THE UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

Institute

for Information Technologies in Education

MEETING OF EXPERTS

"EDUCATION VIA THE INTERNET"

AND THE WORKSHOP

"INTERNET USAGE IN EDUCATION"

Proceedings

Minsk
2000

OBJECTIVES, ORGANIZATION AND OUTCOMES OF THE EXPERT MEETING "EDUCATION VIA THE INTERNET" AND THE WORKSHOP "INTERNET USAGE IN EDUCATION"

(INTRODUCTION)

Following 29 C/5 UNESCO in framework of Major Programme IV UNESCO Sector of Communication, Information and Informatics (CII) and the UNESCO Institute for Information Technologies in Education (IITE) established close collaboration in the field of using the Internet in education. As a result of this co-operation the IITE in conjunction with "University Knowledge Networks" corporation (UNICOR, Russia) elaborated the analytical survey "Experience of Internet Usage in Education". IITE invited Mr. Mike Aston, The Advisory Unit: Computers in Education (UK) as a consultant to this project. Then the survey was reviewed by expert Mrs. S. Charp, Editor-in-chief, T.H.E. (Technological Horizons in Education) Journal (USA) and expert Mrs. Z. Lustigova, International Federation for Information Processing Work Group 3.6 (IFIP WG 3.6), Charles University, Department of Physics Education, Faculty of Mathematics and Physics, (Czech Republic) recommended by IFIP.

On this basis, in pursuance of the decision of the 2nd session of the IITE Governing Board and the IITE work plan, the UNESCO Institute for Information Technologies in Education together with Education Sector, Sector of Communication, Information and Informatics organised the Meeting of Experts **"Education via the Internet"** and the Workshop **"Internet Usage in Education"**. The National Commission for UNESCO of Belarus invited IITE to hold the Expert Meeting (from 1 to 2 March) and the Workshop (from 3 to 4 March 2000) in Minsk (Belarus) and suggested Belarus State University National Institute for Higher Education and the Computer Analytical Centre of the Ministry of Education of Belarus as base organisations for holding the Meeting and the Workshop.

Experts for the Meeting were chosen from those who:

- already sent their reviews and opinions on the survey;
- participated in the Meeting of experts in Kiev (Ukraine) from 12 to 13 April 1999 as plenipotentiary representative of their countries;
- representatives of the IITE national Focal Points.

Besides, that IITE Director asked Council on Co-operation in Education of the Countries of the Commonwealth of Independent States and International Federation for Information Processing to designate participants and observers in the Meeting. So participants from nine countries (Belarus, Czech Republic, Egypt, Germany, Kazakhstan, Russia, Ukraine, the United Kingdom and USA), as well as from the Council on Co-operation in Education of the Countries of the Commonwealth of Independent States and the IFIP WG 3.6 took part in the Meeting in Minsk. All participants and observers were high-level specialists on using ICT's in education. Given the great interest

ISBN 985-6299-48-9

called by this event, a considerable number of Belarus specialists in education and information technologies, as well as representatives of mass media attended the Meeting. At the end of the work the Recommendations, addressed to the UNESCO Institute for Information Technologies in Education, was approved. The participants of the Meeting expressed their desire to participate in the IITE projects by taking part in their development, expertise, approbation and utilisation of results.

A large group of Belarussian educators, researches and students joined the experts during the Workshop, in which more than 100 participants took active part. The main objectives of the Workshop were to share the experience of the Internet usage in education, to present the best practices from different countries and discuss the main problems and perspectives in this area. There were five specialized sections, namely: "Application of the Internet-technologies in education" (moderated by Dr. V. Verzhbitsky, Russia), "Main trends of usage of the Internet in education" (moderated by Dr. S. Charp, U.S.A.), "Virtual universities: design and creation" (moderated by Prof. K. Kveton, Czech Republik), "Experience of application of the Internet-technologies in education in Belarus" (moderated by Dr. S. Maximov, Belarus) and "Sharing experience in the use of the Internet in education" (moderated by Mr. M. Aston, United Kingdom). The main reports presented at the Workshop sections, are published in these *Proceedings*.

CONTENTS

THE EXPERIENCE OF INTERNET USAGE IN EDUCATION

Dr. Vladimir Verzhbitsky,
Deputy Director, Centre of Informational and Analitical Provision of Distance Education System (Russia)

Dear Mr. Chairman!

Ladies and Gentlemen! Dear colleagues!

Let me present you the work "Experience of Internet Usage in Education". It was done by the order of UNESCO. I would like to emphasise the special role of The UNESCO Institute for Information Technologies in Education and personally the Director of this Institute Vladimir Georgievich Kinelev in the organisation of this research. Mister Kinelev initiated this project and supervised it constantly, observing, how we were advancing to the planned purposes.

When I say "we", I mean the organisation "University Knowledge Networks Corporation" (UNICOR) and The Centre for Information and Analytical Provision for Distance Education System of the Ministry of Education of Russia (its abbreviation is CIAN), employees of which also took part in the fulfilment of this project.

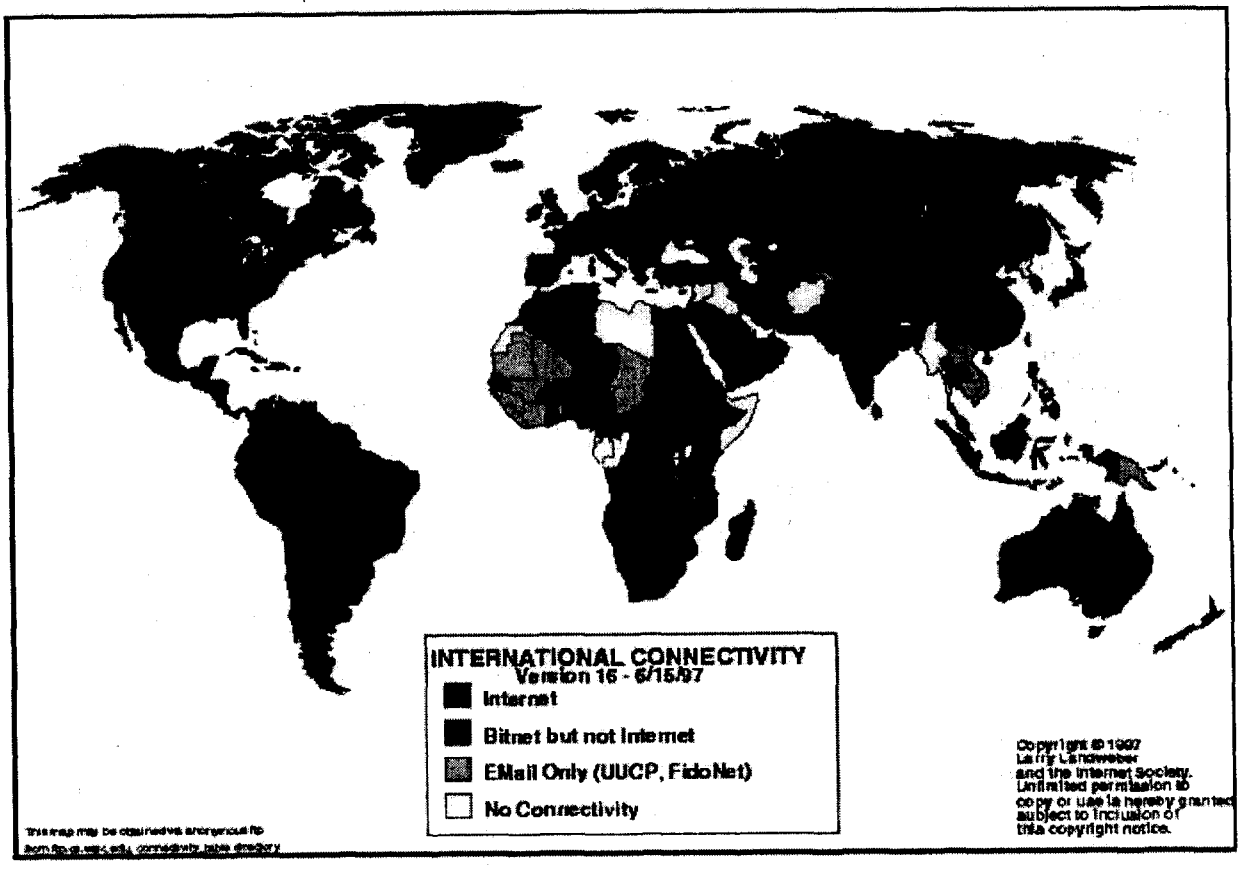
First of all let me tell you about the general tasks of the project, because their adequate understanding will allow you to estimate the results.

As it is known, the 90th are the years of rapid development of the Internet. In the map in the slide 1, you can see the connection of countries to the Internet in 1991. The dark blue colour marks those countries, which had been already connected to the Internet and had the full service. Yellow colour marks the part of the countries, which didn't have any network at all.

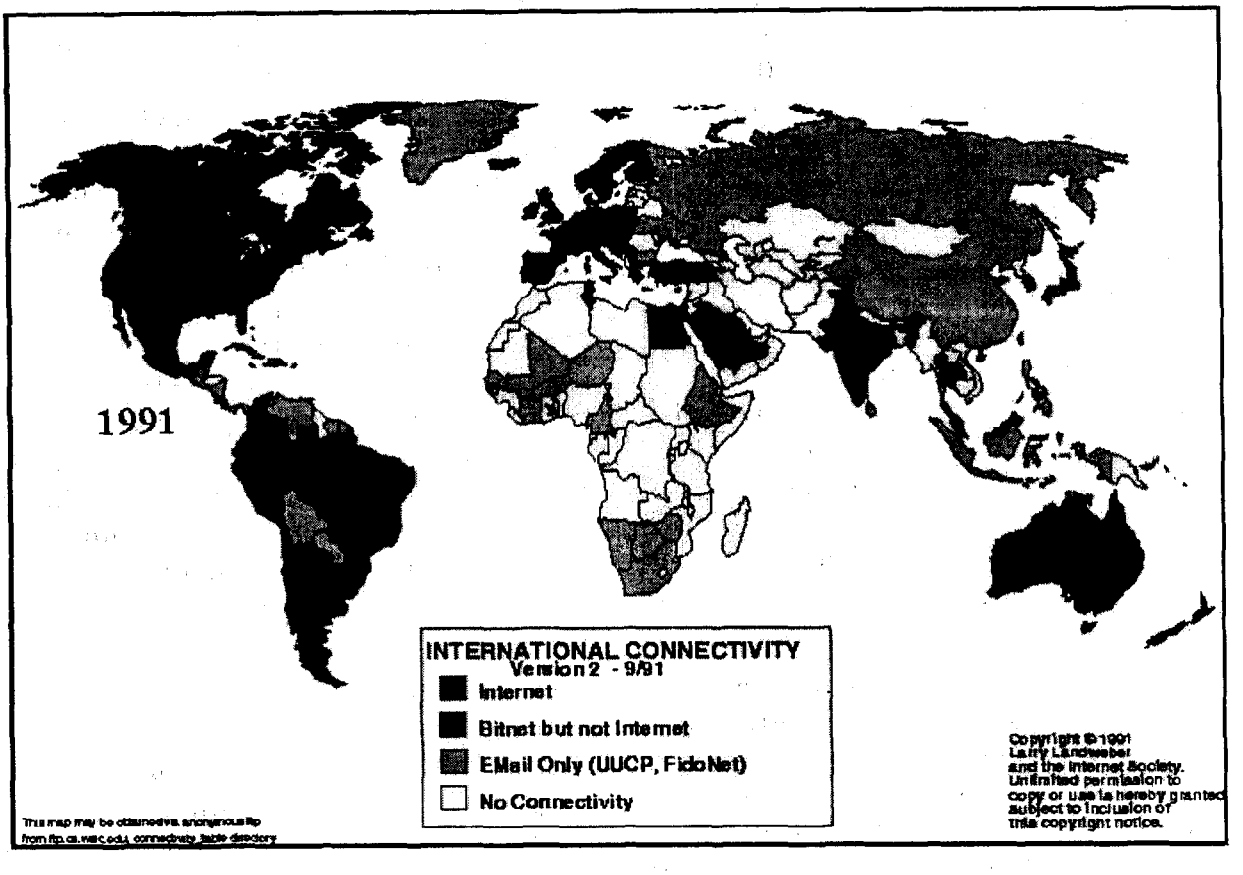
Look, how much changed the situation by the end of the 90th. Practically there are no countries without the Internet.

At the same time, the Internet now is a big ocean of information. Telling the truth, it is compared not only with an ocean, but also with a rubbish dump, with a library, where the catalogues are lost and mixed. We can choose any image in order to understand the situation, but in any case users of the Internet need more effective search engines of relevant information. Such search engines are also necessary for users of the system of education.

Today are created powerful universal search systems that are frequently used and good. At the same time there are many so-called specialised information systems in the Internet, which are limited by their theme, are oriented towards certain groups of users, and frequently allow to reach the relevant information faster and more effectively. That's why we began to research in which extent the UNESCO can help users through its specialised Institute for Information technologies in education. With this purpose we have carried out the research and have put forward a lot of the suggestions on the creation of information system, which we name conditionally "Education via the Internet".



Slide 1.



Slide 2.

Our work consisted of two parts.

First, the main part of the work comprised the analysis of the achievement and problems of Internet Usage in education. Special attention was paid to the revealing of unsatisfied information needs. We tried to analyse how existing information systems, both special and universal, satisfy different information needs. The large experimental part of the work, connected to supervision of different systems, their testing and expert estimation, was devoted to it.

The second part of the work based on the results of this analysis consists of attempting to formulate some initial vision of probable information system "Education via the Internet".

So, as a result of our work we have created:
- the analytical survey (you have it at your disposal);
- the database on information systems in the sphere of education.

You can find it in the text of the report, and I think that if you used the electronic version of our report, you could not only see the description of the systems, but also you could address them.

At last, a part of the results of our work is the project of the Terms of Reference for the Design of an Information System "Education via the Internet", which we regard as a basis for today's discussion.

Now let me characterise that part of work, which was carried out on the preparation of the analytical survey. The time and the means were limited and that's why we naturally could not carry out full research of Internet Usage in Education. We had $8000 and approximately 5 months to fulfil the project. According to the terms of the contract we had to prepare a text within 50 pages. We have prepared 100 pages and we received a lot of suggestions to carry out additional researches and to broaden the survey. That's why I should say about the strict limits, which we were compelled to admit. We have encountered with the task to investigate the whole boundless ocean of the educational Internet. We have only summarised the opinions of experienced sailors about its depths and reefs. We also have made a map of lighthouses, which would be useful for people who are travelling across it. We know that our map of lighthouses isn't full and becomes obsolete very quickly. But we haven't seen a better map. Secondly, we know now how by the united effort to replenish and to update this map, which could be useful for all. This is the main sense of the suggested system "Education via the Internet". And it is this work, which is important that we should be assess together. At the same time we shouldn't forget about the vast seas that haven't been investigated yet. But we mustn't get carried away with the sea of unsettled problems.

Speaking more prosaically, when we were preparing the survey we had to content with the generalisation and analysis of already carried out researches. But it did not contradict our main task. We summarised and ordered the conclusions made by the experts in different countries of the world. It is natural, that the survey can not aspire to be exhaustive. We had to content mainly with the literature in English for the last 3–4 years

and, first, with those sources, which are accessible via the Internet. More than 90 literary sources were analysed and they are given in the bibliography to the survey.

We understood that within the framework of the limited survey it is impossible to give a full analysis of experience of Internet usage in all the UNESCO member states. That's why the analysis was carried out primarily on the results of the researches, which had been received in the most developed countries without taking into consideration the "geographical" factor.

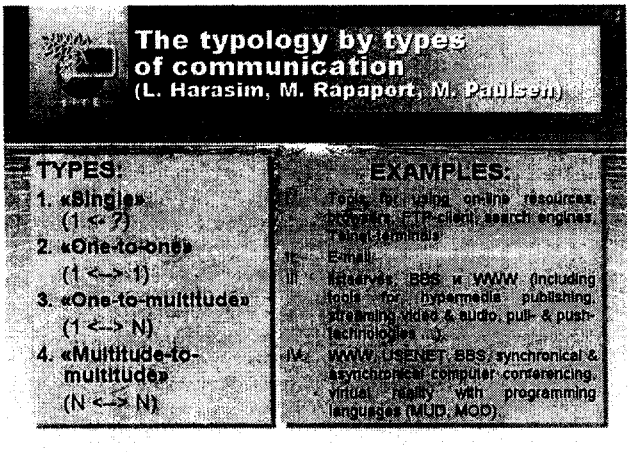
We saw our main task not in simple enumerating of all achievement and problems in this field, but in carrying out their ordering. Such systematisation is rather valuable in itself. I had to make a report on the results of the research before different audiences in Russia, and I should tell that these results were comprehended with great interest both by the experts and those who only began to study the problems of Internet usage in education. This interest arose because the survey allowed seeing achievements and problems in a systematic way.

It is necessary to say that different authors use different foundations for classification of applications of Internet technologies in the field of education. The comparative analysis of basic classifications is given in our survey. We think that the most interesting typology is based on revealing of types of communication, which support Internet technologies. This typology is proposed by a number of scientists (Harasim, Rapoport, Paulsen) practically independently from each other.

