theorems FL4, and a rule of deduction A, $(A \to_{\mid} B)$ / B would be a derivative rule in FL4, it is necessary to fulfil the following terms:

1. The formula $(A \to_{\mid} B)$ must be defined in language FL4.

2. $(((A \to A) \wedge (B \to B)) \supset ((A \to_{\mid} B) \equiv (A \supset B))$ (booleanity).

3. $(A \to_{\mid} B) \supset (A \supset B)$ (conservation of *modus ponens).*

The number of various implications, satisfying this terms, is equal to 419904.

The computing results, obtained by means of the program MaGIFL4, are shown in the following table:

•	Ø	324278	I	38523
•	N	39289	IN	4256
•	X	6438	IX	1330
•	XN	1753	IXN	530
•	K_1	355	IK_1	426
•	K_1N	70	IK_1N	50
•	K_1X	99	IK_1X	93
•	K_1XN	70	IK_1XN	56
•	W	160	IW	501
•	WN	159	IWN	126
•	WX	36	IWX	111
•	WXN	54	IWXN	44
•	WK_1	6	IWK_1	54
•	WK_1N	4	IWK_1N	12
•	WK_1X	2	IWK_1X	2
•	WK_1XN	5	IWK_1XN	7
•			ICK_1	30
•			ICK_1N	14
•			ICK_1X	2
•			ICK_1XN	9
•	CWXN	2		
•	CWK_1	4	$ICWK_1$	32
•			$ICWK_1N$	16
•			$ICWK_1X$	2
•	CWK_1XN	2	$ICWK_1XN$	1
•	B	151	IB	46
•	BN	2		
•	BX	85	IBX	48
•	BXN	2	IBXN	2
•	BK_1	95	IBK_1	123
•	BK_1X	51	IBK_1X	40
•			IBK_1XN	2
•	BW	4	IBW	4
•	BWN	2	IBWN	2
•	BWXN	33	IBWXN	16
•	BWK_1	4	$IBWK_1$	30
•	BWK_1N	4	$IBWK_1N$	4
•			$IBWK_1X$	2
•	BWK_1XN	4	$IBWK_1XN$	12
•	BC	2	IBC	15
•			$IBCK_1$	12
•			$IBCK_1N$	4
•	BCK_1X	2	$IBCK_1X$	16
•	BCK_1XN	2	$IBCK_1XN$	5
•	BCWN	2		
•	$BCWK_1$	2	$IBCWK_1$	20
•	$BCWK_1N$	4	$IBCWK_1N$	12
•	$BCWK_1X$	2	$IBCWK_1X$	10
•	BCWK1XN	9	IBCWK1XN	4

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COMPUTER GAMES AS A BASIS FOR LOGIC TEACHING IN SECONDARY SCHOOL

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The fist stage of this project was realized through the support of «Cultural Initiative» International Foundation in the frameworks of the Programme № FS95-105-200395-101. The project is realized on the base of Moscow gymnasium № 1543.

A logic course for secondary school is presented, which is based upon teaching and developing computer games. The creation of such course allows to overcome the drawbacks of existing system of logic teaching school, it bases the foundation for successful implementation of this subject in the secondary education system.

Currently, the task of wide and steady introducing of logic teaching into secondary school is especially actual. It may be explained both by matured needs of the society in the increase of logic culture and in the increased interest to this science among the trainees and their parents. Recently logic has become a fashionable discipline, its presence in curriculum is now a question of prestige for lycee, gymnasium, special school. However, the situation with teaching of this subject in the secondary school is, not by any means, cloudless. Moreover, if in the nearest future there would not appear serious changes in this field, a situation of the after war years may repeat, when introduced due to the order from above logic and physiology soon have disappeared from school curriculum without any track.

Currently, in the process of logic implementation in the school one could notice two tendencies.

On one hand, there has been stored a certain experience of logic teaching in the secondary school by teachers of the higher school. In most cases, it's carried out without necessary adaptation to the intellectual level of the trainees and to the peculiarities of the school as an educational institution. Let us note, that logic appears, in this case, in the best one, only as one of the educational subjects. Its study essentially transfers into end in itself, not forming steady practical skills of intellectual procedures realization.

On the other hand, the attempts to put the development of logic culture of thinking as a main objective of logic teaching, as a rule, don't bear on the achievements of contemporary logic. This leads towards the absence of strict criterion of used cognitive operation correctness in trainees. As a result, the basic skills of correct solution don't transfer into the skills of acting in problem-situations hat appear in real life.

The turned out situation is aggravated by a set of circumstances, such as the absence of text books on logic for secondary school, that are produced on professional theoretical level; serious lack of qualified pedagogical staff; absence of training and retraining system.

The approach, which is realized in the framework of «Homo Ludens ergo Sapiens» project (Complex programme of logic thinking culture forming with the use of training and developing of computer games), allows not only to overcome the drawbacks of both above mentioned approaches, but also to avoid mentioned difficulties of informational and staff character. The main innovation project idea consists of the synthesis of high theoretical teaching level and aims at the development of practical skills in intellectual operations realization. Such combination may be possible due to the use of training and developing games during mastering of the main parts of logic course.

The logic teaching through computer games utilization requires new methodologies, principally changes the traditional practice of logic teaching. One ought to take into consideration some peculiarities of the educational process.

1. The training becomes active process. The schoolboys obtain a real possibility for self-education and self-control.
2. Due to the game character of training, to the presence of competition elements, an increase of motivation is achieved towards acquisition of logic knowledge and skills. Hence, the motive is present in the content of the activity, but not beyond it. The addressing to the theoretical material is stimulated by the desire to reach success in the game.

3. In the course of the educational process a gradual enrichment of the trainee's knowledge takes place. This is reached through the involvement of trainees into the real problem cognitive situations, through the activities, bearing on the certain game material.
4. Just the same psychological barriers are removed, which impede the material mastering. In the case of «face to faces» competition with the computer, the trainee looses the fear of public mistake.
5. The process of logic knowledge acquisition becomes practically oriented. In its course not pure mastering of theoretical material takes place, but rather mastering of certain skills, i. e. finding the concept for certain subject; generalization of the subjects into a class by picking out of their characteristic features; the correct conclusion on the basis of comprehension of simple and complex statements of logic senses; knowledge of the conditions for their truth or falsity etc.

The utilization of computer games as a basis for the school course of logic allows to decide successfully the staff problem (the games initially contain training moment and control mechanism of the training process itself and of material mastering quality, that prevents possible negative consequences of not sufficiently qualified teaching), and also to compensate the absence of text-books (every game is supplied by necessary "Logic minimum" of knowledge according to the corresponding theme).

The game complex includes the games on the following main issues of the Logic Course: "Concept", "Judgement", "Statement logic", "Syllogisti". Such selection is determined, firstly, by central role, which the above themes play in the logic science, and, secondly, by its practical importance for the development of steady skills of logic procedure realization. Finally, namely these themes are the most difficult for the trainees, and, thus, require enlarged attention and additional training.

All the games are designed, in spite of significant thematic and scenario diversity, according to the similar plan. Each game includes several complicity levels and possibility for preliminary training. Apart from that, a special control text is foreseen, which contains the tasks of all levels. Its fulfilment requires the time, which is usually spent on fulfilment of control or individual work, while the results are fixed automatically that provides the possibility for task control. The games are supplied by support system, which includes the description of the game rules and strategy. They are also supplied by a certain minimum compendium of logic tasks, connected with the game theme, which is necessary for successful solving of the game objective.

Currently two games have been already realized and are in the course of approbation in the secondary school. Other games are in the stage of development.

The first game «*Vibiralochka*» (computer realization of V.I. Shalak) on the «Concept. Volume and content» theme simulates the procedure of finding a concept for a given subject. In the course of the game, practical skills are mastered to determine, whether or not different objects possess some complicated feature. Hence, the trainees obtain a strict understanding of «the volume» concept, of volume element of the concept, of the content of the concept, and of simple and complicated features; the sense of logic connection also becomes clear.

In the beginning of the game the figures of funny people (*«logicanchiks»* or inhabitants of Logic country) appear on the screen. They might be similar or differ by form of body, colour, spirit etc. On the bottom of the creen the description of *«logicanchiks»* is presented, structure of which becomes more complicated from stage to stage. It presents the content of the concept of *«logicanchiks, possessing complex feature of A type»*.

The simple features in the composition of this description are presented by graphic pictures, while logical connections are presented by words of natural language.

The task of the player is to pick out during the shortest time those and only those *«logicanchiks»,* which correspond to the description, e.g. which are included into the volume of corresponding concept. Then the description presented in the screen bottom, is changed. For every correctly realized activity, prize points are added, while every mistake are punished by penalty points.

The given level of the game is finished, when the player makes all the game field free, on which a funny pattern is opened, as a reward for good game. As a whole, the game includes seven levels with through control of time and collected points. A possibility is provided to write down the result and to compare it with the achievements of others.

The control test, including the concepts of the most diverse structures, allows to evaluate the quality of the produced skills. According to the results of testing the mark is turned out, which takes into account the number of correct and wrong actions. The results of test are fixed independently of the trainee's desire and might be used by the teacher as one of the knowledge parameter along with the results of regular control works.