In the slide 3 you can see 4 basic types of such communications: "single", "one-to-one", "one-to-multitude" and " multitude-to-multitude ", which differ by the number of participants in communication. I will clear up the meaning of these terms later. I want to say why we choose this typology. The matter is that those types of the communication really exist in educational process. So, the technologies are classified according to educational tasks.

Really, the "single" type of communication, in which a user interacts with a vaguely large information mass, rather passive on itself, is a characteristic case, which is similar to the situation when a student comes to the library. The type of communication "one-to-one" corresponds to interaction of two individuals, which are involved in the exchange of information. You can frequently meet this type of communication in educational processes. First of all these are different consultations, dialogue of a teacher with a concrete student.

At last, communication "one-to-multitude" corresponds to the situation when a teacher communicates with a large group of students, for example, at lectures or at a seminar.



Slide 3.

The communication " multitude-to-multitude ", when there are many persons from both sides, corresponds to situations of joint work, joint discussion of problems on seminars and practical lessons, in any joint projects, etc.

Internet technologies mainly cope with these types of communication. That's why the system of types of Internet applications according to the types of communications, which already practically take place in educational process, connects at once Internet applications to the appropriate elements of educational process. It allows to better analyse the problems and achievements that may be discovered while using these technologies.

The list of Internet applications, which correspond, to the given types of communications, is in the slide. You know well these technologies.

This approach to the typology of Internet applications in education has allowed us to systematize the problems and achievements not on separate technologies, which are too different, but on the indicated types of technologies.

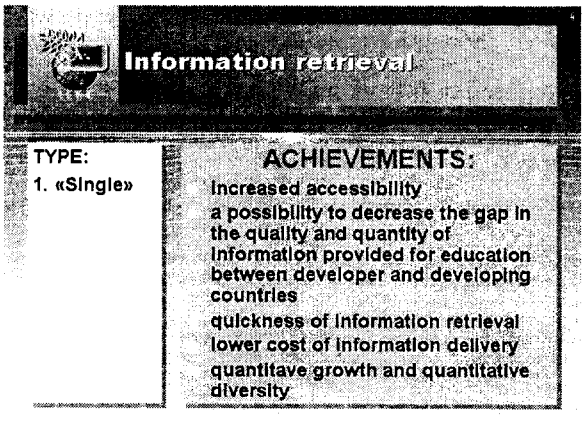
The achievements connected with the use of Internet technologies which support the "single" type of communication and are oriented towards the information maintenance of educational process, from the point of view of the experts, are here in the slide 4. These achievements are given a detailed comment and examples of successful activity in the survey.

For the communication "one-to-one" — a classical example is e-mail — the experts consider the following achievements. You can see it in the slide 5.

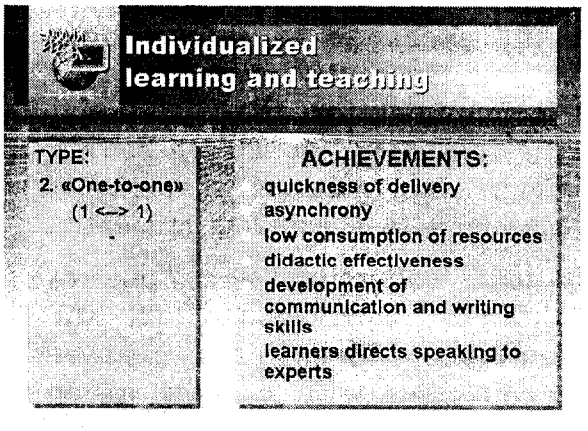
Analysing the achievements concerning Internet technologies, which support the communication of the type "one-to-multitude", the experts speak about its positive influence on progresses of the students. Other important achievements the experts underline are shown in the slide 6.

Perhaps, the experts to the achievements in use of Internet technologies give the highest estimation when these technologies are applied in organisation of joint educational activity. It corresponds to the type of communication "multitude-to-multitude" (slide 7).

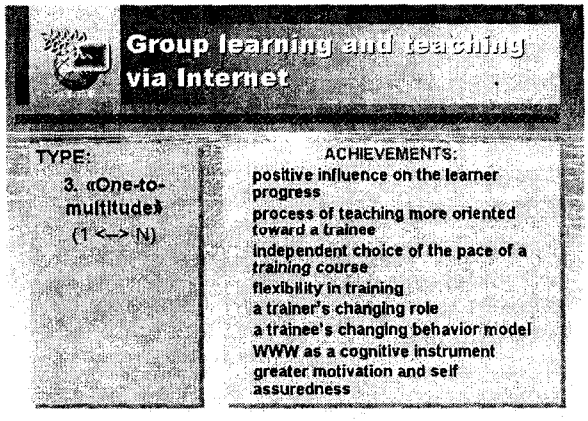
Meanwhile the experts have considered problems, which we have also grouped according to the types of communications supported by Internet technologies.



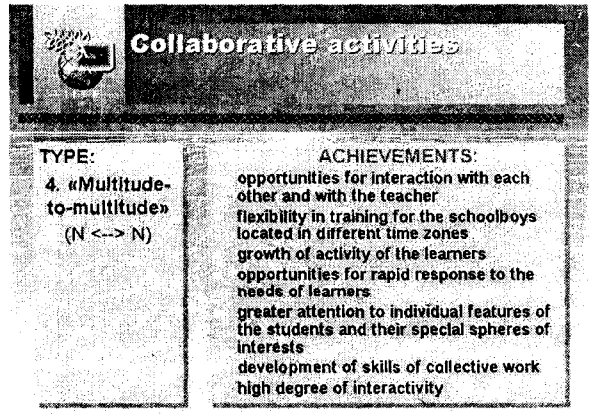
Slide 4.



Slide 5.



Slide 6.



Slide 7.

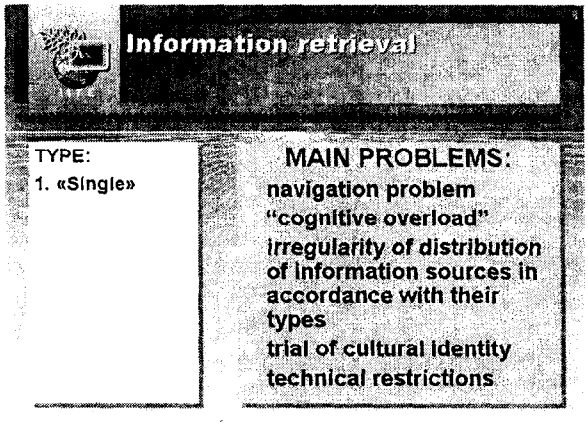
In particular, while using Internet technologies for information maintenance (the type of communication is "single") all experts speak about a big problem of navigation. Other problems are presented in the slide 8.

The technologies used for individual training (which corresponds to the type of communication "one-to-one" and the classical example is e-mail) encounter with the following problems. Please look at the slide 9.

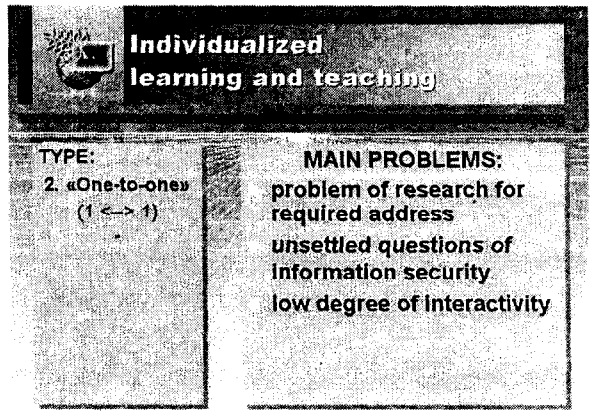
The problems of use of Internet technologies for teaching of groups when the communication belongs to the type "one-to-multitude" are presented in the slide 10.

The use of Internet technologies for joint educational activity (these are the technologies which support the communications of the type "multitude-to-multitude") causes a lot of problems despite their high efficiency. The researchers speak about economic problems connected to the fact that it is necessary to allocate expensive hardware communication resources for these technologies. Other problems are shown in the slide 11.

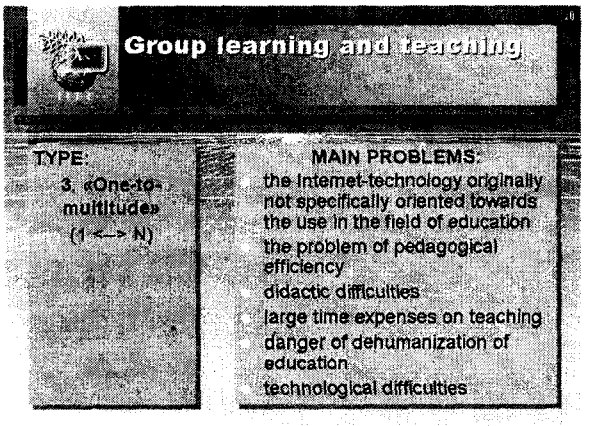
Now let me say a few words about the questions connected using of Internet technologies in organisation and management of educational systems. There are achievements and problems here and we can apply



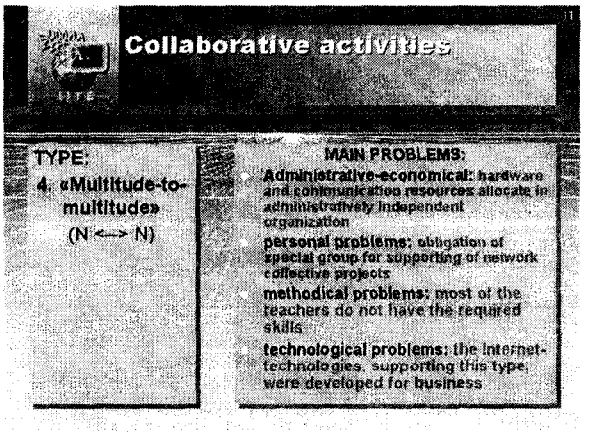
Slide 8.



Slide 9.



Slide 10.



Slide 11.

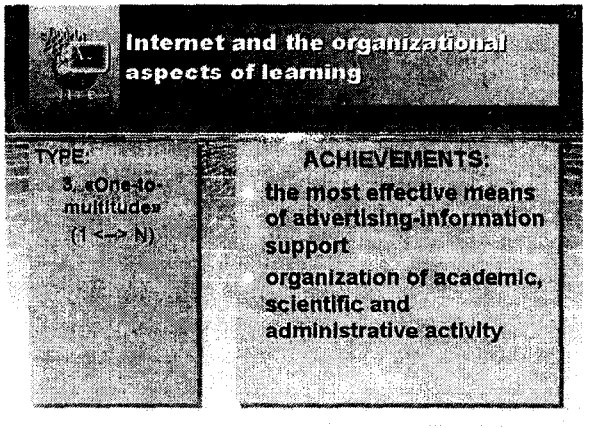
accepted typology of Internet technologies to the analysis of this part of the problem.

Most interesting are two classes of organisational tasks in which the information is distributed according to the type of communication "one-to-multitude" (from one managing centre to many executors and participants of educational process) and according to the type "multitude-to-multitude" (the system of interactions of departments and staff of educational institution).

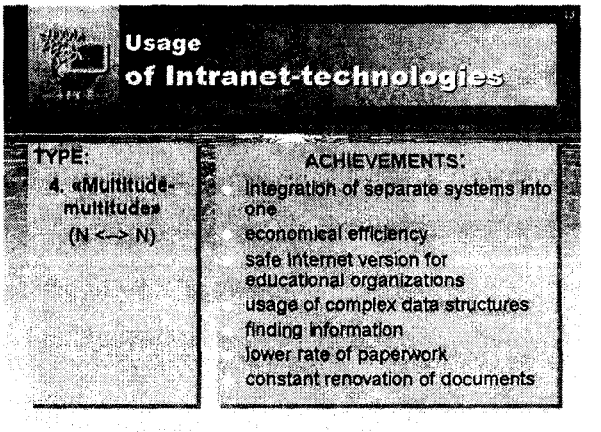
The classical example of the former type of use of Internet technologies is the creation of Web-sites of educational institutions. The achievements emphasised by the experts you can see in the slide 12.

The use of technologies supporting the communication of the type "multitude-to-multitude" is a more advanced case. We can speak here about the use of Intranet technologies, because this sphere of the applications of Internet technologies is the most developed. The main advantages of the Intranet are shown in the slide 13.

There are at least three groups of problems mentioned in the researches concerning the use of Internet technologies in management. (Slide 14). First, the executive boards of educational institutions, as a rule, are not sufficiently prepared for the use of these technologies. It is mainly for this reason that the educational institutions frequently base on out-of-date



Slide 12.



Slide 13.

organisational strategy, which doesn't allow to use fully all the potential of new technologies.

The special case of use of Internet technologies is the organisation of distance education. Here takes place the complex use of the Internet for teaching and learning and for organisation of educational process. It is necessary to say that this topic is worth a special consideration. It wasn't considered in details because of the limits of our survey. I would like to tell you about some results of additional researches, which we have carried out on the territory of Russian Federation. I think, they can help to clear up the picture given in the survey, and will be interesting for you.

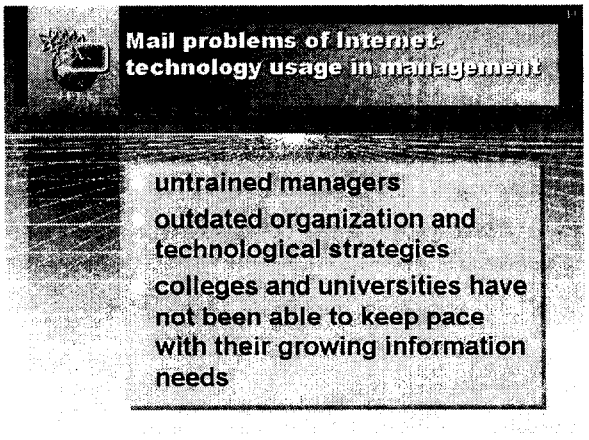
So, by the order of Ministry of education of Russian Federation we have carried out a complex assessment of readiness of applicants of Russian Institutes and Universities for consumption of educational services with the help of the Internet. While preparing this assessment we considered a number of factors. They appear in the slide 15.

Taking into consideration all these factors, and also keeping in mind the real number of applicants in Russian regions, we could assess the would-be contingent of students, who are ready for distance education via the Internet on the territory of Russia. These data are shown on the map, which you can see now (slide 16).

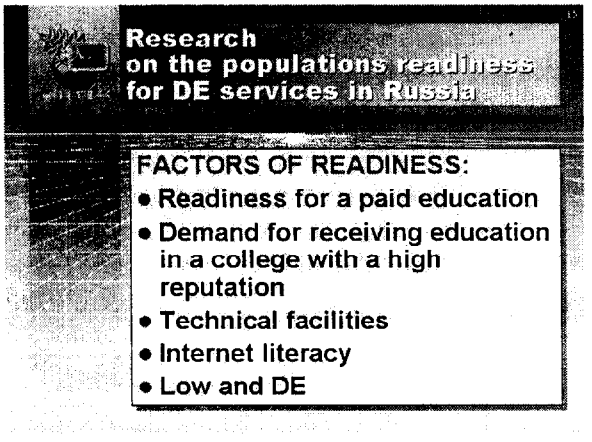
There are two regions in Russia (it is Moscow and Moscow region and St.-Petersburg and Leningrad region), where there is the greatest number of students who are ready to study via the Internet. The regions marked with green colour have only insignificant number of applicants who are ready to study via the Internet, their number does not exceed 1000 people in separately taken region. There are a lot of such regions now. But at the same time you can see on the map that a sort of mountain range is being formed of approximately 20 regions where there is possibly a rather big demand for services of Education via the Internet.

As I have already said in the beginning, one of the main tasks of our work was the research of information systems in the sphere of education.

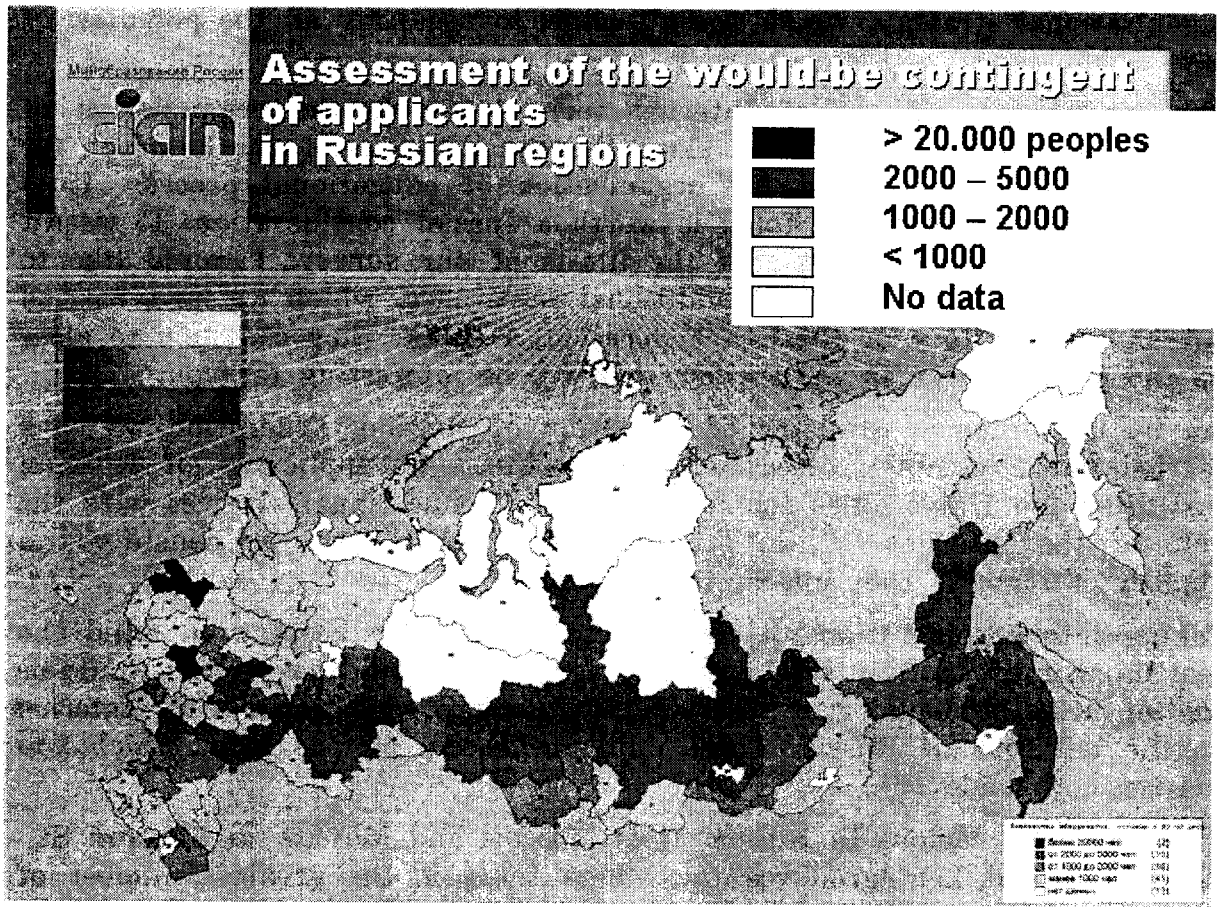
We considered the information systems accessible via the Internet, and divided them into two basic classes:



Slide 14.



Slide 15.



Slide 16.

- Universal search systems, which are not specialising in the field of education, but are giving opportunities for searching the information on educational issues, and sometimes containing in their catalogues separate sections, devoted to education.
- Secondly, the specialised information systems, which index and contain the information concerning exclusively educational issues.

We have analysed more than 30 universal search engines in Russian and English. You can see the list of them in the slide 17.

The assessment of the given systems was made from the point of view of ability to satisfy information needs of different categories of users. These information needs are rather diverse and must be considered separately. Within the framework of the analytical survey we could only give expert assessments of what kinds of information needs exist among different groups of users. These materials are given in the tabulared form at pages 44 and 45 of our survey. Of course we realise that these assessments are insufficient for making final conclusions about what systems better or worse satisfy the needs of concrete categories of users. Nevertheless we have received a general picture of the ability of these systems to satisfy information needs.

So, the research of the catalogues of universal search engines has shown that on the whole they are oriented towards students, to some extent

1. AltaVista	Reference&Education	16. MetaCrawler	Education
2. Anzwers	Reference&Education	17. Netscape	Education
3. C/Net Search	Learning	18. Omen	Образование, обучени
4. Euro ferret	-	19. Open Directory Project	Education
5. EuroSeek	Education	20. Rambler	Образование
6. Excite	Education	21. Russia on the Net	Наука и образование
7. Galaxy	Education	22. SEARCH CENTRE	Образование
8. HI	Образование	23. SNAP	Education
9. HotBot	Education	24. Web list	Образование
10. Infohiway	-	25. WebCrawler	Education
11. Infoseek	Education	26. Yahoo	Education
12. List	Наука и образование	27. Апорт!	-
13. Look Smart	Reference&Education	28. AY!	Образование
14. Lycos	Education	29. Созвездие Интернет	Образование и наука
15. Magellan	Education	30. Улитка	Работа и обучение
		31. Яndex	-

Slide 17.

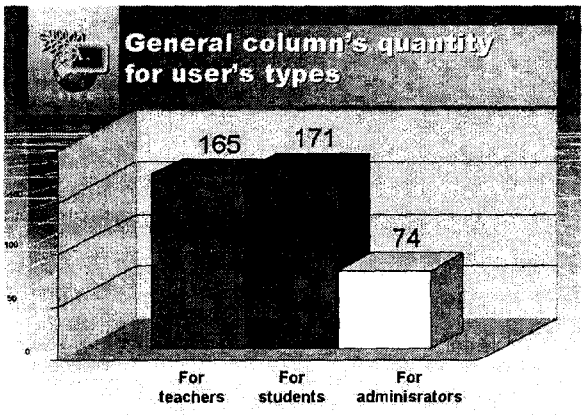
towards teachers and almost not oriented towards managers in the field of education. You can see it in the diagram in the slide 18.

In order to assess the comparative amounts of the information on educational issures, the access to which can be received through given systems, we have carried out their experiment testing. The results of this testing have revealed a group of the most powerful systems which give the maximum of the information on issures of education, training, study. (Slide 19).

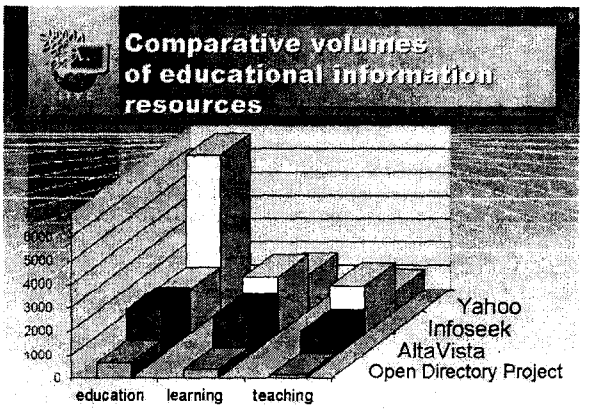
The comparative analysis of universal systems is given in the survey in detail, but at the same time I would like to emphasise, that we didn't have the detailed data from organisations-developers of these engines. That's why our assessments are only assessments of an outside user and they cannot aspire to comprehensive analysis. But nevertheless they give us food for reflections.

There are many specialised systems, and we cannot say, that we have found all or even a big part of them, but there were about hundred of systems of this type in our analysis.

The example of the specialised information system is the international Internet catalogue "Information resources of an open educational system", which CIAN has developed together with the UNESCO Institute (slide 20). This catalogue can be used within the framework of the projects of IITE. CIAN together with IITE also conducts a specialised Web-site on problems



Slide 18.

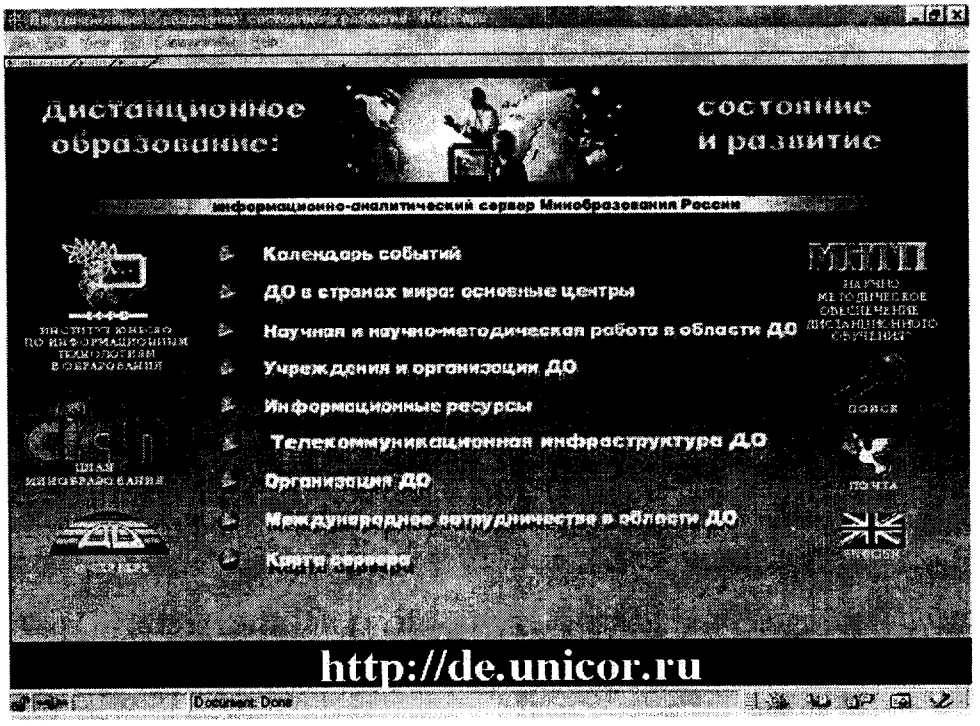


Slide 19.

of development of distance education. You can see now the first page of this site (slide 21). Another example of these specialised systems is the system of WWW servers of higher educational institutions of Russia, which was developed by the corporation UNICOR (slide 22). It allows to find quickly the necessary server of educational institution of Russia according to a number of features.

I give these examples in order to emphasise, that IITE, UNICOR and CIAN, as organisations, have already some practical experience of creation and exploitation of the specialised information systems in the field of education and our suggestions take into account this experience.

Slide 20.



Slide 21.

Slide 22.

Certainly, our special interest attracts the largest information systems, and now I am going to speak about them.

We have found 5 largest systems, bearing in mind complex criteria, not only amounts of information, but also a lot of other factors. The first pages of sites of these systems you can see now on the screen (slide 23–27).

There are sites "The Education Supersite", "Globalwide Network Academy", "The NODE", "Education Word" and "ERIC".

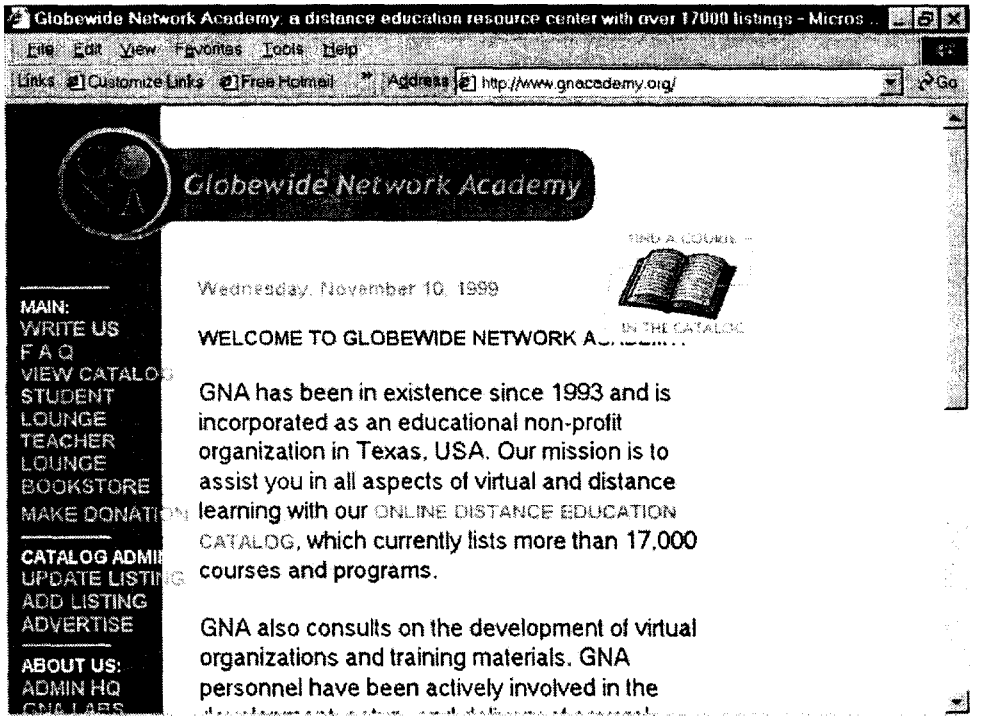
The results of the comparative analysis of these specialised information systems are given in the diagram. The comparison of these systems is made according to a big number of parameters. You can see the results in the diagram (slide 28) and they show that ERIC, Education-World and the NODE are the first according to the vast majority of parameters and the leadership of ERIC and Education-World is obvious enough.

This picture was made in summer, 1999. It is natural, that other information systems are developing quickly and the picture could change. Nevertheless, according to assessments, which we have carried out not so long, ago, the situation with the first five systems has not changed radically

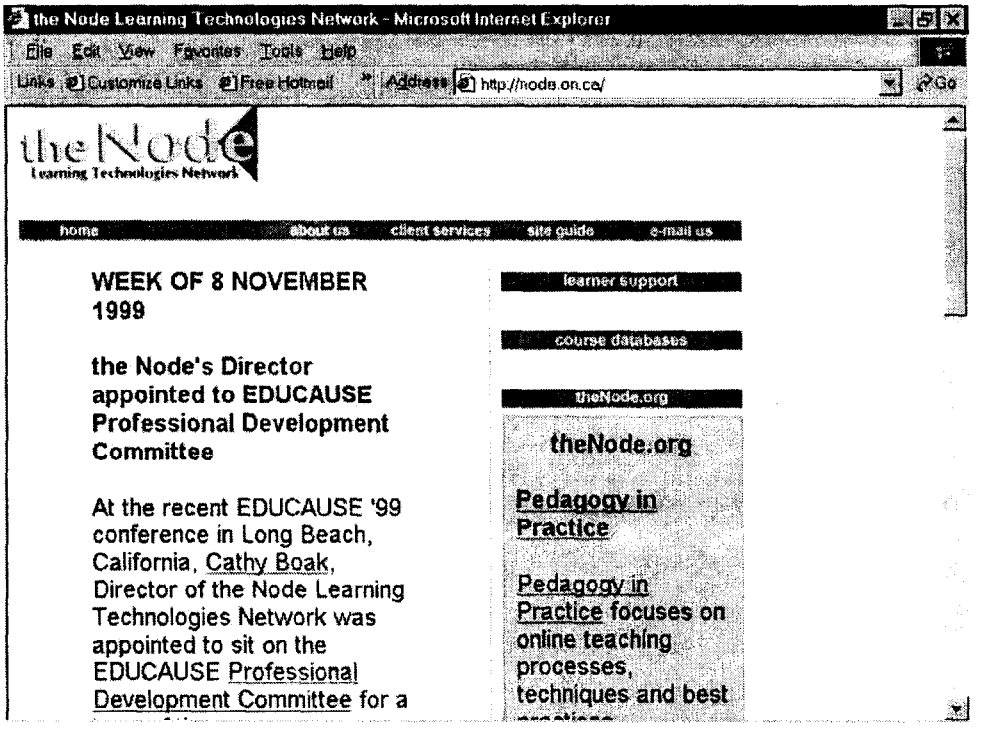
It is necessary to note that the results of our assessment of the specialised information systems in the field of education have significantly coincided with the assessments, which had been received independently from us. We have learned about it only after finishing our work.

So, we have found out, that the system "ERIC" has received very high estimations, and now Spanish "ERIC" which is designed for Latin American countries is being created. Chinese "ERIC" in Chinese is being created too.

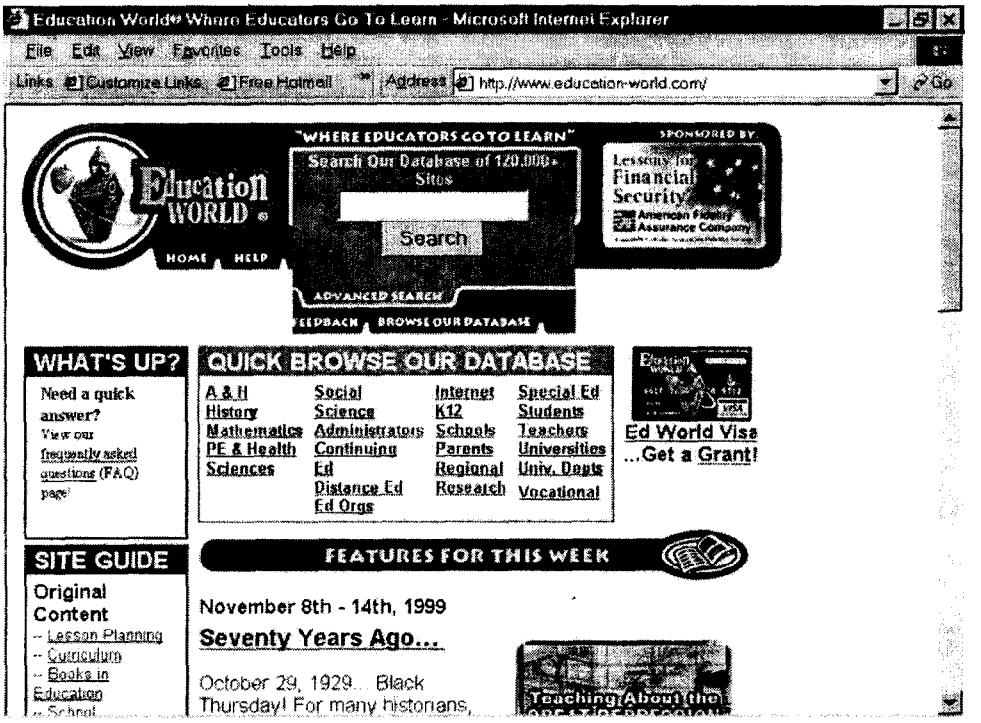
Slide 23.