The second game *"Three* cards" (computer realisation of A.E. Novodvorsky, P.A.Novodvorsky and A.B. Smirnov) is aimed at the mastering of the theme "Deductive discussions. Syllogisms". With its help the skills are developed for turning out of logic consequences on the basis of simple categorical statements.

The syllogistic of Luis Carroll is put into its base, according to which the correctness control of the syllogisms is carried out with the help of original diagrams.

The game is realized in the form of trick type card game, in which the display of the trick corresponds to turning out of syllogistic consequence from two premises.

That is the reason for the game name - for the display one ought to have three cards: two of them - with premises and one with the conclusion. Three persons take part in the game, while two of the players - computer personages - present the heroes of Carrd's «Ailis». Each of them has his own game strategy, corresponding, from the author's point of view, to the personage character.

Each player gets cards of different suit on his hands: for premises and for conclusion. After each pass the player must expression the Carroll diagram a logic information of the premise, presented on the selected by him card, or to pick out the conclusion from the premise joint information, if he intends to take the trick.

There is a system of points calculation, analogous to that, used in traditional card games, while a penalty is foreseen for the wrong logic actions.

For the knowledge control a special test was developed, where already without any cards the trainee is presented to «solve» several syllogisms, using Carroll diagrams.

It's necessary to note, that games are oriented for children of 12-15 years old. However, as practice shows, even grown ups take part in this game with pleasure. Thus they may be successfully used in the process of logic teaching n high school institutions.

Other games of the complex, which are currently in the stage of finishing off and selection of the game material, are also developed according to scenario. These include both roulette, «puzzles» and even «gallivantings». In the prospect it's supposed to create complex set of training games on logic, which is included into envelope, purposed for Windows.

Apart form this, the envelope would include several accessories, which make it easier to use the game complex in the frameworks of united school course on the base of computer classes. Moreover, it's supposed to write a special educational supplies on logic for secondary school, oriented towards the developed by the authors computer games, and also towards the preparation of methodical and didactic materials for teachers, who work in this programme.

The game complex may be implemented into the learning process not only in the form of logic teaching as an independent learning subject. It may be also used in the school informatics course for supporting of the essential line named "Formation of readiness to the information technology utilization and development of logic thinking, attention and memory" as well as in the work with the school boys in the extra lesson-time (creative hours, facultative, self preparation and self education, testing of intellectual developments of the trainees).

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COGNITIVE COMPUTER GRAPHICS AND LOGIC OF SCIENTIFIC COGNITION

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1. INTRODUCTION: NEW CRISIS OF FOUNDATIONS OF MATHEMATICS

The proof theory is one of the most abstract and complicated sections of modern logical science. Remarkable successes of mathematical logic and meta-mathematics (or what is the same - of the proof theory) in 20-th century caused an illusion, that a theory of logical (deductive, certain) conclusion, whose foundations have been still laid by Aristotel, gained its final completion in the advanced theory of formal axiomatic systems. Really, we say, that within the bounds of some formalism F formulae (statement) X_n is a derivable (provable, true), if there is such a sequence of formula from F

$$X_1, X_2, X_3, \ldots, X_i, \ldots X_{n-1}, X_n, \qquad (1)$$

that a) any formulae X_i in (1) is the axiom or b) any formulae is derived from formula preceding it and c) formulae X_n is the last one in (1). Methodological clearness and conclusiveness of similar definition of logical (and mathematical) *deductive* authenticity of formal considerations seemed final and fixed for a long time. But science (true science) is full of paradoxes and sudden «points of bifurcation»: the theory of formal systems created a theory of algorithms and algorithmic languages, forming a «physiological basis of a present-day machine «intellect» - this highest (I don't assert it in the absolute sense) presently achievements of natural intellect. In this case, we can observe remarkable metamorphoses in the «technology» itself of intellectual deflection of «material and spiritual reality». Today' science is impossible without computers, and modem computer system without computer graphics is absorbed as horse carriage on a runway of an aerodrome. In short, today not only scaling computations, and computer «pictures» become important (and often inalienable) element of a mathematical proof - this historical extremum-rigid polygon for verification of the logical authenticity paradigm itself. In this connection a question about the way how a logical status of the formal proof is transformed, if one (or some) from X in sequence (1) will be replaced by results of multi-hour computer super-calculations or graphical equivalent of such calculations - one or another computer «picture», is not useless by no means. Depending on the answer to this question, mathematicians are today divided into two camps very far from unanimity. One half of mathematicians, mainly connected with a world of advanced computer technologies, believe, that «computers transform methods themselves, by means of which mathematicians devise and prove new ideas». This point of view is most completely expressed by John Horgan in his bright article «Death of Proof» [1]. This article made great noise in the mathematician society and caused multiple and not always benevolent comments. The most bright representative of «radical opposition», i.e. in this case, the most compromiseless adept of the traditional *pro-computer* mathematics was a famous specialist in the field of the algebraic geometry Steven Krantz, which in his bright article «The Immortality of Proof» [2] advance the following three main slogans: 1) traditional mathematical proof is immortal in the sense, that it gives us the absolutely authentic knowledge, which «is a truth today, tomorrow and always», while knowledge obtained with the aid of computations or by analysis of computer pictures can be arbitrary plausible and probably-true, but it will never gain a status of *certain* - true knowledge; 2) computer can be used on secondary technical stages of mathematical considerations, but computer will never be able to prompt to a skilled-mathematician (in its traditional sense) such a new idea, about which he will not be able to guess .independently, i.e. without use of computer and in any case 3)»computer pictures proves nothing» and they will never be able to serve as an argument of a rigorous mathematical proof (in its traditional sense.

We will consider only several logical problems, connected with the third most peremptory slogan of Krantz: show, that under the *certain conditions* . computer pictures can nevertheless serve as quite legitim arguments of absolutely rigorous proofs of general mathematical statements (GMS).

I also note, that the most part of logical and mathematical results, described in this article, are obtained with the aid of computer system DSTCh, based on a *Cognitive Computer Graphics* (CCG) concept. CCG - in contrast to more usual *illustrative* (or photo-realistic) computer graphics - is a *knowledge-creating* or, more accurate, graphics, *favouring creation of new knowledge* ((at the present time, naturally, in head of man).

The CCG system of DSTCh is a Dialog System for CCG-researches of problems of an additive number theory - one of the most abstract (and, consequently, the most extremum for employment of wny graphics) sections of the advanced fundamental science. The unique experience of practical creation of essentially new knowledge in the field of modern number theory by means of a CCG-system of DSTCh, is used in creating a *training* version of this system, in particular, for special course "Authentic Conclusion on Non-verbal Knowledge".

2. PROOF OF GENERAL MATHEMATICAL STATEMENTS WITH THE AID OF COMPUTER

Consider *general* (in sense of traditional classic logics) statement of $\forall_n \geq P(n)$ type for any $n \geq 1$, i.e. statement «for *all* values of natural parameter n=1,2,3 and so on, predicate P(n) is true". On one hand, the traditional mathematics assumes, that GMS of $\forall_n \geq P(n)$ type for any $n \geq 1$ are provable only by the *complete mathematical induction* or by means of *deductive conclusion* from more general statements (for example, from axioms of the appropriate theory). On the other hand, it is quite evident, that it is impossible to prove the truth of such GMS, if for this purpose it is necessary to carry out the successive verification of truth values of predicate P(n) for each value from the infinite set of natural numbers $n \geq 1$:

$$P(1), P(2), P(3), \ldots, P(n), \ldots \qquad (2)$$

In principle, in this case application of computer changes nothing: step-by-step - i.e. from *n* to *n+1* - travel of Infinity is and for any most powerful supercomputer - from the point of view of this Infinity - the same absorbing running in place, as for man.

However, hence it is not follows, that such a GMS are probable only analytically , i.e. without used of computers. Solution of known problem of "four paints" [4] is the most bright and sensational example of proving GMS by means of a computer. Analysis of this example (and naturally several others) allows us to formulate in the explicit form the following sufficiently-evident general method of solving GMS *with the use of computer,* which is naturally to be later called a method «Truncation of Infinite Tail» (TIT) in sequence (2), accounting for its specific features.

Method "Truncation of Infinite Tail"

1. *Prove* analytically, i.e. deductively the *existence* of a *threshold* natural number, designate it as n_0: exists n_0 for any $n>n_0$ P(n).
2. *Determine* (*as* a rule, *analytically*) the *value* of this threshold number no (very nontrivial moment in all theoretical-numeric problems).
3. *Prove* the truth (check with the aid of computer the correctness) of P(n) for *finite number* of cases: for any $\forall n \leq n_0$.

   If stages 1-3 are successively implemented, then thereby
4. We *proved,* that GMS P(n) for any $n \geq 1$ is true.

Today we can assume sensational solution of once more mathematical problem - the known Waring Problem for sums of bi-quadrates (forth degrees) of not-negative integer number, as already classic example of successive application of the TIT method. A *hypothesis* about the fact, that any natural number can be represented in the form of some sum of 19 bi-quadrates is known more two thousands years. However, only in 1986 the international group of mathematicians and software engineers proved the correctness of this - one of the oldest "General Mathematical Statements". In so doing, it is worth underlining, that *existence of* threshold number no has been yet proved in 1925 by Khardi and Littwood (1 stage) - naturally analytically. Once more than half century later Balasubramanian, Deshouillers and Dress [5] first set the order of this threshold number (2 stage): with the use of advanced methods of analytical number theory authors shown, that no is equal approximately 10^{367}. Then, be means of computers they proved (verified) the truth of P(n) and for all $n \leq n_0$.