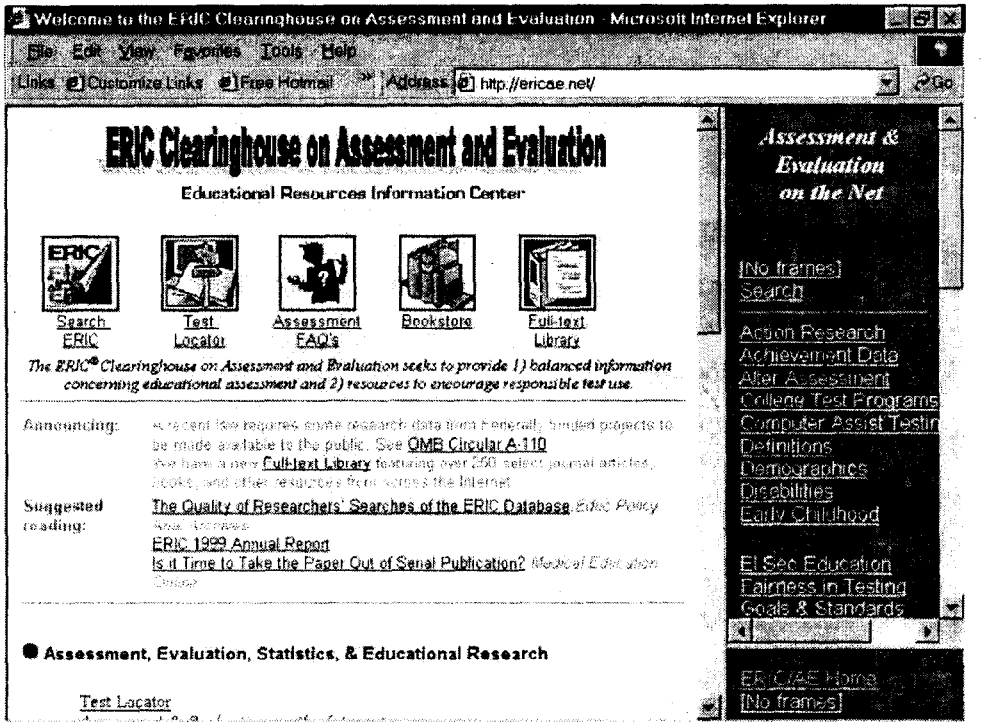
Slide 24.



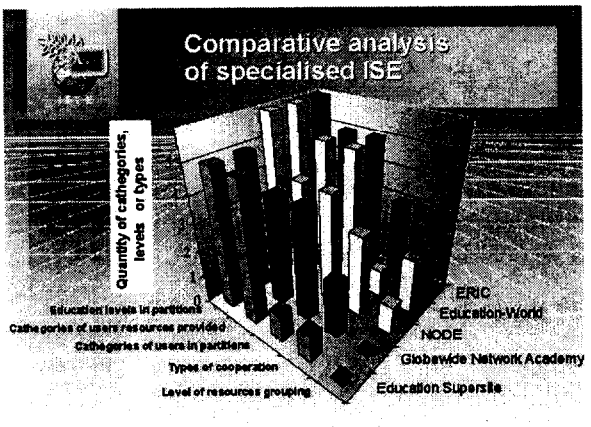
Slide 25.



Slide 26.



Slide 27.



Slide 28.

I would like to notice, that it doesn't mean that UNESCO should create a system superior in the capacity and in the scales to the largest world systems. But it can offer its own information system, which will be based on cooperation with the most advanced existing systems. This is the idea, which lays in the basis of the project of the information system "Education via the Internet". And I would like to stress once again the idea, which the director of The UNESCO Institute for Information Technologies in Education Mr Kinelev expressed in his speech, we consider the offered Terms of Reference only as a basis for thorough discussions and as the first step to a detailed formulation of tasks of the system. And we suppose that only after necessary discussions and elaborations made by the experts of different countries, we can make the decision of development of the system, which can be competitive. We believe that in this discussion it is important to take into account all palettes of opinions.

A certain vision of the objectives, functional capacities and technical features are presented to you in the Draft of Terms of Reference. You are also offered a questionnaire and filling it in you can suggest your own vision of objectives and functions of the system or to dismiss the necessity for its creation.

We count on a detailed discussion and a benevolent participation and cooperation. Thank you very much for your attention!

EDUCATION AND THE INTERNET: SOME EXPERIENCES FROM A UK PERSPECTIVE

Mike Aston,
Consultant, Institute of Information Technology in Education (Moscow) and The Advisory Unit: Computers in Education (Hatfield, UK)

Quick look at the recent history

Mike Aston traced some of the key elements that have influenced the use of the Internet in British education. In the early seventies, 'dumb' terminals in schools and colleges were linked by the public telephone service to mainframes in Polytechnics and Universities. The storage media was 8-hole paper tape and for the first on-line users of the Open University, remote access to learning materials and messaging to tutors was a significant advance. Modem and communications technology developed quickly and, at the same time, early microcomputers started to arrive in schools. By 1980, most secondary schools had at least one microcomputer, the Post Office (later to become British Telecom) had developed Prestel — an on-line viewdata service available in homes and schools via an enhanced television set, a standard voice phone line and a modem — and the BBC and commercial TV stations had established standards for teletext potentially available to anyone with a TV and teletext adapter. The Council for Educational Technology managed a great variety of projects during this period, to establish the potential of the new technologies for enhancing teaching and learning. The UK Government's Microelectronics Education Programme (1981–1986) moved things on rapidly and by 1986, many UK schools were using the BTGold service provided by British Telecom to communicate with schools as far away as Australia as well as accessing educational information. In the late eighties, the Internet superseded BTGold for messaging and Prestel for information delivery as both were locked into limited graphics interfaces and neither was accessible via MS Windows™.

Enter the Internet — in historical terms an extraordinary phenomenon. Just consider:

- it took 38 years for the WIRELESS (RADIO) to reach 50 million listeners world-wide
- it took 13 years for TELEVISION to reach 50 million viewers world-wide
- but it took only 4 years for the INTERNET to reach 50 million global users remarkably
- In 1994 the INTERNET had 3 million users.
- At the end 1998 the INTERNET had 148 million users.
- Of these an estimated percentage living in the U.S.: 52
- Adults using the Internet in the UK (end of 1999) — 27%
- Estimated number of Internet users in China at end of 1999 — 4 million

and

- Internet traffic doubles every 100 days.

Reference was made to a winning description of the Internet by a student in a global competition:

"The Net is possibly (now probably) the largest store of information on this planet. Everybody can be part of it; it is one of the few places where race, creed, colour, gender, sexual preference do not prejudice people against others. All this through the magic of modern technology. Communication is the key. People talking to people. The Net isn't computers. That's just the way we access it. The Net is people helping each other in a worldwide community."

Grade 5/6P Technology Page

http://www.netc.net.au/wangps/

Find out how to make a land yacht, read our interviews about old technologies, and more.

Fun Aussie activities!

http://www.ozemail.com.au/~wprimary/acts.htm

Kids just love finding out about Australian animals by doing these activities!

Meet Matthew!

http://www.ozemail.com.au/~wprimary/matt.htm

Despite being confined to a wheelchair, Matt is our resident "Net Guru".

Come and say G'day to him.

Hi! This is me... Matt Slater.

I am disabled. I have cerebral palsy and I am in a wheelchair. I was born with a body that doesn't work very well but my brain works fine.

I wish I was not disabled. But it's OK sometimes because I get to use three computers, two at school and one at home. I use them for everything, even reading books on the CDROM.

I live in Eldorado, Victoria Australia. Eldorado is an old gold mining town. It's a great place and about 200 people live there.

My age is 8 and I'm in grade 2 at Wangaratta Primary School.

My teacher's name is Mrs Hunt. She is very nice. I like everything about her! Now I'm on the Internet and I have my own email address.

One of the earliest web sites to be created by pupils at a primary school came from a small rural town in North East Victoria, Australia. It is interesting to note that, by the 7th July 1995, the home page had already received 26344 hits.

Matthew, although severely disabled, has found a secure place in the school environment and in the eyes of his fellow pupils is an 'expert'. We can be sure that he has an interesting career in front of him.

In 1998, the UK Government made a decision to bring all the strands of education and the Internet together under the banner of The National Grid for Learning (NGfL). The British Educational Communications and Technology agency (BECTa) was given the task of managing it and a very large budget has been allocated over a period of 4 years, ending in December 2002, with the goal of significantly raising standards in teaching and learning.

The specific features of the NGfL are:

- A way of finding and using on-line learning and teaching materials;
- A mosaic of inter-connecting networks and education services based on the Internet which will support teaching, learning, training and administration in schools, colleges, universities, libraries, the workplace and homes;
- National focus for raising standards;
- Removes barriers to learning;
- Provides quality software, content and services;
- Stimulates public/private partnerships;
- Ensures a sound public/commercial balance.

Linked to the NGfL are a variety of other ICT initiatives:

- A Teacher Training scheme (all 650000 teachers will have to complete ICT training by 2002)
- All schools have access to the Internet (over 30000)
- Grants of 500 towards the cost of a microcomputer for teachers
- A revised National Curriculum with ICT firmly embedded
- A network of ICT support centres nation-wide
- Government funding for network upgrading in schools
- Free Internet-terminals in public libraries and museums
- Digitisation of educational resources in museums and libraries

Looking to the future, a number of broadband delivery systems are being piloted in different regions along with wireless local networking in schools. Many Local Grids for Learning are emerging, usually based in Local Education Authorities and a great store of local knowledge, history and geography is emerging to be made available to a much wider audience.

Lastly, a number of research projects are in place to measure the impact of ICT and access to the Internet is having on education standards and the learning process.

STATE OF IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATIONAL SYSTEM OF THE REPUBLIC OF KAZAKHSTAN

Erlan Aryn,
First Vice-Minister of Education and Science of the Republic of Kazakhstan,
Dr. Ermek Balafanov,
Director of Republic Scientific-methodical Center of Informatization in Education (Kazakhstan)

INTRODUCTION

Modern condition, trends and paces of development of information technologies in the world, as well as new public-political and social-economic conditions of Kazakhstan, created new situation in the scope of education. Kazakhstan, as other countries of the world, have come to do real steps in the field of informatizations of education — creation of a united information-educational space.

PURPOSES, PROBLEMS AND METHODS OF THEIR DECISION

Main purposes and tasks were determined in the President's State program Informatizations of the Secondary Education System of the Republic of Kazakhstan, approved by the direction of President on September, 22 of 1997 No.3645, in the performance of which Government of Kazakhstan accepted Resolution on April 1998 No.221 on approving of Extended Plan of Actions on realisation of the given program.

Achievement of the given purposes and tasks are bolted in Resolution I of Convention of Education Employees' of the Republic of Kazakhstan (Almaty, December 3–5 of 1998). Besides, in the Law "On Education", accepted in June, 17 of 1999, questions concerning informatizations are determined as a priority direction and one of the primary tasks.

On the Extended Meeting of the Government, which was held in February, 9 of 2000, President of the Republic of Kazakhstan N. Nazarbaev has putted a concrete problem to the Government — to computerize all schools to the Tenth Anniversary of Independence of the Republic of Kazakhstan (2001).

Concerning this, Ministry of Education and Science has contributed corresponding corrections to the working plan on realization of the State Program of Informatization of Secondary Education System. A work on mobilizations of all available resources for the school computerization began and will be completed before the end of 2001.

Resolution of Government "On the Gratuitous Transfer of Computers to Schools" was accepted on February, 10 of 2000 (No.200).

STATE OF INTRODUCTION AND PROBLEMS OF REALIZATION

Realization of the Governmental Program and Extended Plan of Actions was realized gradually by organizations and subdivisions of the former Ministry of Education, Healthcare and Sport and Ministry of Science and Higher Education.

According to Resolution of the Government and Order of the Ministry were created: Republic Scientific-methodical Center of Informatization of Education (RCIE) and 16 Regional Centers of New Technologies in Education in regions, and in Astana and Almaty. But level of technical equipping of the Centers still stays unhigh.

Domestic computer production was created on the base of National Center of Radioelectronics and Communication (NCRC) using "Siemens" technologies, with the productivity of 30 thousand computers per year.

In accordance with State Standards of Secondary Education, studying of Informatics is divided into two stages: first stage — 7–9 classes basic course, and second stage — 10–11 classes — specialized course.

Many scholastic institutions carry out research on different subjects using modern computers, which meet high requirements of the present-day needs. Software Study aids are developed and oriented on the study of different scholastic disciplines.

Work on creation and development of Information Management System (IMS) for the Secondary System of Education is carried out: 1 phase <Ministry of Education and Science ↔ Regional Departments>; 2 phases <Regional departments ↔ Schools>.

Development of IMS is realized by using DBMS, INTERNET INFORMIX FOUNDATION 2000:

1. System and technical decisions of IMS with using Informix technologies is improved in the architecture of client-server and Internet.
2. Information filling of WEB-server of Ministry of Education and Science is designed.
3. Unauthorized access protection is created.
4. HTML pages for WEB-a server are designed.
5. Structure of database for the reference base on the scholastic institutions, and on statistical forms for schools is made. Reports about using of these bases (8 forms) with usage package of Crystal Report are developed. Program for preparing of an electronic statistical forms is created by scholastic institutions.
6. Pilot project of IMS system on the base of Local Network System RCIE (client-server system, as well as Intranet technologies) is advanced.
7. Technical requirement on designing of IMS logical structure database is developed.
8. Interdepartmental Program "Internet — schools" is accepted (refer to appendix 1).

9. Projects of target integrated programs are prepared:
- target integrated program for Informatization of Primary and Secondary Professional School System of the Republic of Kazakhstan;
- target integrated program for Informatizations of High School Education System.

CONCLUSION

This presented situational analysis shows that the Republic of Kazakhstan has defined Informatization of Education (implementation of information and telecommunication technologies) as a priority direction for Education, paying a particular attention to the Secondary Education System.

Entering of the Republic of Kazakhstan into United Information and Educational Space without active cooperation, exchange of knowledge and experience is impossible on such levels like:
- conceptual;
- Program Systems of Scholastic Purpose (PSPS);
- standardized, certificated tools for creation of the electronic issues for educational purpose;
- target integrated programs for informatization of the different levels of education;
- projects of UNESCO on information and communication technologies in education;
- development of infrastructure;
- educational centers;
- creation of the International Systems of Certification and Funds (ISCF);
- creation of the international educational standards on information technologies in education.

Systematization and coordination of decision-making on horizontal and vertical levels, by the development of infrastructure of system: <UNESCO IITE ↔ FOCAL POIINTS>, are highly important.

Appendix 1

INTERDEPARTMENTAL PROGRAM "INTERNET — SCHOOLS"

Under the Law on Education of the Republic of Kazakhstan and State Program of President about Informatization of Secondary School System integrated steps are carried out in order to computerize gradually more than 8000 schools of various types. More than 1700 schools are provided with computer equipment of the new generation, over 150 out of them have an access to Internet. Computerization infrastructure is developed; literature, study aids, software programs on new information and communication technologies for education are released. Now teachers of different fields of study have been training to use computers in the educational process.

At present it is vital to use broadly computer facilities for getting an access to information by connecting to Internet.

Purposes of Program

This program is designed to accomplish the following goals:

- to connect gradually all schools of the country to the Internet. This will make a precondition for creation of United Informational and Educational Network of Kazakhstan;
- to develop Performance of the educational resources on servers of Ministry of Education and Science, and other divisions;
- to increase a number of trained specialists who actively use information and telecommunication resources.

Main participants

Ministry of Education and Science of the Republic of Kazakstan

Ministry of Transport and Communication of the Republic of Kazakstan

Department of Secondary Education (R. Zhumabekov, Director)

Department of Informational Systems (A. Nasiev, Director)

Republic Scientific-methodical Center of Informatization in Education (RCIE, E. Balafanov, Director)

JSC "Kazaktelecom" (N. Sakipov, president)

Regional Departments of Education, Regional Centers of New Technologies in Education

Regional Departments of JSC "Kazaktelecom"

Schools, Colleges

Regional Points of Telecommunication

Basic Events

Realization of Program is gradually carried out according to the developed and coordinated schedule.

On the first stage (before 01.09.2000) connect schools, which have necessary equipment, facilities and communication links to Internet.

On the second stage (before 01.09.2001) connect all other schools to Internet, which will be provided with computers, technical equipment, and technical facilities for receiving tone frequency channel or for connecting to the telephone lines.

On each stage:

- make list of schools;
- conduct their examination;
- develop technical project;
- determine costs, sources of financing;
- conduct erection works, maintenance of equipment;
- put equipment into operation;
- educate and train personnel of schools.

Financing and Maintenance

Ministry of Education and Science

- gives necessary information about schools; makes schedules of readiness and order of priority of schools, which are provided with computer equipment; appoints responsible persons, ensures an access to created information and educational resources;
- solves problems concerning financing of the departmental organizations of the republic and local level, including reimbursement of the repair expenses of buildings for accommodation of the computer classes;
- supplies furniture and equipment to the schools, which are located in the regional telecommunication points;
- ensures fulfilment of technical facilities (telephone lines for connection to Internet).

Ministry of Transport and Telecommunication

At first, connect schools to Internet , which are provided with the modern computer equipment and connection lines to Automatic Telephone Stations (ATS), in the dial-up regime. But more than that, the access to the National Educational Network and use of internal resources of Internet Kazakhstan, JSC "Kazakhtelecom" is obliged to tarifficate as a separate type of service, according to the Agreement with Ministry of Education and Science.

JSC "Kazakhtelecom"

- promotes realization of the project "Informational Management Systems of Education" by providing with necessary high speed channels and placing of servers on "Kazakhtelecom" territory without charging of the rent;
- ensures a connection of the Republic and Regional Centers to Internet and charges expenses on the account of Ministry of Education and Science. And if it is necessary "Kazakhtelecom" gives buildings to the computer classes in the regional telecommunication points and provides them with power and protection;
- according to demands of the Regional Education Departments and Schools "Kazakhtelecom" supplies technical facilities for organization of the connection lines.

Terms and Further Development

Terms of realization are determined by the degree of readiness of schools and telecommunication points, and are reflected in schedules and concluded agreements.

The development of Program must demonstrate modern trends of Internet, information and telecommunication technologies.

Questions about the access of computer classes to Internet will be regulated by separate agreements.

Principles of Collaboration

All the questions concerning this Program are solved under the basic principles of goodwill, trust, partnership, and mutual support.

Nothing creates problems concerning juridical claims or appearance of undesirable situations with other Divisions, Fiscal Departments.

REFERENCES

1. Kazakhstan National Report. Formation of a New Educational System of the Republic of Kazakhstan in the Epoch of Information Technologies. Education and Informatics (Policy in the Field of Education and New Technologies). Materials of the Second International Congress of UNESCO, Moscow: IITE, 1996.
2. State Program of President of the Republic of Kazakhstan about Informatization of Secondary System of Education (approved by the Instruction of President of the Republic of Kazakhstan on September, 22 of 1997, No.3645).
3. Law on Education of the Republic of Kazakhstan (accepted in June, 17 of 1999.).
4. Resolution of Government of the Republic of Kazakhstan from 10.02.2000 No.200 "On the Gratuitous Transfer of Computers to Schools".
5. Interdepartmental program "Internet — schools" (approved by Minister of Education and Science, Minister of Transport and Communications on March, 10–13 of 2000).

MAIN TRENDS OF USAGE OF THE INTERNET IN EDUCATION

Dr. Sylvia Charp,
Editor-in-Chief, T.H.E. (Technological Horizons in Education) journal

Educators have used computers and other information technologies as tools to enhance student learning. Advances in telecommunications technology have increased access to the Internet allowing students and teachers to communicate with people from around the world, the process of learning has become significantly richer and students have access to new and different types of information and can learn from each other. Higher education is being challenged by new opportunities resulting from technology that is improving the ways in which knowledge can be produced, managed, disseminated, accessed, and controlled. Equitable access to these technologies should be ensures at all levels. The needs for lifelong learning are growing as specific skills become obsolete and new ones are needed. Distance Education programs are increasingly used for lifelong learning. Virtual courses need support, library resources, registration, financial, and other services as provided for on-campus students. On-line education, which is continued on the use of the Internet and the web is making it possible to bring interactivity into the distance learning experience.

Distance education is booming and the Internet is increasingly available to most off-site students. Instructors are providing course materials (syllabi, assignments, handouts, etc.), assignments, grades and discussions over the Web. Typical distance learners are those who don't have access to programs, employees who work during scheduled class hours, homebound individuals, self-motivated individuals who want to take courses for self-knowledge or advancement, or those who are unable or unwilling to attend classes. The rapid growth of technology and the spreading use of e-learning have eliminated the need for students to be physically present if this growth is to continue. Distance education is available anytime, anyplace and provides technical, administrative and instructional support to the learner. The following characteristics have been noted as those that make distance education programs more successful.

- Clearly defined performance- and competency-based objectives that are understood by both instructor and learner.
- Acceptance of students with the background, knowledge and technical skills needed to undertake the program.
- Manageable class size — classes have enrolment of 15 to 30 students.
- Instructors are available at regular, stated hours.
- Demonstrated commitments and ongoing support, both financial and technical, exist for continuation of the program for a period sufficient to enable students to complete a degree of certification, if so desired.
- Institution evaluates its programs' educational effectiveness, including assessment of student learning objectives.

The use of the Internet and related technologies is making distance education more credible and effective. Its use by educators and the business sector is greatly increasing. An important and necessary component to successful web-based instruction is ongoing communication. The instructor must be able to communicate with the students throughout the semester, and students must be able to communicate with the instructor so they can receive prompt assistance when they encounter problems or have questions. Students also need to be able to interact with one another.

- Better tools are emerging that permit students, faculty and administrators to have 24-hour access to financial records, student transcripts, class lectures, assignments, etc. over the Internet. Students and faculty see applications or resources used at other institutions and want that capability at their institution.
- A more efficient network is becoming available to support a rich variety of communication devices and an increasing number of interactions. Accordingly, the development of Internet 2 (I2) promises vast improvements in bandwidth and performance.
- Teachers are becoming freed from the physical boundaries of classrooms and the time restrictions of schedules. Students are working at their own pace using network-based materials and diagnostic tools. A variety of software helps develop and create rich, interactive courseware. Tools, such as chat rooms and instant messaging, attempt to compensate in some way for the important element of traditional teaching — human contact.
- The virtual university is challenging the existing paradigm of higher education by providing online courses and degrees. It is claimed, at this time, approximately 1700 courses are offered on the Internet.

A very recent study undertaken by the National Education Association and an on-line software company, Blackboard.com, found 24 measures of quality in Internet Based Distributed Learning and stated attention should be paid to the following among others:

Institutional Support

1. A documented technology plan that includes electronic security measures to ensure both quality standards and the integrity and validity of information.

2. The reliability of the technology delivery system is as failsafe as possible.

3. A centralized system provides support for building and maintaining the distance education infrastructure.

Course Development

4. Guidelines regarding minimum standards are used for course development, design, and delivery, while learning outcomes — not the availability of existing technology — determine the technology being used to deliver course content.

5. Instructional materials are reviewed periodically to ensure they meet program standards.

6. Courses are designed to require students to engage themselves in analysis, synthesis, and evaluation as part of their course and program requirements.

Teaching/Learning

7. Student interaction with faculty and other students is an essential characteristic and is facilitated through a variety of ways, including voice-mail and/or e-mail.

8. Feedback to student assignments and questions is constructive and provided in a timely manner.

9. Students are instructed in the proper methods of effective research, including assessment of the validity of resources.

Course Structure

10. Before starting an online program, students are advised about the program to determine if they possess the self-motivation and commitment to learn at a distance and if they have access to the minimal technology required by the course design.

11. Students are provided with supplemental course information that outlines course objectives, concepts, and ideas, and learning outcomes for each course are summarized in a clearly written, straightforward statement.

12. Students have access to sufficient library resources that may include a "virtual library" accessible through the World Wide Web.

13. Faculty and students agree upon expectations regarding times for student assignment completion and faculty response.

Student Support

14. Students receive information about programs, including admission requirements, tuition and fees, books and supplies, technical and proctoring requirements, and student support services.

15. Students are provided with hands-on training and information to aid them in securing material through electronic databases, interlibrary loans, government archives, news services, and other sources.

16. Throughout the duration of the course/program, students have access to technical assistance, including detailed instructions regarding the electronic media used, practice sessions prior to the beginning of the course, and convenient access to technical support staff.

17. Questions directed to student service personnel are answered accurately and quickly, with a structured system in place to address student complaints.

Faculty Support

18. Technical assistance in course development is available to faculty, who are encouraged to use it.

19. Faculty members are assisted in the transition from classroom teaching to online instruction and are assessed during the process.

20. Instructor training and assistance, including peer mentoring, continues through the progression of the online course.

21. Faculty members are provided with written resources to deal with issues arising from student use of electronically-accessed data.

Evaluation and Assessment

22. The program's educational effectiveness and teaching/learning process is assessed through an evaluation process that uses several methods and applies specific standards.

23. Data on enrolment, costs, and successful/innovative uses of technology are used to evaluate program effectiveness.

24. Intended learning outcomes are reviewed regularly to ensure clarity, utility, and appropriateness.

(Source: "NEA and Blackboard Inc. Study Finds 24 Measures of Quality in Internet-Based Distance Learning", Blackboard, Inc., March 21, 2000)

General agreement seems to exist on issues such as:

- Teachers need at least three years to acquire expertise in using technology:
- Year 1 — Mastering technical resources
- Year 2 — Exploring the curriculum
- Year 3 — Refining classroom applications

Education is undergoing rapid and dramatic changes. Technology is helping to meet the learning needs of a diverse population. Business leaders are increasingly vocal in their demand for graduates who can use basic skills, who are capable of working together, who can communicate verbally and in writing, and who can use information to arrive at reasonable conclusions.

It is clear that networking is considered of utmost importance in forming goals and priorities for the future planning of educational institutions. However, let us not become overwhelmed with "Internet fever." The role of the Internet is still emerging, and issues such as open access, cost of services, ease in locating resources, and the amount of advertising need to be addressed. The Internet is making an impact on many aspects of our lives. It has changed the way we work and communicate, as well as the way we learn. It is serving as a vehicle for the exchange of information regardless of social, economic or geographical differences.

No evidence exists that technology can replace a good teacher. Technologies, such as e-mail, presentation systems, two-way interactive video, sophisticated management systems, etc. will be fundamental to the learning environment. However, technology will not eliminate the need for campuses and residential programs, especially for undergraduates. Traditional educational institutions shall continue to be faced with growing competition from non-traditional educational organizations.

Availability of technology is bringing students to traditional institutions and positive changes in the way teachers teach and students learn. The Internet is modifying the way we learn, work, communicate and play in ways that we are just beginning to imagine. The Internet Revolution, as it is often referred to, is more than about finding resources, but about building relationships, engaging people and communicating — this needs to be taught.

PREPARATION OF THE CZECH AND SLOVAK VIRTUAL UNIVERSITY

Prof. Karel Kveton,
Director, UNESCO International Centre for Scientific Computing, Computing and Information Centre Czech Technical University in Prague

Project aims to establish an effective Working Group, concerned with the analysis of modern systems of distance education (DE) and Virtual University systems. *Generally, stress will be given on design of user-friendly learning services and flexible learning activities. Comprehensive research on main issues in DE will provide theoretical background for the project advancement, make recommendations and provide guidelines based on the examples. Number of short scientific visits, seminars and conferences will be organised. Milestones should be common seminars. Project results will help to university managers, educational decision-makers, students, teachers and staff to design, implement and maintain user-friendly learning services, providing them with examples of good practice in DE and Virtual University systems. Project should enhance the Czech and Slovak co-operation and the synergetic aspects of co-operation by interconnecting the existing groups, which develop similar activities. This article is focused on* ***Web-based training*** *as an important part of the future Czech and Slovak Virtual University.*

General Objectives

- Define and analyse the main issues in DE and Virtual University systems. Enhance research and exchange of experiences in DE and Virtual University systems. Make recommendations and guidelines based on the examples.
- Provide university managers, educational decision-makers and practitioners with examples of good practice in DE in management, policy and programs issues.
- Provide students, teachers and staff with examples of good practice in DE in teaching and learning, technology and management issues.
- Enhance the Czech and Slovak and CEEC co-operation. Provide the opportunity for project partners from Central and Eastern European countries (CEEC) to contribute to open European debate on the challenges of the Information Society. Enhance the synergetic aspects of co-operation by interconnecting the existing groups, which develop similar activities.

Description of the work

1. **Research of the main policy issues in distance education (DE) and Virtual University systems:** Mandates and mission statements, Strategic planning, Resource allocation, Faculty policy, Student policy, Copyright and ownership issues, etc.

2. **Design and development of course materials for DE:** overview of the tools; comparing experience and methods; presentation, communication and feedback aspects; management and guidance; evaluation of the program's effectiveness, quality assurance and student support.
3. **Training teachers and staff in producing of technology-based instructional programs:** Review of practice in ICT in teacher education. Links with teacher education courses. On-line course for staff development in HE with focus on teacher education.
4. **Create a handbook for educational managers:** examples of good practice in DE policy, management and implementation. Recommendations and guidelines based on the examples.
5. Disseminate findings through on-line course, invited seminars and conferences, report and journal papers.
6. Contribute to the solution of **specific objectives,** including **Web-based training.**

We make some remarks to the last point — Web-based training, which seems to be a core of the project. We would like to follow experience of the **UNESCO Cairo Office Program USEE** (Upgrading Science and Engineering Education), see http://www.unesco.org.eg/usee/index.htm.

Web-based training

See Brandon, H. FAQs About Web-Based Training, http://www.brandon-hall.com/frereslin.html.

Web-based training is instruction that is delivered via a Web browser, such as Netscape Navigator or Internet Explorer, through the Internet or an intranet. More and more information services and programs within organizations are moving to the World Wide Web. The Web can provide the most efficient delivery of information because of its ability to be accessible from anywhere, anytime and to disseminate a standardized, updateable version to multiple users. The future of the Web and Web technologies is long-term and big impact according to all estimates.

The advantages of Web-based training are flexibility, accessibility and convenience. Users can proceed through a training program "at their own pace and at their own place". They can also access the training at any time, and only as much as they need — known as "Just in time and just enough". Web-based training can be accessed by Web browsing software on any platform: Windows, Mac, UNIX, OS/2, etc. You can deliver your training program to any machine over the Internet or intranet without having to author a program for each platform. Web-based training can be accessed from any computer anywhere in the world, keeping delivery costs low. If changes need to be made in the program after the original implementation, they can be made on the server, which stores the program, and everyone worldwide can instantly access the update. New demands in organizations are increasing the interest in Web-based training on a daily basis. The need for less expensive ways to deliver training has led many companies to explore the option of Web-based training. The conveniences

for users of the programs — at their own pace, at their own place — and the engaging nature of the multimedia delivery are big advantages. The centralized nature of web-delivered training makes the delivery standardized for all users who take the course. Web-based training is often less expensive and more convenient the alternatives.

The disadvantages of Web-based training are first of all caused by bandwidth limitations. Limited bandwidth means slower performance for sound, video, and intensive graphics, causing long waits for download that can affect the ease of the learning process. There's a general concern that as we move towards more computer usage, a glowing terminal replaces a friendly face. Decreasing instructor-led training makes some trainees uneasy. If this is a concern, consider a gradual introduction of the technology. Today's Web-based training programs are too static. As with any emerging technology, the level of interactivity in Web-based training is too-often limited. This is gradually improving, and as it does the impact of the training on performance improves also. Web-based training takes more time and more money to develop than expected. Like any first-time challenge, learning about and implementing new technology takes more resources than expected. You can make it easier by starting with a simple program and building on success. Also, remember that the greater portion of costs associated with Web-based training is start-up costs. Programs can be delivered and re-used with fewer costs than with traditional methods.

What criteria should be used in evaluating Web-based training?

Here are ten criteria we use in the judging of the semi-annual Multimedia and Internet Training Awards sponsored by the Multimedia and Internet Training Newsletter:

1. *Content* Does the program include the right amount and quality of information?

2. *Instructional Design* Is the course designed in such a way that users will actually learn?

3. *Interactivity* Is the user engaged through the opportunity for input?

4. *Navigation* Can users determine their own way through the program? Is there an exit option available? Is there a course map accessible? Is there an appropriate use of icons and/or clear labels so those users don't have to read excessive documentation to determine program options?

5. *Motivational Components* Does the program engage the user through novelty, humour, game elements, testing, adventure, unique content, surprise elements, etc.?

6. *Use of Media* Does the program appropriately and effectively employs graphics, animation, music, sound, video, etc.? Is the gratuitous use of these media avoided? Is the soundtrack really annoying?

7. *Evaluation* Is there some type of evaluation, such as:
   - completion of a simulation?
   - mastery of each section's content before proceeding to later sections?

- section quizzes?
- final exam?

8. *Aesthetics* Is the program attractive and appealing to the eye and ear? Does the structure of the screen add to the program?

9. *Record Keeping* Are student performance data recorded, such as time to complete, question analyses, and final scores? Is the data forwarded to the course manager automatically?

10. *Tone* Is the program designed for the audience? Does it avoid being condescending, trite, pedantic, etc.?

Team for development of Web-based training

Teams range from just one, very dedicated person who does it all, to project teams of over 40 professionals. In general, at a minimum, you will need:

- a project manager capable of dealing with diverse work styles and personalities
- an instructional designer familiar with computer-delivered instruction
- a programmer or author to use the authoring tool
- a graphic artist
- a subject matter expert
- a web master for maintaining the program on the server
- and, of course, someone who can obtain funding for Web-based training from management

Authoring systems for Web-based training

WebCT, Authorware, ToolBook II, IconAuthor, Quest, IBTAuthor, CBIQuick, and many others are currently available, most with training components built in. If you want to start with a simple program, an HTML editor or Web page layout program like Netscape Navigator Gold, Microsoft FrontPage, Claris Home Page or Asymetrix Web Publisher may be all you need.