Hence follows the authentic truth of P(n) for *all* $n \geq 1$. Note, that not only the stage of analytical proof of the truth of P(n) for all $n>n_0$, but also the stage of computer proof of the truth of P(n) for *finite* number $n \geq n_0$ with so magnificent value of the threshold number itself, is a non-trivial one.

3. SUPER-INDUCTION METHOD - NEW METHOD OF PROVING GENERAL MATHEMATICAL STATEMENTS WITH THE AID OF COMPUTER AND COMPUTER PICTURES

Before coming to description of the super-induction method, make one important methodological remark, concerning the GMS notion itself. Till now we considered GMS in its classic form: $\forall n \geq 1$ P(n), that is P(n) for *all* n = 1,2,3,... . However, in mathematics there is a more spread and natural case, when some statement is true not for all n belonging to N (here N designates a set of natural numbers), and for all n belonging to N, except several n belonging N_e, where $N_e = \{n \geq 1 : \neg P(n)\}$ is the so-called *exclusive* set of values for natural parameter n or set of *counter-examples* for predicate P(n). It is considered, that the specified-type GMS is *proved completely,* 1) if proved, that it is true *for all* n belonging to N, except n belonging to N_e and 2) if *structure* of exclusive set N_e is determined *explicitly,* i.e. it is known what values n belong to N_e. It is evident, that specified here sense of GMS is *generalisation* of the traditional one: if exclusive set is empty, then we return to traditional form of GMS in the shape of P(n) for all $n \geq 1$. We can give a variety of examples, showing, that in mathematics just these exclusive values n belonging No often contain information, which is the most valuable for further investigations.

As it was mentioned above, we have studied the logical structure of such proofs with the aid of a man-computer CCG-system of DSTCh, based on conception of *cognitive computer graphics* [3,6,7]. These investigations allowed us to see, *formulate and substantiate a new method* of proving GMS [7]. What about its name, there were few alternatives: the nearest analogue - classic deduction according to J. S. Mill' - presents a *plausible* conclusion "from *particular* to general", that is why it was natural to name an *certain* conclusion "from *unit to general»* just *SUPER-induction.* We will specify its complete and rigorous statement.

Super-Induction Method

1. *Construct (i.e.* devise) and *prove* analytically *(deductively)* the *conditional* statement of the following rather exotic form:

$$\exists n^* Q(n^*) \rightarrow \forall n > n^* P(n),$$

with $Q \neq P$ is the *essential* condition.

2. *Search* (usually with the aid of a computer, but may be on computer picture and there is also a possibility in principle to carry out the traditional search manually) *exotic* in the definite sense *-unique* - natural number n*, having property Q (usually Q - some combination of nontrivial theoretical-numeric properties).

If we can find such a number (this result is not generally guaranteed beforehand), then

3. *Proved the truth of unit antecedent* $\exists n^*Q(n^*)$ of our implication.

4. From the proved truth of statements $\exists n^*Q(n^*)$ and $\exists n^*Q(n^*) \rightarrow \forall n \geq n^*P(n)$, it follows according to *modus ponents* the *certain truth of general consequent* $\forall n \geq n^*P(n)$.

5. *Perform* successive verification (usually on a computer, but may be done by a picture or even by means of manual count) of truth values of predicate P(n) for all $n \leq n^*$ and *explicitly express* (create) finite exclusive set $N_e = \{1 \leq n \leq n^* : \neg P(n)\}$.

If similar verification of P(n) is implemented for every n=1,2, ..., n* (what is not always performable for great n* even with the aid of the most powerful supercomputers), then:

6. *Proved and absolutely strongly the following GMS,* $\forall n \geq 1 P(n)$, кроме $\forall n \in N_e = \{1 \leq n \leq n^* : \neg P(n)\}$.

So, the essence of the super-induction method consists in substitution of direct absolute and therefore usually complicated *analytical proof* $\forall n \geq 1 P(n)$ for proof of two statements: some *conditional* statement $A \rightarrow B$ and *unit* statement A. Such a substitution is connected with appearance of very important degree of freedom:
we can now carry out the choice of statement A so, that to maximally simplify both the stage of analytical proof of our very nontrivial implication A ->B and subsequent computer proof of unit statement A. Such a proof of unit statement A can be very often reduced to imposing some CCG-image of corresponding abstract mathematical object and *make the proof clear* (i.e. directly visible by eyes) - in compliance with well-known criteria "clearness and distinctness" (Descartes and Leibniz), "evidence of initial intuition" (Kronecker and Brauer), while obtaining certain mathematical knowledge.

Consider two examples of rigorous proof of GMS by means of the super-induction method and ... a computer picture.

Example 1

Fig. 1 shows colour-music (of course, on a computer screen) CCG-image (pythogram) of new theoretical-numeric object - invariant set Z(1,3) of Generalized problem of Waring (GPW), devised with the aid of CCG-approach. This pythogram is «read» as a page of standard book from left to right and from top to bottom, but only with the use of numbers: 1,2,3 ... and so on with 21 numbers per row. Black squares-numbers are elements of set Z(1,3). However, we don't know, if we see in front of ourselves all elements of set Z(1,3) and there are other black squares «beyond frame"? In other words, this computer picture allows us to formulate sufficiently plausible *machine hypothesis* about the fact, that number 149 is the maximal (last) element .of set Z(1,3). Show, under which conditions one *and the same* computer picture can become an *argument of strong* (in the sense of traditional mathematics criteria) proof of this hypothesis.

The sought implication A ->B is the following statement: "*if* (A) exists (though one) black square, which is directly followed by at least 7 white squares, *then* (B) and all subsequent squares are white". This implication was

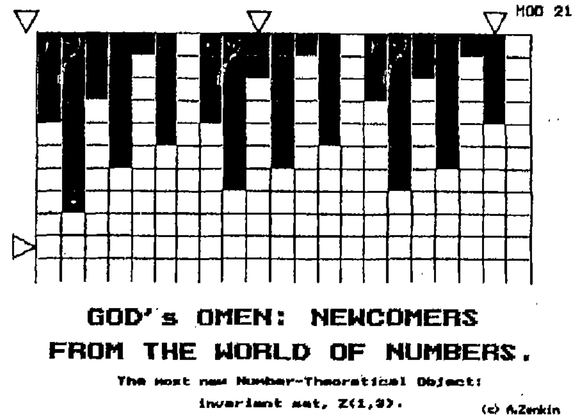

Fig. 1. Pythogram of invariant set Z(1.3) for Generalized problem of Varing

proved analytically, naturally, in more general form [8]. In this case, it remains to prove the truth of *unit* statement A, i.e. to *find* such a black square, which is followed by at least 7 white squares. For this purpose, look at pythogram, see a black square marked (only for demonstration purposes) with a white asterisk and showing natural number 149, which is followed by a row of white squares in a number, evidently exceeding 7 (you may not count) - it is a very essential moment. Thus, *unit* statement A is proved (just proved) not only by a *clear* method, but by a method directly **seen** *by eyes*. Hence, according to modus ponents it follows, that (B) marked square-number 149 is really the last black square, as set Z(1,3) is *finite* and we see all its elements in front of ourselves. It is not difficult to see, that - not in direct and in «usual» figurative sense - that we prove the following GMS: *«Any* (notorious *all)* natural number n>149 does not belong to set Z(1,3) and among all numbers n<149 only the following black squares-numbers (see picture): 1-6, 8-13, 15-20, 22-25, 27, 29-32, 34 and so on are elements (here matching with *exclusive)* of set Z(1,3) - the rest elements of set Z(1,3), not written here explicitly, we can *physically see* on pythogram in Fig. 1.