Authoring system WebCT

See WebCT.com: http://www.webct.com/

WebCT is a tool that facilitates the creation of sophisticated World Wide Web-based educational environments. It does this in ways:

- It provides an interface allowing the design of the presentation of the course (colour schemes, page layout, etc.).
- It provides a set of educational tools to facilitate learning, communication and collaboration.
- It provides a set of administrative tools to assist the instructor in the process of management and continuous improvement of the course.
- WebCT can be used to create entire on-line courses, or to simply publish materials that supplement existing courses.
- WebCT requires minimal technical expertise on the part of the developer of the course, and on the part of the student.

- WebCT is entirely web-based. There is no software to install (other than a web browser such as Netscape or Internet Explorer) on the computers used by the students or instructors.

WebCT was developed in the Department of Computer Science at the University of British Columbia. The faculty member in charge of the project, Murray W. Goldberg, has had experience building, delivering and studying the success of web-based courses, and of web-based material used to supplement existing courses.

As of March 2000, WebCT have sold licenses to more than 1300 institutions in 55 countries. WebCT has roughly 6 million users. WebCT has five times more users than its nearest competitor, even though some of the competing tools were available well before WebCT.

WebCT is a member of the Instructional Management System Project (IMS), is tracking the standards effort closely, and is implementing those standards. WebCT believes that the IMS is going to play a significant role in the future of online learning technologies and WebCT staff is working hard to conform to the standards as they emerge.

Some departments of the Czech Technical University have chosen WebCT as a tool for the creation of sophisticated World Wide Web-based educational environments.

References

1. Brandon, H.: FAQs About Web-Based Training, http://www.brandon-hall.com/frereslin.html.
2. Kveton, K.: Proposal of IST — 1999 — 14161 HEBNET Project.
3. Shawki, T.G.: Towards a Technology — Mediated Educational System. Report for the International Expert Meeting, Minsk–Belarus, March 1–4, 2000.
4. WebCT.com: http://www.webct.com/.

EDUCATIONAL NETWORKS OF BELARUS

Dr. Nikolai Listopad,
Director, The Computer Analytical Center
of The Ministry of Education of Belarus

The Subject of my presentation is Belarussian Educational and Research Computer Network UNIBEL. The purpose of my presentation is to advertise our experience of creation and development computer networks in Belarus in general and in Minsk in particular. We also would like to present how to introduce information technologies based in computer networks in field of education.

At the beginning I would like to say some words about Unibel computer network. Secondly, I will pay your attention to Computer Analytical Center as leader in the field of information technologies and as a structure supported UNIBEL network. Than I will turn to the projects Unibel network is involved.

So, now let's move to Unibel network. Since 1992 UNIBEL network provides a wide set of full services based on TCP/IP protocol and has developed extensive experience in this area. It currently serves more than 350 customers, including a lot of major institutes, Belarussian State University, Belarussian State polytechnical Academy etc. UNIBEL represents Belarus in many international networking organisations such as TERENA, RIPE, CEENet. Network is supported by Open Society Institute, NATO, UNESCO programs, NICE-Global project on ATM-technology and others.

UNIBEL provides services through Computer Analytical Centre (CAC) communicational node. CAC is a research organization responsible for research and coordination of activities in the field of information and computer communications for academic and research community of Belarus. CAC is involved in a number of projects and activities connected with the promotion of informatization of the universities of Belarus and with the establishment of computer networks in the country.

Some successfully realised by the CAC communication Projects are the following:

- Minsk Internet Project
- INTERNET project supported by UNDP
- NICE-project

The main goals of these Projects are to provide full access into information resources of the global computer networks for a lot of organisations of the City of Minsk and to introduce the Internet culture as a part of the civil life of the city and nation.

The main goal of the Project named Minsk Internet Project was to create a powerful Internet backbone network in Minsk. The Project was supported by Open Society Institute/Soros Foundation. It was started in December 1995. The tasks to be solved in the frame of the Project are:

- to set up a powerful IP backbone network in Minsk in order to develop Internet infrastructure around the capital, and provide it with high-speed Internet communications;

- to make Internet access possible for a great number of organisations from the social sector in Minsk and Belarussian regional areas;
- to introduce and spread Internet culture and ideology as being a way of bringing together large groups of different users; and to carry out active educational and teaching programmes concerning computer networking for both users and specialists.

An Internet backbone network was put in place once the first stage of Minsk Internet Project had been implemented in Minsk. Fibre optic network is now connecting nine nodes including Belarusian State University, BELTELECOM, Centre of Information Security and UNIBEL Network Operation Centre located at Computer and Analytical Centre of Ministry of Education. Using the current equipment, it is available for users more than 350 organisations and numerous private individuals in Minsk. Training Centre has been established at Belarusian State University.

Currently we have got line to BELPAK (official provider of Ministry of Communications). Fibre optical cable connecting Minsk backbone and BELPAK has also been put in operation. It gives us a possibility to use BELPAK's satellite connectivity.

The second stage of the project is to create Internet backbone nodes in Belarusian regional towns and hook them up to the Minsk backbone network. As a result of this stage, over 75 organisations from the Belarussian provinces will gain Internet access in the nearest future. Among them are Vitebsk State University, Vitebsk University of Technology, Polotsk University, Gomel University, Gomel Polytechnical Institute, Mogiliov Technical Institute, Mogiliov Regional Library, Brest Polytechnic Institute, Grodno State University, Grodno Medical Institute and others.

The program's aims for future are to develop the infrastructure and increase the number of Internet users in the Republic of Belarus. We feel that the first priority for future should be to provide international Internet connectivity. The second priority should be to develop infrastructure further in Minsk and the regions. We hope to hook up Belarusian higher educational institutions, institutes of the Academy of Science, etc. to the Minsk fibre-optic ring network. We feel that the third priority should be providing training of specialists for science, education, culture, legislation, etc.

UNDP Internet Project is a mutual project of United Nations Organization Development Program in Belarus and Government of the Republic of Belarus.

Project participants are:

Ministry of Education of the Republic of Belarus;
Ministry of Economy of the Republic of Belarus;
UN Representation in the Republic of Belarus.

The main goal of the project is:

Strengthening the national information and communicational infrastructure to

promote democratic reforms;
improve state government;
develop market economy.

This aim can be achieved by solving the following major tasks:

- further development of information exchange system infrastructure in Minsk and regional centers of Belarus based on Unibel network on non-commercial basis, providing connection to Internet;
- assistance in information services creation and support; dissemination of the Internet culture (ideology) principles; running educational and training programmes.

So, that's the general picture for the project itself and now let's look at the results. I believe you realize now that Unibel has grown greatly since UNDP Internet project begun. In general, we've managed to solve both tasks of the project. And what is the most important this way have been provided a lot of people in Belarus with new informational technologies based on computer networks. People have received a wonderful opportunity to exchange information with their colleagues and friends all over the world. And all these rather quickly and without any restrictions.

So there is a wide variety of information technologies based on computer networks. Unibel, for example, provides the users with such services as e-mail, WWW, News and so on. We also have an experience of holding videoconferenses.

Let me say some words about NICE project. The main idea of the project to hold distributed videoconferenses. Abbreviation NICE means National Host Interconnection Experiments. Project NICE is the part of the ACTS Programme (Advanced Communications Technologies and Services) within the European Union's 4th Framework Programme for R&D.

The NICE Project was carried out between January 1996 and March 1998 by a consortium of 35 partners from 22 countries in Western and Eastern Europe (including Russia), assisted by collaborators from Canada. Partners were a mixture of telecommunication service operators, equipment suppliers, academic network operators and universities and research institutes. The consortium included members of 15 different National Hosts.

The objective of NICE is: to integrate systems to enable the National Hosts to provide broadband application-level services based on ATM and new information technologies

The significant results of NICE project in terms of development of R&D infrastructure are the following:

A. NICE has shown that it is possible to use broadband connections between the EU and the CEE/NIS countries for the purposes of R&D.

B. NICE has successfully supported trials and demonstrations by different ACTS projects.

C. The components and validated configurations developed by NICE have enabled National Hosts to start to provide group interaction services to third party organisations, both nationally and internationally.

The possibilities of Minsk Internet Backbone were demonstrated during our participation in CEE/NIS conferences. UNIBEL was the first Belarussian network, which was able to participate in such global distributed event as an interactive site. This is the last teleconference held from 30 of November till 2 of December 1998.

To summarise I'd like to pay your attention to the following.

Firstly, We've managed to create computer network with the most developed infrastructure.

Secondly, running MIP, UNDP and NICE projects We've introduced information technologies in different fields of our society, in particular in science, in education, in distance education and in social sphere in general.

So, the option that We strongly recommend for more detailed consideration is to make using of information technologies in day-to-day your work. Otherwise you'll not be able to become civilized citizen of modern society.

Not be afraid to do this. You'll be a success using modern information technologies especially based on computer networks.

TEACHING/LEARNING ICIC TECHNOLIGIES — A PATH FOR DISTANCE EDUCATION TO COME TO BELARUS

Dr. Sergei Maximov,
Head of Department, Belarus State University National Institute for Higher Education

We are getting into a new era — one would have to say that information era comes. The computer has made our lives easier in many ways. In particular, it has made the writing process faster and less tedious. At a computer, you can easily move words, phrases, sentences, paragraphs, and pages from one part of the document to another. It is not tricky problem to enhance then in a plain text applying styles, lists, tables, forms, etc., when using modern word processor, e.g. MS Word. As the result, a paper written on a computer has a professional appearance. More a sophisticated work can be done with PC while using OLE interface. It is handled MS Windows for other objects easy to come to the document. These objects are from other MS Windows applications and from MS Office components as well. These useful examples are, for instance, electronic spreadsheets, databases, slide shows, etc. Doing with all such things at PC is not tricky. It is of common practice while doing office jobs, and throughout the world.

In almost all professions, you must know how to use computers. Using computers is good job training for the future. It comes also a great challenge for modern education. Students do now much work on the PCs; they do PC modeling, writing programs, and solving problems. In recent two decades, such the trainings were running to go on much more effective. First, it was made by introducing the LANs. Then, the Internet has come a practicable thing. It brings opportunities a lot for people for to get them "closer" each to the others. People can do now their jobs much more efficient way — doing them working teams; it is quite common now, when the people involved do their jobs at very separated places and often they do not do their works at very the same time. The Internet has come and it is running to be a new "universe", reach in information and huge. Its unique feature is that everybody can publish on the Net. Information to the Net comes anytime and from anywhere. These information objects, however, are not real — they are just a virtual reality. It looks like knowledge — these are anywhere and nowhere at the same time; these used to belong to individuals or groups; these used to obsolete and to come up with new experience comes to people. The Internet does demonstrate very the same. It is not surprisingly that the Internet is thought and throughout the world the media that would be helpful for to bring education to people.

Thus, knowledge of both the Internet and computer comes to be increasingly important for people. Students have to be taught to use Information, Computer, Internet and Communication (ICIC). The knowledge in this field is growing very fast. There are new technologies born through going this way. They have made great progress in industry and in about all people services. These new working places, "made" with computers, are very attractive to young people getting for jobs. Looking for the future good jobs and high

incomes, people used to apply education. Distance learning is the modest way, which is taken and followed in much to reach these benefits.

While concerning distance learning, its current state in the NIS, and in Belarus as well, one can admit that there is a certain gap. First, training materials made in electronic forms are rare. Those presented in the Net are not made well enough; some are poorly designed. Unfortunately, vast majority of teachers here, throughout the region, are not quite well at computer or even their doing well they are not quite aware about the Net, so the materials produced are still bad in use.

These stones along the way for the expected distance learning in the region that shall be a partner form to the others in education are as following. First, while getting along the way, both students and teachers should develop theirs composition skills. It is in the focus of training programs we offer to people. The unique feature here is that the development, one has to be going on, put forward the idea that computer is a universal tool. It is quite a new practice for many to go such a way. Some people can do create text at a computer; others can do more at electronic spreadsheets, etc., but it is time now for everyone to be able to search for, to select, to pick up information, and to create a new one. Secondly, teachers should know how to bring this useful information to students, and the students — how to present it to the netmates. For the purpose, any information should be processed so to carry on with knowledge.

Thus, for distance education to meet high standards and be of high quality to students, the teachers should be prepared for the first. They are staff used to disseminate knowledge directly to people. They are providers of new ones. Thus, if one want to start with distance learning, and then running such the activity for a long, first, he should hit over the problem, which is of the mastering of teachers in the field. Many of them are at least about to the in computer mastering, especially young and ambitious ones. Here, the main problem about the teaching is to give them a clear outlook of the interconnections existed among the ways of how to do a good job at a computer. During and due to the training process, trainees have to become experienced in total using of computer. Here we write down in organization chart of training process. It has been applied for and at least six times in our institute for faculty teaching/learning ICIC.

First, we used to teach small groups — eight to twelve trainees in each. Large groups were divided in sub-groups. It allows team training. This means that each group is encouraged operating in collaborative fashion. Networking supported it. So, it comes soon to trainees that they are the team, which is feeding with the goal. We also used to select applicants and then among the students to group them. The selection process aims at making groups of people with comparable initial skills. We used to select trainers also. As soon as they having selected on the basis of their proficiency, they are asked to teach each one in one subject only, which subject is that of the trainer's most proficiency.

To make a program to teach in we apply team working as the approach to make up the program. Firstly, the trainers are asked to bring theirs ideas to make a curriculum. The discussion focuses on up-to-date issues included

into the course of training. Secondly, the trainers are asked to bring content to each item. These items with the content embedded we put then into a line, which is getting along the course for to complete it step by step. Then the training materials are made to come to people. All training materials come to the students in two forms — printed and electronic documents. Those made for lecturing we used to present of PowerPoint slides. The others were made in very the same program environment which will be teaching/learning how to use it.

Here, just below, we present such a program as the sequence of training modules (activities) for to teach faculty in the using of the Internet/ Intranet. It is assumed with this short-time course that the trainees applying are good in using MS Office; intermediate level is expected (knowing of the MS Office components and having had practice at them) for to get in the course. The course is scheduled for two weeks long (in 72 academic hours total). The program focuses on getting knowledge and practice by hand as well as in Internet/Intranet platforms, program agents (e.g., browsers, HTML-editors, etc.), and tools to create electronic materials and to publish them on the Net.

Here, in the curriculum are:

- What is the Net (the Internet's pre-history, development and current state) and how does it work? What is on the Net (typology of the resources) and

Table 1

Program of the Training Course "Using the Internet/Intranet in Professional Work"

#	Section/ Subsection	Academic hours					Assessment
		Total	PC by hand	Method of teaching/learning			
				Lecturing	Workshop	Another	
1	2	3	4	5	6	7	8
1	Local Area to Global Networking	35	35	11	24	–	
1.1	Introduction to the Internet. Exploring the Net	14	14	6	8		
1.2	Searching Information on the Net	9	9	3	6		
1.3	Making Communications via the Net	12	12	2	10		
2	Web Site Development	30	30	8	22	–	
2.1	Introduction to Web-mastering	2	2	2			
2.2	Web Site Visual Design	10	10	2	8		
2.3	Web Site Design with HTML	6	6	2	4		
2.4	Web Site Authoring	12	12	2	10		
3	Course Quality Assessment					7	Presentations of Web-sites, round-table discussions and evaluation of the outcomes
	Hours Total:	72	72	19	46	7	

how to get for? How to get in the Net and what has one to keep in mind about security and confidentiality while PC is on-line in the Net?

- Getting for more about the Internet's structure and organization. Sub-nets and their classes. Addressing computers in the Net. Exploring Domain Name System on the Net. Hardware and software components for to make connections to and via the Net: more about network adapters, cables, hubs, switches, repeaters, routers, client-server platforms, program agents (e.g. browsers) and plug-ins, and how to install these in a PC. What are information transportation levels and protocols for to get through the Net?
- Lookout the using of information resources and services available on the Net: sending/receiving e-mail, searching information, organizing teleconferences, applying electronic boards (e.g. bulletins, ads), looking for and getting back transfer of a new software. Getting more about the typology of information resources and where to go for. Internet Yellow Pages.
- Searching information in the Net. What are searching engines and how to use them? Basics in the principles of using of catalogues, keywords, and special symbols (Boolean operators) to search relevant information. How to pick up a useful piece of information and to put it to a client computer?
- Developing information resource. Basics on hypertext technology. What is HTML and how to do programming with the language? How to build a Web Site? Web Site components: text, tables, frames, clip arts, images, active-X and Java components (e.g., counters, fields to fill in). Software and program tools for to make them up and come to the seeing and to be living on a Web Site.
- Using MS Office components to create a Web Site. Using MS Front Page to make up a Web Site. Improving Web Site with embedding, by hand, HTML code.
- Web Site authoring and publishing on the server. Getting more about client-server interaction and platforms. How to assess in workouts of Web Site design? How to make presentations to come more attractive when viewing through the Web? How to estimate in the views, i.e., Web Sites?

While trainees are trained in this, there is a set of programs we are applying for to teach in and how to use these. Standard package we choose consists of MS Office 97 and its components, MS Front Page 98, MS Internet Explorer 4.0 and Netscape Communicator 4.05, Net Meeting 2.0. These programs are widely known and shared in the region, and of these can be made a core for people to enhance them both knowledge and practice, by hand, how to search information, to create "scenes" and to make connections to other people or organizations.

The program presented has been applied for and several times. Those training sessions were offered young faculty to come to take them training in the field, ICIC. It has been revised several times in the program also for to make it more effective one. The revision process we used to apply was made due to the discussions. These were made at the end of training sessions. The problems, if found or faced with, were made subjects to discussions open to trainers and trainees. At completion of the course, we provide these have demonstrated high attitudes with the certificates of completion.

It should be stressed in the end that none the program and approach presented in the report is unique. They are rather regular frameworks of doing in Belarus while preparing the staff and faculty as well as for to get them more experienced in the field. It has come to many in the NIS that there is no way to create massive, reach in resource, effective and flexible distance learning as so to make people get prepared well for to do with. It varies with the situation in the region where we are. Here is little information that would be marked good enough for to teach students ICIC both in science and humanities. One would to point down language barriers as boring problem but we do not. Here, in Belarus, we think the problem is mostly of absence of the resource to teach with; the resource to come up here we need people who can do create it. So we do our first job in this way — we do "create" people who will be able to teach in and to manage with distance learning. We are going this way and very consequently to build up distance learning system. It is considered very important path for more people to be able here, in Belarus, to create training materials of a very new style, modern content and appearance. During training sessions, the teachers will get more experienced in how to use them in distance education. It is another, "invisible" hand, which rules with the process. Both the effects, first made of taking knowledge and training by hand on how to do, and second made of getting more experienced in the fashions how to apply with, are very important. Being armed with such knowledge and experience, teachers passed through the course will come modern educators. They would be taken then to be the instructors or tutors to distance learning.

Additional reading

1. Maximov S., Naumov V. *The Concept and Program How to Develop Distance Learning at Belarus State University.* Proceedings of the 7th International TIBO Congress, Minsk, 2000 (paper to be presented, in Russian).
2. *Education and Informatics.* Proceedings of the Second International UNESCO Congress. Moscow, 1996.
3. *Selected Papers on Distance Education.* Third revised edition. Published FernUniversitat, Hagen, 1993.

A SYSTEMS APPROACH TO KNOWLEDGE MANAGEMENT

Prof. Jan Plass,
Organizational Learning and Instructional Technologies Program University of New Mexico

There is an increasing demand for Knowledge Management Systems for they address the growing need for solutions that allow for better access to complex data presented in various types and formats of information. In this paper, a systems approach to the design of such a knowledge management system is presented. This approach is based on three dimensions: a knowledge management dimension, a learning dimension, and a systems design dimension.

INTRODUCTION

The amount and complexity of information available to us in different media types is ever increasing, but the tools we use to acquire this information have remained relatively unchanged. From a communications standpoint, we are faced with an increasing amount of data that needs to be made accessible by representing it as information, using methods of information design (Fig. 1). Individuals select, manipulate, interpret and process information, often using activities developed by methods of instructional design and interaction design. Based on this information an individual constructs knowledge, and, ultimately, meaning, or wisdom.

The wealth of available information requires domain-specific customized solutions for making the information readily available to all users. Often, however, a mere search capability or a document management solution is not sufficient to solve an individual's need for accessing that information. Instead, a systemic knowledge management solution is needed that includes, in addition to document management features, components for advanced searches, decision support, case examples and best practices and instruction covering the use of the information in an integrated form.

Salisbury, Plass & March (2000) propose a conceptual framework for the conceptual design of such a knowledge management system. This framework

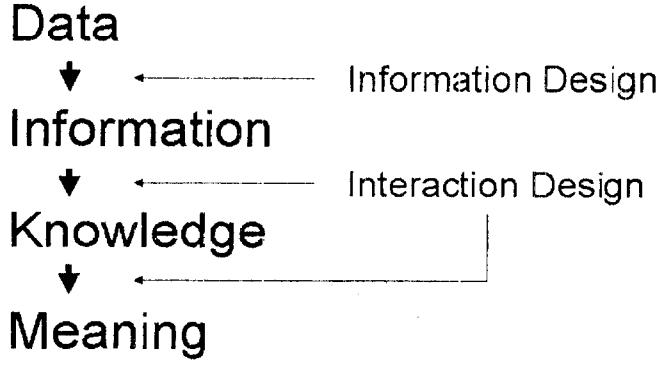


Fig. 1. Data, Information, Knowledge and Meaning

consists of three dimensions: a knowledge management dimension addresses the need to grow and share knowledge, a learning dimension allows the design of instructional materials that will provide assistance to the learners in using and applying the new knowledge, and a systems design dimension assures the design of an open system that allows for growth and change. These three different dimensions are described in the following sections.

DIMENSIONS OF CONCEPTUAL FRAMEWORK

Knowledge Management Dimension

The knowledge management dimension provides a means to promote the growth and sharing of knowledge within a community of learners. In order to facilitate the individual construction of knowledge, information has to be captured and made available in meaningful ways. For a practical implementation, a system needs to be designed that supports the knowledge creation process with practical mechanisms for capturing and disseminating knowledge. Figure 2 shows the components that such a knowledge management approach would require. *Document Access* refers to the search capability of the system that lets the user retrieve information in different levels of granularity using a key word search. *Best Practices* show real-life examples of how information was applied by other individuals in a given situation. *Case Examples* illustrate key concepts by providing examples that were especially developed for this purpose. *Decision Support* provides assistance to the inexperienced user in the form of procedural knowledge of how to apply their newly gained knowledge in a given situation. The central piece of this system is the *Communication* between individuals in order to form a community of learners that shares and grows knowledge.

The capabilities that support the knowledge creation process in such a system are based on Nonaka and Takeuchi's (1995) description of creating

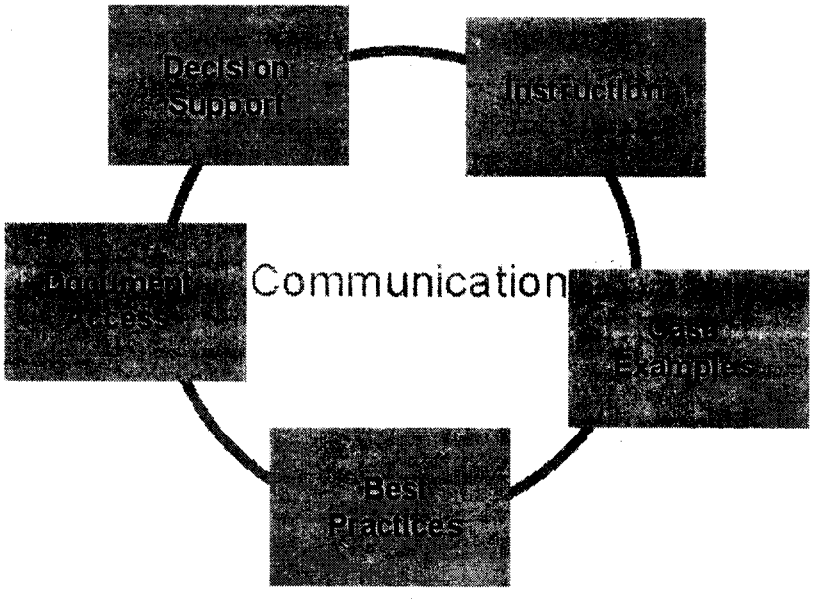


Fig. 2. Elements of a Knowledge Management System

a knowledge spiral in an organization. In their view, the process of transferring knowledge from one individual to another begins by the first individual converting tacit knowledge (i.e., intuitions, unarticulated mental models and embodied technical skills), into explicit knowledge (i.e., a meaningful set of information articulated in clear language including numbers or diagrams). This explicit knowledge can then be passed on to another individual — who must convert it into tacit knowledge (internalization) before he or she may use it.

Systems Design Dimension

In order to implement a knowledge management system, a development methodology needs to be used that reflects the complex and changing requirements for the system and provides a means to control further development and maintenance costs. One possible approach, described by Salisbury, Plass & March (2000), is to view the system as a "living" and adapting organism. That is, since growing and sharing knowledge is, by definition, an ongoing and self-modifying process, the goal is to design and build a system that is adaptable to its environment — a living system. This view of a system as a living entity falls under research that has been labeled "autopoiesis theory." This concept was developed over thirty years ago in biology through the work of Maturana and Varela (1980). It enabled them to make a distinction between living and non-living systems. Since autopoiesis is Greek for *self-production*, an autopoietic system is one that has, within its own boundaries, the mechanisms and processes that enable it to produce and reproduce itself. Applying this concept to human social systems such as our development process, Luhmann (1986) describes such a system as one that is both opened and closed to the environment. As such, it is closed to information and knowledge but is open to data. The system constructs its own knowledge through the process of accommodating data from the environment. As a result, the very structure and nature of the system is shaped and changed by the process. (See von Krogh, Roos, and Slocum (1996) for an essay on the history and application of autopoiesis theory.)

Learning Dimension

The capabilities of this Knowledge Management System need to be designed to serve a diverse group of users for a wide variety of individual purposes. Our learning approach is user centered (Laffey, 1995), and it applies the principles of situated cognition (Brown, Collins, & Duguid, 1989; Laffey, 1995). That is, it supports "just in time" capabilities for end-users to apply their newly constructed knowledge within the ongoing context of their everyday work (Plass & Salisbury, 2000). The demands of this situation be can best described as learning-on-demand. The design of the learning component of this system may be based on an extension of the Cognitive Flexibility Theory (Spiro & Jehng, 1990) and the Situated Learning Theory (Lave, 1988, Wilson, 1993).

Situated Learning Theory recognizes the fact that learning is dependent on the activity, context, and culture in which it occurs. It demands that knowledge be presented in an authentic context, and emphasizes the importance of social

interactions and collaboration in the learning process. Watkins (1993) calls learning in and knowing in actual situations and with authentic activities a "process of enculturation, not simply a matter of acquisition." (p. 77). He further argues, "problem solving and human cognition are carried out in conjunction with the setting, not simply as internalized mental processes" (p. 77). Others extend this idea of situated cognition to a form of cognitive apprenticeship, in which learners engage in authentic activities in a way similar to craft apprenticeship (Brown, Collins & Duguid, 1989).

For the purpose of designing the learning dimension of this system, we use an approach that integrates Situated Learning Theory and Cognitive Flexibility Theory (Spiro & Jehng, 1990). Cognitive Flexibility Theory, as originally conceived, aims to develop the ability of spontaneous restructuring of one's knowledge to adapt to changing situational demands. Spiro and Jehng (1990) argue that this ability depends on how the knowledge is represented in the learning situation, for instance, as instruction with a limited number of examples versus a large number of cases that illustrated the complexity of the concept taught. But it also depends on the question of whether the goal of learning is to provide learners with answers, i.e. with intact schemata that need to be retrieved in order to answer a question, or whether it is to enable the learners to construct or assemble schemata from several schemata stored when the situation demands it (Spiro & Jehng, 1990).

Based on these two theories, Situated Learning Theory and Cognitive Flexibility Theory, the design of the instructional component of this system is tightly integrated with the decision support component and the document management component. In fact, these theories give additional support for the idea of using an integrated systems solution for a knowledge management system. The integration of these components assures an authentic learning situation where the users request instruction when they need help in order to construct the knowledge needed to perform the task at hand. The reciprocal relationship between instruction and the other components, decision support and document management, results in a situated learning environment. The instruction provided supports the use of the document management and decision support components, while these components in turn root the instruction in an authentic environment with case studies, examples, and authentic documents. In addition, the flexibility of restructuring knowledge and assembling of schemata, which is the aim of Cognitive Flexibility Theory, results from the different access routes to the instruction and documents that this design makes available to the user. In other words, the mini-cases needed to construct rich schemata are provided in forms of documents, examples and case studies, as well as in the instruction. Any given instructional component can be accessed from different parts of the document management system or from the decision support component that relates to the topic covered. In turn, different documents or parts of the decision tree can be referred to from the tutorials to serve as examples for the instruction given.

While cognitive flexibility hypertext might be useful for the expert learner, the use of constructivist learning environments with rich connections and

a large number of choices for the learner is not an appropriate solution for all levels of learners. New hires or learners with little experience in a particular subject will not be likely be able to make the choices required by such a system. Instead, for these learners, a more structured environment might provide the necessary scaffolding and guidance for the initial instruction. After this more structured instruction has been completed, these learners can access the less-structured cognitive flexibility hypertext described above.

Summary and Conclusions

The situation described in this paper represents a typical problem as it faces individuals as well as corporations and other institutions today: Highly complex information needs to be made accessible to a variety of users with different levels of expertise and different job functions. The solution described takes a systems approach and includes document management features, decision support, advanced searches, case examples, best practices and instruction. The design of the instruction is based on an extension to the Cognitive Flexibility Theory (Spiro & Jehng, 1990) and Situated Learning Theory (Lave, 1988). Both theories emphasize the importance of the rooting of instruction in authentic situations, which, in the case of the example described in this paper, is the user's work environment. This rooting is facilitated by providing case studies, examples and best practices. In addition, the examples given allow for the construction of rich schemata that can be used to construct a new schema when needed for a task at hand. The extension of these theories consists in the structuring of the instructional materials in different ways for different levels of knowledge, the use of a growing system that allows learners to feed their knowledge back into the system and the expanded concept of mini cases that provides multiple access routes to the information a learner needs.

REFERENCES

1. Brown J. S., Collins A., Duguid P. "Situated Cognition and the Culture of Learning", *Educational Researcher*, January-February, 1989.
2. Lave J. *Cognition in Practice: Mind, mathematics, and culture in everyday life.* Cambridge, UK: Cambridge University Press, 1988.
3. Marsick V., Watkins K. "The Learning Organization: An Integrative Vision for HRD", *Human Resource Development Quarterly* 5(4): 353–360, 1994.
4. Nonaka I., Takeuchi H. *The Knowledge-Creating Company.* New York: Oxford University Press, 1995.
5. Norman D. *Things That Make Us Smart — Defending Human Attributes in the Age of the Machine.* Reading, MA: Addison-Wesley Publishing, 1993.
6. Plass J.L., Salisbury M.S., March, J. Integrated Instruction as a Component of a Knowledge Management System: A Case Example. *Submitted for publication,* 2000.

7. Salisbury M.W., Plass J.L. Building a Web-Based Organizational Learning and Information Support System (OLISS). Paper presented at WebNet 99 World Conference on the WWW and Internet, October, 1999 in Honolulu, HI.

8. Salisbury M.W., Plass J.L., March J. A Conceptual Framework for a Knowledge Management System. *Submitted for Publication,* 2000.

9. Spiro R.J., Jehng J.-C. Cognitive Flexibility and Hypertext: Theory and Technology for the Nonlinear and Multidimensional Traversal of Complex Subject Matter. In D. Nix & R. Spiro (Eds.), *Cognition, Education and Multimedia: Exploring Ideas in High Technology.* Hillsdale, NJ: Lawrence Erlbaum, 1990.

10. Turban E. *Expert Systems and Applied Artificial Intelligence.* New York: Macmillan, 1992.

11. Von Krogh G., Roos J., Slocum K. "An Essay on Corporate Epistemology", in G. von Krogh and J. Roos (eds.) *Managing Knowledge: Perspectives on Cooperation and Competition,* London: Sage Publications, 1996.

12. Wilson A.L. The promise of situated cognition. *New Directions for Adult and Continuing Education,* 57, 71–79, 1993.

13. Zuboff S. *In the Age of the Smart Machine.* New York: Basic Books, 1988.

TOWARDS A TECHNOLOGY-MEDIATED EDUCATION SYSTEM

Dr. Tarek Shawki,
Regional Informatics Advisor, UNESCO Cairo Office

This report reflects the views and experiences of the author regarding the integration of modern Information and Communications Technologies (ICT) in higher education systems. It is particularly customised for discussions during the sessions of the international expert meeting to be held in Minsk–Belarus from March 1 to 4, 2000.

THE ICT REVOLUTION

Recent years have witnessed a remarkable, if not breathtaking, revolution in the area of Information and Communications Technologies (ICT), particularly in the utilisation of the Internet for transporting and sharing information world-wide. Although the Internet has been in place for over twenty years, it is only in the past four years that its presence has been strongly established. In fact, the recent revolution in information technology may be traced back to mid-1993 when NCSA (National Center for Supercomputing Applications), on our campus, released the first version of NCSA mosaic. This new browser, as this kind of software has come to be called, opened the Internet to nonacademic users and triggered numerous developments of the new communication tool.

The rapid evolution and availability of Internet-related technologies has fuelled extensive efforts and discussions in the areas of education and professional development. The ease by which the Internet bridges the distance barrier has led to numerous new models of education that are expected to prevail in the twenty-first century. The numerous interconnected computers communicating over the Internet, and the nature of the software services available on them, has led to the notion of a World Wide Web of information resources. We will primarily reserve the name "Internet" to the physical vehicle allowing communication, and use the term "Web" to describe this vehicle augmented by rapidly developing software tools and repositories of data. When we use such terms as "Web technology" we are primarily concerned with the interface seen by a computer user, not with issues of physical connectivity or bandwidth. It is in this area of software on a distributed computer system with strong communications software tools that one should expect to see the most profound influences on education.

TOWARDS A NEW LEARNING MODEL

It appears to us that the Internet and Web technologies offer a remarkable medium for a new learning framework that is destined to dominate education in the twenty-first century.

The classical learning models

Learning has generally been accomplished through a classical model involving direct instruction. The classical learning model is restricted by limitations of both time and physical space. This model confines the student to the experiences offered by the instructor, at the time scheduled, and to the locally available reference materials. When applied in schools with limited financial resources, the classical model suffers from lack of resources (e.g., laboratories, software, reference materials, etc.). Video-based instruction, as we offer to off-campus students, suffers from similar limitations except for the time limitation, since a tape may be viewed at any convenient time. However, video-based course material may quickly become out of date, and unless very professionally produced, which can make the cost prohibitive, may be exceedingly dull. Moreover, video-based courses lack the important component of student involvement and engagement in the learning process.