Example 2

In Fig. 2 we already see an entire cartoon film about application of the super-induction method for visual proof of known theoretical-numeric theorem, proved in 1933 by American mathematician G. Pall [9] with the use of methods of usual pre-computer mathematics. Without going into details note, that this proof takes several pages of compact text. The essence of general statement, proved by Pall, consists in the following: «With $s \geq 6$ only numbers s+1, s+2, s+4, s+5, s+7, s+10, s+13 have theoretical-numeric property P(n)» (any one, who wishes to familiarise himself with details of this proof can do it in [1,8]). Within the bounds of the super-induction method we «devised» and proved analytically the following implication: «if (A) there is a natural number n*, simultaneously representative by sum of first, second, third, fourth and fifth squares of integer numbers, then (B) for any n>n* the square is white». Then by means of a computer we found the minimum of these numbers:

$$n^* = 169 = 13^2 = 12^2+5^2 = 12^2+4^2+3^2 = 11^2+4^2+4^2+4^2 = 10^2+6^2+4^2+4^2+1^2.$$

Thus, both A and $A \rightarrow B$ are proved. Consequently, according to *modus ponens* B is true, i.e. there are no white squares *«behind"* number 169 (marked with asterisk on pythograms with s≥4). Everything, that took place *«prior to it»* is before your eyes: if take into account, that the first number on all given in Fig. 2 pythograms is natural number s+1, then on pythogram s+6 we see, that only numbers 6+1, 6+2, 6+4, 6+5, 6+7, 6+10, 6+13 are black squares-numbers, having property P, i.e. we see *evident proof of* Pall theorem. As it is known, the Pall theorem was. the first step towards very nontrivial generalisation of

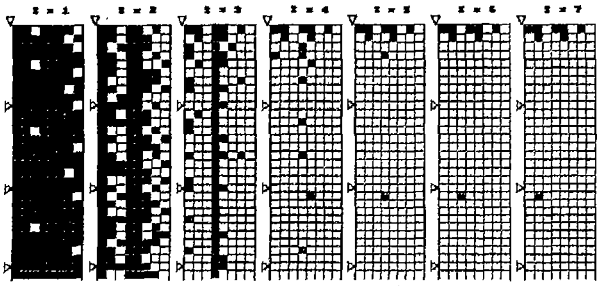

Fig. 2. Visual proof of theorem of G. Pail: g(1,2)=6 or on language of cognitive graphics «It is sufficient to use six frames for stabilising the number of black squares». Here sign «» in 21-th row is used for marking outstanding number n*(1,2)=169, and the first number in the row of every s-th pythogram is number s+1 for all s from 1 to 7.*

known problem of Waring. However, more than half-century have passed before we can see such a potentiality and do the next steps towards this direction: only the CCG-approach allowed us to *see* (in direct sense of this word), that Classic problem of Waring (CPW), which was researched for more than two hundred years by Euler, Lagrange, Gauss, Legendre, Gilbert, Hardi, Vinogradov and many other outstanding mathematicians of XVIII-XX centuries, presents only 0 storey of some essentially more infinite-storey theoretical-numeric structure - Generalised problem of Waring. It is evident, that for travelling between "storeys" of this new «mathematical Babylon" a new technology of "altitude ascent" was required and I could not make bold to put down to "blind" occasion the wonderful Fact, that just the super-induction was the very universal and high-efficient "lifting mechanism", which enables us to carry out successive, reliable and safe lifting over multiple "storeys" of this far-leading problem [8,10]. In any case, from such an altitude we may look over many quasi-scientific palisades, which seem absolutely inaccessible and eternal.

4. MAIN DIFFERENCES BETWEEN SUPER-INDUCTION METHOD AND ITS NEAREST ANALOGUES

Let us briefly dwell on basic differences between the super-induction method and its closest analogues.

a. Mathematics rather often uses a method of substituting the direct - and, as a rule complicated -proof of GMS, for example, B to a proof of some *conditional GMS* of A → B type. The proof of the Great Ferma theorem (GFT) is a bright example of similar substitution: as is known in 1986 American mathematician Kenneth Ribet proved the truth of *implication:* (Hypothesis of Taniyama-Shimura) → GFT, and several years later another American mathematician Andrew Wiles analytically proved not GFT at all - as many think - and «only» Hypothesis Taniyama-Shimura, i.e. *antecedent* of this implication. But, as we know, this is sufficient to conclude according to modus ponens the *certain truth of consequent,* i.e. of famous GFT. So, in this proof GMS of GFT (B) is concluded analytically from *more general* GMS - Hypothesis of Taniyama-Shimura (A) and, naturally, that the proof of GMS of such degree of generality is possible only *analytically,* what was demonstrated by A. Wiles. Within the limits of the super-induction method situation is quite different: GMS (B) is concluded (deduced) also analytically, but from *unit* statement (A), whose truth can be completely established (and really done) with the aid of a computer or even with the use of colour-music cognitive computer images-pythograms.

b. Within the bounds of the TIT method (see above) first, we *analytically prove the existence* of a threshold number no, then (again analytically) determine the value of this threshold number and only at the final stage verify values P(n) on end range [1, n_0] by means of a computer. In the super-induction method we, first, devise *exotic implication* (this stage is missing in the TIT method), then we *analytically prove the truth of this implication* (but not the existence of a threshold number, as in the TIT method); and at last we *find* with the aid of a computer (or in simplest cases - with the aid of CCG-pythograms) the *unit* unique natural number n* with assigned set of theoretical-numeric properties Q(n*). We don't prove its existence and even can't guarantee it. But, if such number n* *exists* and is we can find it, then we «only» prove *the truth on unit antecedent* (this stage is missing in the TIT method) and further we act similarly to the TIT method and prove the required GMS by means of a computer or corresponding pythogram).

c. Consider a method of complete mathematical induction in its most general form [11]:

$(P(n_0)\ \&\ (\forall n \geq n_0(P(n) \rightarrow P(n+1)))) \rightarrow \forall n \geq n_0\, P(n)$.

Here there is some analogue of a "threshold" number $n_0 \geq 1$ (initial step of induction), there are two implications, however, there is only one predicate P(n). At the same time, the specific feature of the super-induction method is presence of just two non-identity predicates in its implication: predicate Q in antecedent of implication and predicate P - in its consequent. In this case, as we earlier underlined $Q \neq P$.

Thus we may ascertain, that the super-induction method essentially differ from all its nearest analogues.

5. CONCLUSION: CCG-MAKING OF CARTOON FOR TRUTH BEARS CONSENT

As it is known, great mathematician and philosopher Leibniz was a principal opponent of proving problems by discussion: "What we discuss for? - Let us sit down and *calculate...* the best solution!". So or almost so he said. New information technologies, possibly, will also soon create new methodology of visually proving the logical and mathematical statements and .respectively, correct a theory of taking decisions of the founder of many mathematical calculus: "What we discuss for? -Let us sit down and *watch a* cognitive colour-music cartoon film about the best solution of problems, which separate us at present!".

Appreciation. *The author express sincere thanks to academics G.S. Pospelov and D.A. Pospelov, and professors V.A. Smirnov, E.D. Smirnova, Yu.I. Ivliev and A.G. Barabashev for useful discussion of a number of problems, covered in this work. He also thanks Anton Zenkin for creating software complex DSNT, with the aid of which he could obtain new scientific results and create all listed here (and many other) pythogrammes of theoretical-numeric objects. This work is supported by grants of International Scientific Foundation of John Soros (No ZZ5000/114), Russian Scientific Foundation Pertaining to the Humanities (No 96-03-04165), Russian Foundation for Fundamental Researches (No 96-06-80657) and the Ministry of Science of RF (Project No 05.04.1221).*

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The original is presented in Russian

Part II

MATERIALS OF WORKSHOPS

Within the framework of the Congress, besides the Plenary and commissions meetings, the workshops on the following 12 topics were made:

1. Information Superhighways and Education

(part I: Perspectives and problems related to development of world and regional common information space for the field of education; part II: From information literacy to information culture).

2. The Psychological-pedagogical impact and the medical consequences of the application of modern information and communication technologies.

3. The software environment - A perspective for effective involvement.

4. Transfer of knowledge and skills through information and communication technologies.

5. National policy - transfer of technologies.

6. Individual distance training.

7. Analysis of UNESCO/IFIP documents published in 1994-1995 (part I: "Informatics for secondary education – A curriculum for schools"; part II: "A modular curriculum in computer science").

8. Logics, Informatics and Education.

9. Information technologies and humanities education.

10. Development of pre-university education via modern information technologies and methods.

11. Medicine: new approaches to knowledge acquisition and improvement.

12. Forming integrated world data bases and knowledge about planets of the Solar System and their use in research and education.

Among supervisors of workshops there were famous scientists, methodologists and organizers of education, among them:

- **David Walker (United Kingdom) - Consultant of DW Associates Company;**
- **Peter Waker (South Africa) - Consultant of IFIP Technical Committee 3 - Computer Olympiad;**
- **Alain Meyer (France) - Director of TV-education Centre of the National Conservatory of Arts and Trades (CNAM);**
- **Tom J. van Weert (he Netherlands) - Director of School of Informatics, Faculty of Mathematics and Informatics, University of Nijmegen, Chairman of Working Group 3.2 IFIP;**
- **Harald Schütz (Germany) - Research Consultant of Deutsche Welle Internet;**

- **K.K. Kolin (Russia) - First deputy director for Research Institute of Problems of Informatics (Russian Academy of Sciences);**

- **Yu.N. Afanasiev (Russia) - Rector of Russian State University for the Humanities;**

- **A.L. Semenov (Russia) - Vice-chairman of Moscow Committee of Education, Rector of Moscow Institute on Professional Development for Educational Staff;**

- **N.N. Evtikhiev (Russia) - Rector of Moscow Institute of Radio Engineering, Electronics Automatics (Technical University).**

Below we expose the main results of the workshops, summaries and recommendations proposed by participants of these workshops.

INFORMATION SUPERHIGHWAYS AND EDUCATION

Supervisors:
K.K. Kolin,
Sh.Sh. Chipashvily,
S.A. Khristochevsky (Russia)
H.Schütz (Germany)

The purpose of the workshop was a *discussion on problems of creating a «uniform» information area for education sphere on the basis of modem and prospective information and communication technologies (including superhighways); problems, connected with school education and balance of «fundamentally» in curricula and «racticality» in the course of Informatics.*

THEMES OF STATEMENTS:

1. *Search of a balance of demand and supply in net education.* (M.A. Guriev, Deputy chief of Department on Analysis and Forecasts of the President administration Analytical Department, Russia).

2. *Role of WWW-technologies in education.* (A.B. Nikitin, Specialist of Decision Development Department of C.I.S. Computer IMC, Russia).

3. *Social and cultural effects of Internet in the countries with developing market economy.* (A.Yu. Zotov, President of Board of Regional Public Centre of Internet Technologies, Russia).

4. *Information superhighway and distance learning.* (Jan Wibe, Chairman of Working Group IFIP 3.6 «Studies in the field of distance learning», Norway).

5. *Virtual computer club.* (G.A. Pachikov, Vice-president of «Paragraph» JSC, Russia).

6. *Problems of distance learning and application of Internet in the sphere of education in regions and districts of Russian Federation.* (E.K. Henner, Head of Information Chair of Perm State Pedagogical University, Russia).

7. *Deutsche Welle - first German broadcaster, suggesting regular broadcasting by Internet.* (H. Schutz, Associate of Deutche Welle Internet, Germany).

The following participants took part in the discussion:

- D.O. Smekalin - Head of Department of .Ministry of Education of the Russian Federation;
- A.D. Ursul - President of Noosphere Academy, Head of the Chair of Ecology and Noosphere Studies of Russian Academy of State Service at the President of Russian Federation;
- S.A. Khristochevsky - Head of Department of Reserach Institute of Problems of Informatics (Russian Academy of Sciences);
- Betty Collis - Chairman of Working Group IFIP 3.3 "Researches in the Field of Education Informatics", The University of Twente (the Netherlands);
- Mike Aston - Director of the Advisory Unit "Computers in Education" (UK);
- A.Yu.Uvarov – Head of laboratory "Telecommunications in Education" of Scientific Council on problem "Cybernetics" of the Russian Academy of Sciences;
- A.Yu. Kushnirenko - Author of the text-book on informatics (Russia);
- I.V. Sokolova - Head of the Chair of Moscow State Social University;
- A.V. Petrov - Head of the Chair of applied informatics of the Russian Academy of State Service at the President of the Russian Federation.

As a result of discussion, new trends were revealed in the education informatics and recommendations for different regions considered on the problems of applying informatics to the education. The experience of various countries was used as a base for discussion.

It was pointed out that the necessity exists of providing an access to information superhighways for a great number of educational institutions. The participants marked the necessity to make a demarcation line between the commercial and scientific information flows, as well as to assert "self-restriction code", at the treatment of the information superhighways for ensuring complete satisfaction of educational institutions requests. The reporters expressed the idea of introducing special courses in the higher classes of secondary schools, colleges and universities with the aim of teaching proficiency of using information superhighways, including principles of navigation through the information world, and also the expedience of making changes in curricula for organizing independent students researches with using of Internet.

The participants also supported the idea of necessity to intensify educational process, as this idea is a strategic one for developing the entire educational system on the threshold of 21st century and for future civilisation progress as well.

High importance of developing new principles for studying informatics as a fundamental scientific discipline was emphasised by analysts.

It was recommended for UNESCO and States-members to support an initiative of Russia concerning new principles of studying informatics in higher and secondary schools. These principles should provide arrangement of new ideas connected with the role of information and information processes in nature and society. In this case, much thought should be given to the fundamental laws of informatics implementation in the social life, the effect of the above process on both social economic structures and the human being role in the modem society. For this purpose, the decision was taken to carry out an international project "Informatics -2000» under aegis of UNESCO, which should result in development of the improved module program for studying fundamental principles of informatics for universities, technical and humanitarian institutes, and also lyceums and colleges.

It was established that information society creation demands an equal access to the information at any area of the world and it should be a key point of educational systems in various countries taking into account all the abundance of national and religious traditions.

It was recommended to introduce into curricula of; pedagogical universities and colleges the new profession for teachers: teacher-methodologist (script writer) on creating and using training multimedia products and "Informative culture" course as well.

It was offered to create under the aegis of UNESCO regional and national centres of system investigations on applying informatics to secondary school, in which data on researches and applications of information facilities during training process should be systematized and generalized.

The participants recommended for States-members to develop national programs on applying informatics to education. One of elements of such programs should be the state support of expensive preparation of electronic multimedia manuals.

It was recommended to begin under the aegis of UNESCO the development of the program "Electronic Art Centre in School" (another name - "School Electronic Library").

Workshop 2

THE PSYCHOLOGICAL – PEDAGOGICAL IMPACT AND THE MEDICAL CONSEQUENCES OF THE APPLICATION OF MODERN INFORMATION AND COMMUNICATION TECHNOLOGIES

Supervisors:
I.V. Robert, A.M. Bolshakov
(Russia)

The purpose of the workshop was a *discussion on problems concerning psychological and pedagogical effect and medical consequences of applying modem information and communication technologies.*

THEMES OF STATEMENTS:

1. *Teaching computer programs and problems of psychological health.* (V.V. Rubtsov, Director of Psychological Institute of Russian Academy of Education, I.M. Ulanovskaya, Senior researcher of the above Institute, Russia).

2. *New information technologies in education and the state of pupils' health protection.* (A.A. Baranov, Director of Scientific and Research Institute of Hygiene and Prevention of Diseases of Children, Juveniles and Youth, Russia).

3. *Information-subject medium with built-in elements of training technology on the basis of applying facilities of informatization and communication: psychological and pedagogical effect: prospects of applications.* (I.V. Robert, Head of the Centre for Informatization of Education of the Institute of General Secondary Education of Russian Academy of Education, Russia).

4. *System for protecting pupils' health with the use of new information technologies.* (A.M. Bol'shakov, Head of the Chair of Informatics and Health Protection of Sechenov Moscow Medical Academy, Russia).

5. *Medical problems of organizing studies with the use of personal computers in pre-school child institutions.* (L.A. Leonova, Head of Laboratory of Age Physiology of Russian Academy of Education, Russia).

6. *Physiological cost of applying automated training systems on the basis of personal computers in training of medical personnel and factors, affecting it.* (V.R. Kuchma, Head of a Chair of Sechenov Moscow Medical Academy, N.A. Bobrishcheva-Pushkina, Senior lecturer of the above Academy, Russia).

7. *Special features of differentiation of the content for informatics training at the last stage of school.* (A.A. Kuznetsov, Chief researcher of the Centre for Informatization of Education of Institute of General Secondary Education of Russian Academy of Education, T.A. Zakharova, Consultant of the above Centre, Russia).

8. *Problem of the adaptation of training programs for individual features of a trainee within the frames of ecological paradigm.* (A.S. Molchanov, Head of the Laboratory of the Institute of System Analysis of the Russian Academy of Science, V.N. Krut'ko, Head of laboratory of Moscow Sechenov Medical Academy, A.M. Bolshakov, Head of the Chair of Informatics and Health Protection of the above Academy, Russia).

9. *Actuality of international education projects organization, with using of new information and communication technologies, with the aim of forming the outlook of juveniles (hygienic aspects, AIDS, drugs) and developing the active ecological attitude of a child as a member of world society.* (T.B. Malykh, Lecturer of the Military Aircrft Engineering Academy, Russia).

10. *Computer and PC user health.* (I.G. Getiya, Head of the Chair of Ecology and Safety of the Moscow State Academy of Instrument Engineering and Informatics, V.K. Shumilin, Senior lecturer, Russia).

11. *Hygienic aspects of students and pupils work with video terminals.* (E.A. Geltishcheva, Senior researcher of Moscow Erisman Scientific and Research Institute, Russia).

The following issues were discussed:

- influence of applying new information technologies (NIT) on pupils psychological health and development of system for protecting pupils health at NIT applying;
- hygienic aspects of work of trainees with video terminal;
- medical aspects of training with the aid of computers in pre-school institutions;
- psychological and pedagogical effect of applying information-subject media with built-in elements of training technology, developed on the basis of information and communication aids;
- adaptation of curricula to individual features of pupils within the frames of the ecological paradigm;
- organization of international educational projects, using new information and communication technologies with the purpose of creating of the outlook of juveniles and developing the active ecological attitude of a child as a member of world society.

As a result of discussion there was developed a declaration for "Psychological and pedagogical impact and medical consequences of applying modem information and communication technologies" UNESCO project. The main objectives of the project are as follows:

1. Performance of short-term pilot investigations of problems how NIT effect on development and state of health of a trained person in pedagogical, psychological and physiologic-hygienic directions.

2. Development of psychological and pedagogical, physiological and hygienic recommendations on applying NIT for developing the personality of a trained person, preparing the rising generation for living under conditions of the modem society and creating teaching systems, connected with general medical problems of the world society, allowing for psychological, cultural and ethnic peculiarities of perception for children and juveniles.

3. Development of courses for training and rising the level of skill of pedagogical personnel on problem of applying NIT in education, accounting for psychological, cultural and ethnic peculiarities of trained persons. One of such courses provides teaching of applying advanced technologies, ensuring information interaction on the basis of multimedia, telecommunication networks and technology "virtual reality". Scientific and educational organisations of a number of countries: Russia, United Kingdom, Bulgaria, Malaysia, Georgia can take part in this project.

4. Development of unified international standards of the pedagogical and ergonomic quality of hardware, information and communication aids, used in educational purposes.

Workshop 3

THE SOFTWARE ENVIRONMENT - A PERSPECTIVE FOR EFFECTIVE INVOLVEMENT

Supervisor:
D. Walker (United Kingdom)

The purpose of the workshop was *showing-up of points of view for representative of educational and industrial spheres for determining prospects, needs, restrictions and possibilities for co-operation. The main attention was paid to opinions of users, hardware and software engineers, companies engaged in hardware production.*

There were noted great scales of the software commercial market with a scope of operations up 60 billion dollars per year. It's worth mentioning that about 30 % of these operations cover the educational sector, what makes education an important part of the market. At the same time, end-users still slightly influence on the developed assortment of products, as production branches are firstly guided by scales of market and its potentiality. The software is significantly affected by the companies-developers.

A review of software and hardware market was made. It was noted, that modern program environment is not a completely integrated in the market. There is a need in creating a model, which can let user gain a possibility to take active part in the integral development of the market segment, meeting relevant needs and giving specific results. It was indicated the necessity to achieve mutual understanding with respect to curricula for all educational specialists and the requirement in realistic and effective joint projects in educational and industrial spheres, and also in creating infrastructure for supporting such a program for strengthening active partner co-operation.

Workshop 4

TRANSFER OF KNOWLEDGE AND SKILLS THROUGH INFORMATION AND COMMUNICATION TECHNOLOGIES

Supervisors:
A.L. Semenov,
E.I. Bulin-Sokolova,
P.A. Yakushkin (Russia)

The purpose of the workshop was to *familiarize participants of the Congress with new directions in the field of educational information and communication technologies with an accent to integrated solutions for primary and secondary school and with new content and integrative tendencies of the education field «Technology».*

The following participants took part in the discussion:

- S.F. Soprunov - Head of LOGO-department of the Institute of New Education Technologies (Russia);
- G.B. Shabat - Teacher of mathematics, Lyceum "Vorob'evy gory», President of Club of experimental mathematics (Russia);
- David A. Tomas - Professor of mathematics, Montana State University (USA).

General directions of workshop were as follows:

- information technologies for teachers of any teaching subjects;
- computer aid mathematics and language teaching in primary schools;
- time and space notions in the "Technology" field;
- Moscow regional policy of introducing information technologies into schools.

These directions consider ways of applying computer environment to intensify using of visual methods and motivation of pupils during the classes; problems of adaptation of program environments to regional and national curriculum; unique structural approach aimed at development of high-level thinking and abilities for creative solution of problems; information processing facilities and integrative tendencies; strategic planning, experience of realisation of specific projects and programs of retraining of teachers.

The participants of the workshop took a visual idea and real experience of work in the information environment of the educational institution, including those on such classical directions, as studying natural sciences, geometry, mother and foreign languages, as well as of design-research approach, based on creative developing environments. The participants familiarised themselves with the best examples of software and hardware of a number of firms and gained an idea about practical ways to cooperation on introducing advanced information technologies into educational systems of their countries.

Workshop 5

NATIONAL POLICY — TRANSFER OF TECHNOLOGIES

Supervisor:
P.Waker (South Africa)

The purpose of workshop was to *discuss problems of co-operation of business and industrial circles with the educational sphere for improving the teaching/training systems when applying information and communication technologies.*

It was noted that many countries collide with similar problems when applying new technologies in education, in particular, with overload of curricula, lack of financial, physical and human resources. In addition to this, different countries and different education systems in these countries implement essentially different policy for settling these problems. It was suggested, that those, defining the policy in each education system, accounted for errors and achievements of the other systems. Discussion of successful experience and failures in the policy allowed to develop some proposals for accomplishing more effective policy.

In the course of discussion there was noted the necessity to bring national, regional and international industrial and financial establishments to application of the potential of new information and communication technologies as facilities for expanding an access to education and educational possibilities for various groups of population. State should develop national strategies for introducing information technologies into their education systems, taking account of social, cultural and economic conditions.

There were discussed problems of creating curricula for school. In this process it is necessary to clearly know, who should supply studying information, what general and special purposes should exist. When realising the developed program, one should answer the questions about facts, who should teach, *what* should he teach, *where* should he teach and *when* should he teach; provision should be made for assessing the level of teacher training, carrying selection and distribution of new training equipment, including software. Schools should organise the teaching process in a new way, allowing for specifics of training with the use of new technologies.

The effectiveness of policy in applying new information and communication technologies is determined by a degree of achievement of set purposes, by evaluating the effectiveness of the curriculum and accepted method of its realisation, by a possibility of revealing possible negative consequences and methods of their elimination.

Workshop 6

INDIVIDUAL DISTANCE TRAINING

Supervisor:
A.Meyer (France)

The workshop was arranged for the representatives of French speaking countries with the purpose of discussion of the problems of distance education through modem information and communication technologies

The director of the Centre for Tele-Education (CTE) Dr. Meyer presented his lecture on distance training experience at CTE under National Conservatory of Arts and Trades (CNAM). He reported about major activity directions of the above Centre, about the reasons that resulted in distance training implementation. In particular, he mentioned the fact that the great majority of those people who needs training lives far from cities and cannot use the services of traditional training system. In this case the distance training is the only possible way for solving the problem.

The strategy for distance training depends upon one of the two situations as follows:

- the case when training and learning processes are carried out simultaneously;
- the case when the above processes are separated in time; a teacher has to realize the process of knowledge transfer through a mean or a carrier (CD-ROM, database). This self-training situation invites more active participation of the trainee and thus results in deeper knowledge.

The system for distance training in CTE comprises the following training types:

- individual self-training by means of books and floppy discs;
- team training where great attention is paid to information exchange among trainees;
- distance control and supervision by a teacher;
- distance report and synopsises;
- meetings of teacher and trainees.

The trainees use *TeleSite* software which is unitedergonomic interface providing wide range of services with the purpose of both work with central server databases and connection with a teacher. The above interface is designed as "user-server" system, which is based upon state global computer network.

The TeleSite system was developed for dealing with various pedagogical problems. It can be used under various conditions and with various purposes: for basic training, for continuous training, for professional training at various enterprises etc.

Standard protocols for computer data processing and transfer are used in TeleSite system thus eliminating the barriers for connecting of various institutions to the TeleSite. However, in this case special training of teachers shall be carried out with the purpose of mastering the peculiarities of teaching •under special conditions of distance training. The specialists in the sphere of informatics shall be also retrained.

As far as there is no special distance system for knowledge evaluation in TeleSite, at SNAM the conventional system of exams and tests is used.

Though installation of the system requires serious investments, its servicing is rather cheap (it comprises payments for user's time of telephone line and SSDN computer network during learning data exchange). In the cases when we need constant control of the learning process, i.e. for teaching and tutor's support of several disciplines, for instance of foreign languages the servicing is .comparatively expensive as to high expenses for teachers' salary. In the above case self-learning is not sufficient.

TeleSITE implementation requires that the learners are self-supporting, executive and disciplined. That is why pedagogical support requires serious expenses and efforts in the cases when the groups of learners have low initial level of knowledge.

Similar projects are realized in Mexico and Tunis, and both comparison of these projects and exchange of the obtained experience are desirable.

In conclusion Mr. Meyer emphasised the fact that individual distance learning provides access to knowledge for all need it and improves the following characters of both teachers and learners: skills of self-supporting, excessiveness and discipline, for rational time distribution and information exchange with other learners, skills for information search and selection by means of PC and other skills which are so necessary on the threshold of the third millennium.

Workshop 7

ANALYSIS OF UNESCO / IFIP DOCUMENTS PUBLISHED IN 1994-1995:

PART I : «INFORMATICS FOR SECONDARY EDUCATION - A CURRICULUM FOR SCHOOLS»;

PART II : «A MODULAR CURRICULUM IN COMPUTER SCIENCE»

Supervisor:
Tom J. van Weert (the Netherlands)

For expanding and improving the effectiveness of application of NIT in education UNESCO in cooperation with IFIP have developed two documents, specified in the name of workshop and containing curricula and syllabuses for systems of secondary and higher education, which, in particular, enable to provide deep training on informatics and allow for prospects of its development. The participants of workshop discussed these documents and those connected with them.

It was specified that development of informatics as a *science* permits to apply technological innovations in information and communication technologies (ICT). On the other hand, informatics and ICT depend on processes, occurring in society. Social and technological development define the content of studying the informatics both at the level of secondary school, and at the level of higher education establishments. For countries which just began to develop the informatics and to apply ICT, it is especially important to train skilled personnel with strong information base, which, in its turn, will permit them to use advantages of new approaches to education. The specified syllabuses are developed just for supporting such trends. Both programs enable to accomplish qualitative studying and, beside that, allow for important development tendencies.

It was noted that integration of information and communication technologies expands the possibilities of personality development, and also favours the support of new type of study organisation for every person, as use of NIT leads to development inductive thinking of man, its abilities for generalization, taking decisions, orientation in dynamically varying situation, and also to development of abilities for working in collective, skills in conceptual approaches to problems under complex, various operating conditions.

There was considered interaction of informatics and NIT in education. It was underlined, that informatics is a *science,* having many important applications, which together *comprise technology:* information technology. Owing to importance of such a technology it is necessary to define the subclass of informatics -*Applied informatics.* In so doing, *Fundamentals of informatics* include elements (programming, development of program products, theoretical foundations of informatics, mathematics), which are common for all application programs. During practical employment informatics and information technologies can be combined with the other sciences or technologies, forming so called "information science" or "information technology". "Information and communication technology» serve as an example of such an information technology.

As applied to secondary education, it was pointed out hat for providing the possibility of pupils to work in conditions of dynamically increasing complexity of the world, it is necessary to study them to create dynamic models of real processes. Conceptual programming language appear, which allow to easily model real processes. It was noted that such an approach to programming is reflected in UNESCO/IFIP curriculum for secondary school, which is named there "Modelling with application of subject-oriented programming". All pupils can study application of information technologies by the interactive way in the other teaching subjects, in this case, information technologies serve as power training mean and permit to account for individual possibility of trained persons. Beside that, applied informatics is important when carrying particular tasks or during additional lessons.

When analyzing processes taking place in systems of higher education, it was noted that possibilities of hardware are spread very quickly, however the most important matter is development of software. In some cases it was noticed close connection between sphere of application and informatics, in so doing, models, methods and technology of informatics essentially depend on concrete application. In particular, one of important fields of application are scientific calculations. All these applications are considered in document «A modular curriculum in computer science".

It was expressed a proposal for UNESCO to support organization of workshops for possibility of using UNESCO/IFIP curriculum "Informatics for secondary education» in developing countries.

Workshop 8

LOGICS, INFORMATICS AND EDUCATION

Supervisor:
Yu.V. Ivlev (Russia)

The purpose of the workshop was *discussion of problems of applying logics in computerization of education processes, as well as of role of informatics in teaching logics. There were shown logic means, suitable for modelling thinking processes on computers.*

THEMES OF STATEMENTS:

1. *Training and developing computer games as a foundation for teaching logics in school.* (D.V. Zaitsev, Senior lecturer of Moscow Lomonosov State University (MGU), V.I. Markin, Senior lecturer of the same university, O.Yu. Karpinskaya, Co-president of Council of Fund «Ratsionalist», Russia).

2. *Electronic manual* "Course *of logics».* (V.A. Bocharov, Professor of MGU, I.P. Golovanova, Researcher of MGU, A.E. Gorchakov, Senior researcher of Institute of Geosphere Dynamics of the Russian Academy of Sciences, A.A. Il'in, Engineer of MGU, E.B. Kuzina, N.I. Kiselev, Senior lecturer of MGU, Russia).

3. *Application of systems for automatic search of conclusion for studying logics.* (A.V. Smirnov, Deputy director of Institute of Logics, Cognitology and Development of Personality, Russia).

4. *Application of systems for automatic search of conclusion for studying deductive logics.* (V.I. Markin, Senior lecturer of MGU; A.E. Novodvorsky, Head of group of Institute of Logics, Cognitology and Development of Personality; A.V. Smirnov, Deputy director of the same Institute, Russia).

5. *Experience of teaching logics to philosophers with the use of computer program DEDUCTIO.* (I.E. Gerasimova, Senior scientist of institute of Philosophy of the Russian Academy of Sciences, Russia).

6. *Analytical classification in logics and informatics.* (K.I. Bakhtiyarov, Professor of MGU, Russia).

7. *Cognitive computer graphics and logics of scientific cognition.* (A.A. Zenkin, Leading researcher of Computer centre of the Russian Academy of Sciences, Russia).

8. *Algorithmization of revalent conclusions from formulae of classical logics of prepositions.* (E.K. Voishvillo, Professor of MGU, Russia).

9. *Quasi-matrixes and semantics for limited sets of descriptions of states as a mean for computerization of modal reasonings.* (Yu. V. Ivlev, Head of chair of logic, MGU, Russia).

10. *Proover for calculating preposition (for system of natural conclusion).* (V.A. Bocharov, Professor of MGU; A.E. Gorchakov, Senior researcher of Institute of Dynamics of Geospheres of Russian Academy of Sciences; Mr. E.E. Bolotov, Russia).

11. *Revalent logics and non-monotonous reasonings.* (D.V. Zaitsev, Senior lecturer of MGU, Russia).

12. *Classification of matrixes for implicative logics by means of program MaGIFL 4.* (A.A. Pavlov, Leading software engineer of Institute of Philosophy of Russian Academy of Sciences, Russia).

There were discussed problems of using logics in computerization of educational processes and a role of informatics in teaching logics.

There were presented logic means intended for modelling thinking processes on computers.

It was noted that successful application of informatics in education is in conflict with low logic literacy of teachers and students.

There was shown the role of computer programs similar to program DEDUCTIO, for improving the training process.

It was also shown that existing algorithms of constructing conclusions and prooves for the classical logics of propositions and computer realization of them are of great importance for training purposes.

The participants noted the actuality of problem of wide introduction of teaching logics in secondary school, cited the basic characteristics of a course of logics for secondary school, based on training and developing computer games.

There was suggested to include into Congress Resolution a recommendation about expanding of teaching logics in secondary and higher educational establishments.

Workshop 9

INFORMATION TECHNOLOGIES AND HUMANITIES EDUCATION

Supervisor:
Yu.N. Afanasiev (Russia)

The aim of the workshop was *the discussion on the questions, concerning NIT implementation in the field of art education and presentation of experience of the Russian State Humanitarian University RGGU (Moscow) in the above sphere.*

The following items were discussed:

1. *Information technologies in educational process of the modern humanitarian university.* (Yu.N. Afanasiev, Rector of the Russian State Humanitarian University, Moscow, Russia).

2. *Information resources of library. Library computer system.* (V.Z. Grigoreva, Director of RGGU library, Russia).

3. *Multimedia-technologies in training process of a humanitarian higher educational establishment.*

(Yu.M. Taraskin, Deputy vice-rector of RGGU on application of informatics, Russia).

4. *New principles of teaching and researches on science history with the use of multimedia-technologies.* (S.V. Kuvsninov, Director of "History of science and new education technologies" Centre, Russia).

5. *University information computer network, its information resources and their using in the educational process.* (A.Yu. Semeikin, Vice-rector of RQGU, Russia).

Within the framework of the workshop there was a roundtable discussion: "Information technologies in educational process of modern humanitarian educational establishment". Among the participants of the above event were professor V.S. Anashin, professor N.I. Basovskaya, professor G.A. Belaya, associate-member of the Russian academy of Natural Sciences D.S. Danin, professor V.D. Korolev, professor A.G. Romanenko, senior lecturer D.G. Lakhuti and other.

The discussed problems include informatization of education as a radical enhancement of information resources and technologies. It was noted that one of the topical aims of applying informatics is creation of a new information environment with using of advanced technologies.

The experience was presented of creating and using information environment in the University: information computer library system, multimedia technologies in training process, information computer network.

It was noted that new information environment, being a new form of knowledge, is simultaneously a new form of humanitarian education and completely meets its vital requirements.

The participants backed up a thesis on the dominant contribution into informatization in humanitarian education, including strategy development for humanitarian education as a whole. Besides, the problems of humanization and humanitarization of system of natural-science education were discussed.

On the basis of discussion there were made the following conclusions:

1. The main sense of informatization of humanitary knowledge consists in information freedom, being the condition and simultaneouly form of political and creative freedom.

2. Problem of informatization of humanitary knowledge is the decisive one in selecting the strategy of developing humanitarian education (including of humanitarian higher educational establishment into modern information networks, creating and development of new information technologies during training process of humanitarian higher educational establishment, convergence of research and training processes on the basis of new information technologies).

3. The sharpest social problem is humanization and humanitarization of natural-science and engineering and technical education. Experience of the Russian State Humanitarian University pertaining to the humanities convinces, that in forming new information environment universities play a special role, as they should become information centres.

4. A sharp necessity appears in co-ordination of forces for forming new information environment in questions of creating bases and banks of data and computer training systems.

5. The Russian State Humanitarian University possesses necessary scientific and technical potential for creating co-ordinating centre on forming new information environment in the field of humanitarian education.

It was suggested to include into Recommendations of Congress the following propositions.

1. To ask Secretariat of UNESCO to finance a complex project on predicting alternatives on development of national and international network education, provided advanced network organisation of such a project.

2. By results of the specified project, to prepare the address of UNESCO to governments of States-members with a request to pay especial attention to •development programs and sources of financing for network education; prepare "White Book" on network education, bearing in mind the issue on its basis the international electronic encyclopaedia on network education.

Workshop 10

DEVELOPMENT OF PRE-UNIVERSITY EDUCATION VIA MODERN INFORMATION TECHNOLOGIES AND METHODS

Supervisors:
N.N. Evtikhiev,
N.I. Klyatova,
V.A. Mordvinov (Russia)

The aim of the workshop was the discussion on the questions, concerning the development of university entrants training with the use of NIT, in particular during the process of distance learning.

The following items were discussed:

1. *On the system of distance learning.* (V.V. Verzhbitsky, Chief specialist of the State Committee for Higher Education of Russia, V.D. Shadrikov, Deputy Chairman of this Committee, Russia).

2. On National Report of Russia "Educational Policies and New Technologies" at the 2nd International - UNESCO Congress "Education and Informatics". *(B.A. Sazonov, Deputy Director of Scientific-Research Institute for Higher Education, Russia).*

3. *Activity of the Federation of UNESCO Clubs on Preventive Education of Youth.* (E.B. Balashov, Vice-president of Federation of UNESCO Clubs in Russia, Russia).

4. *"Development and support of system for creative activity of students" — Program of Committee on family and youth affairs at Moscow City Government.*

5. *Telecommunication programme of «New training technologies" UNESCO Club.* (I.P. Deshko, Deputy director of the Centre of New Information Technologies, V.I. Minakov, Head of a department of Moscow City Centre of Creative Activity for Children and Youth, M.V. Kaminskii, President of «New training technologies" UNESCO Club, Russia).

6. *Basic principles of developing teaching-methodical activity of Centre of new information technologies of the Moscow Institute of Radio-Engineering, Electronics and Automatics (MIREA).* (V.N. Tsypkin, Deputy Director of the NIT Centre, MIREA, S.N. Kovalev, Senior lecturer of MIREA, Russia).

7. *NIT application for school and student creative activity in the system of continuing education.* (N.I. Klyatova, Director of Moscow City Centre of Creative Activity for Children and Youth, V.A. Mordvinov, Vice-rector of MIREA, Russia).

8. *New information technologies in training of handicapped university entrants.* (T.Kh. Latysheva, Vice-rector of Moscow Boarding Institute for People with Moving Disabilities on science work, V.V. Popov, Senior lecturer of this Institute, Russia).

9. *Arrangement of the dialog at distance learning.* (N.A. Smirnov, Professor, Russia).

The examples were shown of the activity of Russian higher schools and the institutions on creating system for distance learning of youth, on development and support of creative activity of students.

The activity of Moscow Institute of Radio-Engineering, Electronics and Automatics provides a good example of new approaches to development of training activity with application of NIT. The role of NIT in the field of school and student creative activity for continuing education was demonstrated.

They paid attention to the role of NIT in pre-university training of the handicapped entrants and discussed problems concerning the arrangement of the dialog in the process of distance learning.

Workshop 11

MEDICINE: NEW APPROACHES TO KNOWLEDGE ACQUISITION AND IMPROVEMENT

Supervisors:
O.S. Medvedev, M.Ya. Natenson,
V.I.Tarnopolsky (Russia)

The purpose of the workshop was a *discussion on the NIT implementation in the medical education system. Special attention was paid to «telemedicine» and system of professional development for medical staff at workplaces at backcountry districts and local medical institutions, which is very important for developing countries.*

In the course of the workshop *the following items were discussed:*

1. *«Telemedicine» as a part of informational area of health protection and a method of new medical technologies implementation.* (O.S. Medvedev, Dean of Basic Medicine faculty of Moscow State University, Russia).

2. *New information technologies in medical science, education and practical health protection.* (M.A. Pal'tsev, Rector of the Moscow Sechenov Medical Academy, S.V. Grachev, Vice-rector of the same academy, M.G. Kreines, Supervisor of the Centre of New Information Technologies of the above Academy, A.P. Pogromov, professor, N.N. Repin, Project director the International Scientific Foundation, Russia).

3. *Professional development of personnel dealing with radiation diagnostics on the basis of new information technologies.* (Yu.V. Varshavsky, Chief Radiologist of Moscow, the Head Physician of Diagnostics Centre No 3, Head of the Chair of Radiation Diagnostics of the Russian Medical Academy of Post-diploma Education, Russia).

4. *Modern information technologies in medical service of «Gasprom» JSC.* (V.V. Sidorenko, General director of Health Centre for Gas Industry Enterprises, M.Ya. Natenson, Senior researcher of Institute of space researches of the Russian Academy of Sciences, V.I. Tarnopolsky, Leading scientist of the above Institute, Russia).

The participants ascertained, that active using of computer technologies and modern communication systems started in medicine at present. It is practised in the technically advanced branch of medicine - ray diagnostics. Practically all the medical facilities are equipped with built-in computerized facilities for physician. These computerised facilities, linked together into hospital information networks "and connected, in turn, to global computer networks (of Internet type), create a medical area, bringing together physicians not only inside the hospital but in different hospitals, regions and countries.

This information infrastructure produces perfectly new situation, allowing to settle a number of social and educational problems, as particular:

- a possibility occurs for realising the most important political and social principle for united medical service for a patient irrespective to its social status and residence, owing to the participation of specialists of leading diagnostics and medical treatment centres;
- a possibility occurs for permanent and continuing training and professional development for medical personnel of all professional levels on part time basis. It is especially efficient for diagnosticians who deals with "images". Formerly the transmission of the above «images» with using of trunk lines was either impossible or complicated. Practically only text descriptions were transmitted which resulted in considerable information losses.

During the discussion there were chosen some *main directions connected with training and professional development for medical personnel:*

- realization of the «telemedicine» potentialities and drawing of specialists from leading medical centres for the purpose of consulting and following involvement of physicians to the advanced medical technologies;
- application of information technologies in training medical students and giving students and. physicians an access over computer networks to newest medical information in any medical databases;
- application of new information technologies in post-diploma education and creation of system for continuous professional development on part time training basis;
- application of new information technologies directly in process of medical treatment and diagnostics, including possibilities for specialists to take part in teleconferences, irrespective of place and time of their performance.

The participants of workshop discussed and adopted a sequence of practical measures and recommended to include proposals into the Final Resolution of Congress on the project of creating in Russia a network of medical education, arrangement of medical personnel courses for professional development and mastering practical «telemedicine» as a part of a global «telemedical» network. The possible participants of this project may be Russian medical universities, regional medical institutions connected with them, similar centres in USA and Europe, information structures of towns and industrial companies. Results of this project implementation permit to introduce developed computer information technologies into medical practice in countries of Africa, Asia and Latin America, which mostly need in improvement of the quality of health protection service.

Workshop 12

FORMING INTEGRATED WORLD DATA BASES AND KNOWLEDGE ABOUT PLANETS OF THE SOLAR SYSTEM AND THEIR USE IN RESEARCH AND EDUCATION

Supervisors:
V.I. Tarnopolsky,
M.Ya.Natenzon (Russia)

The aim of the workshop was *the discussion on the questions, comprised creating a world database on Solar System planets for education and researches.*

Programme of workshop included the discussion on the following questions:

1. Integration of planetary information world databases. Strategy of users circle expansion.
2. Structure of databases on planets of Solar System with the aim of their using in education.
3. Application of databases in the university course of comparative planetology.
4. Application of NASA network technology and databases in the general course on Solar System planets.
5. Geo-Informational systems in the course of university training of geographers.

The following participants took part in discussion:

- R. Arvidson - University of Washington, Sent-Luis, USA;
- N.S. Kasimov - Moscow State University, Moscow, Russia;
- R.O. Kuzmin - GEOHI (Russian Academy of Sciences), Moscow, Russia;
- M.Ya. Natenzon - Institute of Space Researches (Russian Academy of Sciences), Moscow, Russia;
- V.I. Tarnopolsky - Institute of Space Researches (Russian Academy of Sciences), Moscow, Russia;
- G. Noikum - Planet Researches Institute, Berlin, Germany;
- N.F. San'ko - Russian Space Agency, Russia;
- F. Shayres - Jet Propulsion Laboratory (JPL), Pasadena, USA;
- T.S. Kirsanova - Institute of Space Researches (Russian Academy of Sciences), Moscow, Russia;
- K.B. Shingareva - Moscow State University of Geodesy and Cartography, Moscow, Russia;
- A.A. Lukashov - Moscow State University, Moscow, Russia;
- Yu.I. Fivensky - Moscow State University, Moscow, Russia;
- W. MacKinon - University of Washington, Sent-Luis, USA;
- Yu.F. Knizhnikov - Moscow State University, Moscow, Russia;
- I. Luriye - Moscow State University, Moscow, Russia.

It was noted that NIT implementation permits to bring leading scientists knowledge and experience nearer to young people and to expand considerably their auditorium. The above possibilities look most topical in the research of Solar System planets, which is comparatively new and promising area for young scientists. That is why this science field (which, in fact, comprises a very thin "cultural stratum") is extraordinary sensitive to interest fluctuations of young scientists. Using of new information technologies allows to optimise the processing of vast information content on planets researches, created by joint efforts of scientists from different countries.

Certain problems have been arisen and caused by imperfection of initially employed information technologies, resulted in the necessity for applying of updated technologies for saving previously obtained scientific data, as a cultural all humanity legacy.

The reported results were related to started international program for creating global computer databases on planetary investigations. These bases allow to save both the earlier obtained data and provide new opportunities of access for users of various levels, beginning from the school one.

The review of materials of workshops is performed by E.A. Manushin, V.A. Galichin (International System Research Centre for Higher Education and Science, Moscow, Russia)

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УДК 378 : 007

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EDUCATION and INFORMATICS
EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
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(IN FOUR VOLUMES)

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