The new learning model

The Web potentially offers a world-wide forum in which to teach courses. One can assume that each student at any time has, for example, the Encyclopedia Britannica at his/her disposal. Course material can be dynamically updated. Course text, examples and exercises can be interactive in the sense of immediately illustrating equations with graphs, changing parameters and seeing the results, linking to other web-sites according to the interests of the student. The Web-based learning model is essentially free from limitations of space and time while it reaches students around the world with great ease (given adequate bandwidth). In addition, the Web-based learning model offers students a wealth of information that was never possible through the classical model. For example, the student who suddenly becomes interested in what kind of music was composed during Newton's lifetime, could link to that information, even though the instructor may not know the answer to this query, and certainly would have a hard time producing a sample on short notice. The possibility of linking to information world-wide in a multitude of formats creates a remarkably rich medium for learning that opens the doors for great creativity and holds considerable promise.

What does the web offer for learning?

Before addressing this question we would like to distinguish two different utilizations of the Web in teaching:

- Scenario 1: using the Web as a *supplement* to in-class instruction, and
- Scenario 2: using the Web to offer *remote*, self-contained instruction.

The two scenarios benefit from a set of common advantages but the second one is far more involved than the first. The first scenario aims primarily at enhancing the learning experience through the utilization of Web technology, while the second aims at the enlargement of the student pool through outreach to a world-wide cadre of students across the global Internet.

In both scenarios, the Web allows the introduction of many useful ingredients to a course. Examples include:

Static Web Content

- Posting all organization-related course material (e.g. course syllabus, calendar, guidelines, grading policy, etc.) Such material is today typically distributed to students in class or posted on departmental bulletin boards. The benefit derived from electronic posting of such material becomes more evident for classes of large size.
- Posting lecture slides used by the instructor during in-class instruction.
- Posting of complete homework/exam solutions or posting of complete databases of example problems.
- Class announcements.
- Posting of grades.
- Access to extensive electronic help engines, software manuals and links to other relevant sites.

Dynamic/Interactive Web Content

- Electronic teaching assistance through the utilization of interactive, on-line discussion groups.
- Interactive interfaces to software packages. This is a very powerful component of the evolving web technologies. Examples may be found on the MOTI web site (see web references).
- Multimedia enhanced content. This includes the utilization of audio, video and animations to illustrate difficult concepts.

A primary difference between scenarios 1 and 2 for Web utilization relates to the completeness of the web site. In scenario 2, the web site has to include complete lecture notes and study aids to substitute for the lack of an instructor. Our first attempt in this direction may be examined by checking the reference for TAM 485 at the end of this document. This experimental offering is progressing rather smoothly.

Benefits of the web-based learning model

Here, we compile some observations regarding the benefits afforded through the proper utilization of the Web in teaching:

- The Web offers students a far richer environment for learning than the classical in-class teaching. On a properly designed Web-page the student has access to a wealth of information pertaining to the topic of interest, that is indexed and completely searchable. Hence, the student can pursue a particular topic more efficiently and in greater depth.
- As the Web content continues to grow, both faculty and students begin to gain access to information in related fields of knowledge. For example, while offering the course TAM 485 — Fracture Mechanics, we made numerous links to topics addressed by the lecture notes of another course, TAM 452 — Solid Mechanics. This specific feature of the Web dissolves the boundaries between subjects and courses and allows students to gain a proper sense of their major field of study as a continuum rather than a set of discrete entities.

- Again, as Web content continues to grow, instructors may be freed from presenting similar material in different courses. References to existing Web content may substitute for redundant revisions in various courses.
- The Web allows the instructor to offer many more examples and high quality drawings as opposed to the constraints presently found in the classical instruction model.
- Web technology allows for the introduction of animations and video clips that explain topics which are not easy to discuss using traditional means.
- The Web offers unprecedented opportunities for educators to collaborate on teaching efforts. Traditionally, a student in a particular graduate school receives his/her primary input from the instructor assigned to a particular course. With the advent of the new technology, one may envision a learning environment where faculty in different schools can share their course material over the Web for the benefit of students and the field of study at large.
- Web technology allows for a new breed of applications based on the idea of interactive interfaces and collaborative learning. For example, we have written server scripts that allow a Web client to access the *Mathematica* software residing on our server through Web forms. The outcome is that a student may run *Mathematica* on the server while receiving the output (both text and graphics) on the client side. This feature allows an instructor to use certain software packages without additional financial burden on either the students or the institution. The instructor may prepare highly illustrative examples using such an interface, and students can interactively explore the outcomes of those examples. Similar efforts are underway to allow students to run finite-element computations interactively on the Web. This should prove very useful when combined with traditional theoretical developments of the subject.

Typical ict-based models of learning

The recent revolution in Information and Communications technologies has produced a variety of ICT-based models of learning. Here, we may cite a few examples:

- Learning by "correspondence"
- Learning through "Pressure Sensitive Blackboards"
- Learning through "Video Taped Lectures"
- Learning through "Interactive CD's"
- Learning through "Web-based courseware"
- Learning through "Satellite delivered courses"

In reviewing the above list, we note that all of the preceding solutions provide some level of integration of ICT in higher education. However, all models stop short of the optimal utilization of available and emerging technologies. Moreover, educationalists would strongly argue about the pros and cons of each of those solutions. Figure 1 presents a schematic illustration of a typical ICT-based model of learning.

A careful examination of the above model identifies a number of important characteristics:

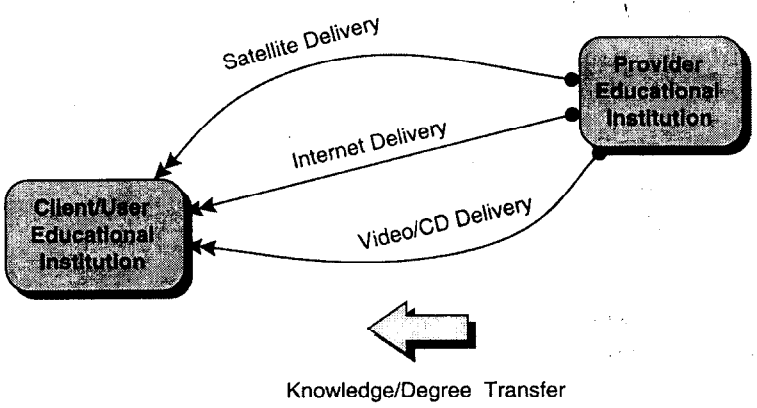


Fig. 1. Basic models of ICT in higher education

- The model involves only one provider institution and; therefore, is limited by the content and quality of this institution.
- The academic degree is offered by the *provider* institution to students attending the *client* institution. This model usually receives significant resistance by faculty and administrators at first rate institutions. Moreover, this particular issue brings to the forefront issues related to the quality of the academic degree.
- This model poses a direct threat to faculty at the client institution who are typically uncomfortable with their replacement with a foreign curriculum.

It is important to note that we did not comment on the "method of delivery" chosen for the knowledge transfer between the provider and client institutions. This is due to the view that the delivery technology plays a minor role in the proposed learning models as opposed to the general framework itself.

In an attempt to find a new learning model that utilizes the emerging ICT technologies while avoiding the shortcomings of typical ICT-based models, we envisioned the modified ICT-based model illustrated in Figure 2.

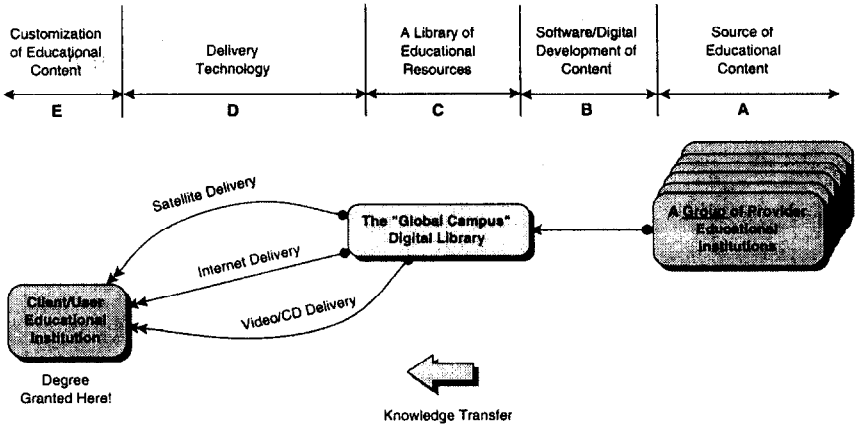


Fig. 2. Modified model of ICT in higher education

It is essential to observe that this model involves a *group* of first class provider institutions instead of just one. *This feature alone presents a significant departure from all previous models known to distance learning.* At the same time, it brings to the model a number of additional difficulties. In addition, we stress that the academic degree, in the proposed model, is granted by the client institution where the students are enrolled. The model does not suggest distance learning model in the traditional sense of an unattended student learning. On the contrary, the model attempts to retain all of the traditional aspects of learning including the direct contact between faculty and students.

We will end this subsection by identifying the major components of the proposed model since they are needed for future sections of this document:

- Stage A
  Content authoring and initial preparation at the provider institution.
- Stage B
  Content conversion into interactive, object-based courseware ready for delivery over CD's and/or the Internet
- Stage C
  The compilation of courseware into an extensive library of digital educational resources.
- Stage D
  The delivery phase which is directly related to the choice of a delivery technology.
- Stage E
  The customization and final preparation of the courseware by faculty at the client institutions for dissemination to the students.

THE WEB-BASED COURSEWARE

This section explores the general elements of web-based curricula in our opinion. Such views are reflected on the general design of our training programmes (USEE) and future activities.

Description

The Web-Based (WB) courseware is not merely an electronic duplicate of the original course material. The WB courseware is a new breed of education material which takes full advantage of the emerging web and multimedia technologies in order to achieve an efficient, yet enjoyable, learning process. The WB courseware utilizes the new programming languages (e.g. JAVA, JAVA SCRIPT, PERL, etc.) to bring interactive simulations and virtual laboratory experience to the course material. Thus, complex concepts are introduced in innovative new ways. Full linking to vast resources available worldwide introduces new levels of usefulness to the courseware. The final WB course is envisioned to be a dynamically-evolving resource that will prove beneficial to both students and instructors alike.

In light of the foregoing remarks, it is evident that the design of a web-based course is a multifaceted process that closely resembles that of movie

making in cinema productions. That is, a WB course is developed through the efforts of a team of professionals with a complementary range of skills as opposed to the classical course design which is typically developed by the faculty. A WB course begins with the basic "script" typically provided by the specialized faculty member(s) in a given field of knowledge. Next, the WB course development team, in collaboration with the script author, needs to settle on a "scenario" for course presentation as well as a set of course ingredients. The richness of the modern web and multimedia technologies allow for unlimited creativity when it comes to electronic courseware development. Such richness offers educators new opportunities to develop very interesting course material while it also poses a challenge in that it requires faculty to rethink their own course offerings in light of the new technologies. Various CII Initiatives were put in place in order to help faculty in the region publish their intellectual works into an interactive electronic format and then make it accessible to learners globally. In a way, you might think of the CII development components as a "course studio" in which your own course is made into a "courseware" through the efforts of skilled professionals in the areas of information technology and software development.

In order to make those ideas clear, we consider an example involving an engineering course in the area of "Behaviour of Engineering Materials". We assume that the course involves in-class lectures as well as laboratory components when taught on campus in the classical fashion. The students are expected to study from a reference book (selected by the instructor), instructor handouts and/or slide presentations as well as from exposure to laboratory live experiments. If we were to prepare a WB version of such a course, we would first gather the educational material from the instructor (e.g. handouts, slide presentations, homeworks, solutions, laboratory manual, etc.) and the copyright permissions from the publisher of the reference book. Next, we discuss with the instructor the option of producing "video clips" of the laboratory experiments along with other possible enhancements such as "interactive simulations" or "computational engines" and other similar software components. As the development team converges on a design strategy that is most suitable to the course material at hand, the development process starts. As you might expect, such a process requires the continued involvement of the instructor as the development proceeds. Furthermore, the instructor's familiarity with the underlying technologies is a definite plus although the lack of it is not supposed to affect the courseware development in any major way.

Design

In light of the general objectives of the USEE framework, it is found that courseware developed for use within the USEE curricula proves to be most useful if designed in object-based fashion. More specifically, a course in mathematics could be designed to match a specific textbook, or designed according to the preferences of a specific author or designed around an abstract set of topics. We seek the last option in which the core course material is divided into smaller objects (sub topics) instead of being presented as lectures.

The same philosophy carries over for all other course ingredients such as course slides, homeworks, examinations, etc. The idea here is to make the WB courseware as flexible as possible which facilitates different implementations by various faculty. We try to parallel the process of course development undertaken by a typical faculty. A faculty usually searches the published literature for relevant material and then composes his/her own set of lectures by integrating material from different sources. Hence, we try to design the WB courseware in such a way that this "authoring process" is still an option. Therefore, we present the faculty with a "digital library" of resources in a given field of knowledge. The digital library may include lecture objects, illustrations, libraries of worked-out problems, libraries of interactive Java applets, libraries of video/audio clips among many other ingredients.

Along with the digital library, we seek to develop a custom software called "WB Composer" which helps the faculty build their own lecture material from various ingredients residing in the WB digital library. This facility helps faculty accommodate the guidelines imposed by their host institutions and also help them maintain their own identity related to the teaching of the respective course material.

Thus far, we have mentioned a "course composition software" called the "WB Composer" and "WB Digital Library" of educational resources. The third ingredient is a set of software tools for the client institutions to be used during the course delivery. This software set is referred to as the "WB Course Management Toolkit". The toolkit is supposed to help instructors in client institutions manage the delivery of WB courseware, track student progress and assessment of performance. It is also intended to help administrators in client institutions manage operations involving students' registration, admittance, tuition collection, etc.

On the methodology of courseware development

The next figure presents a diagrammatic view of the general methodology involved in the development of the USEE courseware. The first step following course material acquisition is the production of a set of typeset course content (if not already in digital form).

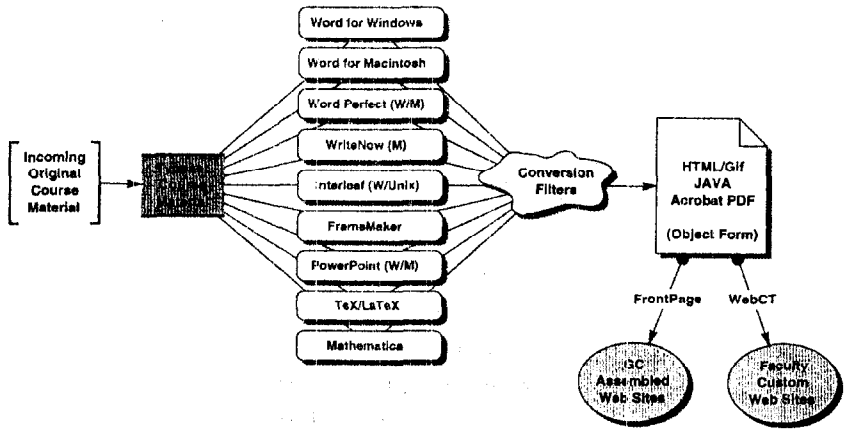


Fig. 3. Methodology of courseware development

Typically, we receive typeset material from contributing faculty. The usual problem is to craft an effective solution to the "filtering" problem, which means the conversion of the typeset material from its original format to a web friendly format. This process is the fundamental development step especially in science/engineering content.

Filtering of science/engineering course content faces the challenge of preserving the extensive number of embedded equations and graphics. The quality of the final product depends strongly on the filtering strategy selected. At the same time, the considered solution is a matter of *software artistic developmental skill*! For instance, we were faced with course content provided in some old word processor formats such as Lotus Manuscript (DOS) or Word Perfect version 1.0 for the Macintosh. Such situations pose a serious challenge to our process. For each of the 10 courses developed in phase I of the project, we used a different filtering solution. In certain instances, we were forced to retype the original content in a "filter-friendly" file format.

EVOLVING LEARNING ENVIRONMENTS [1]

> *"By the year 2000, American colleges and universities will be lean and mean, service oriented and science minded, multicultural, and increasingly diverse — if they intend to survive their fiscal agony."*
>
> *Time, April 12, 1992*

In a recent symposium, leaders in higher education were brought together to discuss the place of technology in colleges and universities. They addressed the following general questions:

- Why does education need technology?
- How will technology effect education, as it is known today?
- What justifies technology's cost, and what is its value to higher education?

To an intelligent person, it seems impossible that educators could possibly need to ask these questions in the last decade of the twentieth century. The fact that these questions were asked, however, suggests that there is a major problem. In a society where almost all cultures have embraced technology and are moving quickly to fill gaps in order to utilize technology, higher education as a whole lags behind. One wonders if, in the past, higher education was as slow to embrace running water in dorms or slide projectors in classrooms. In a recent issue of *The Monitor*, Tom Wason reaffirms the fact that no situation in which the world finds itself is truly new:

> *"If you look far enough into the future... you can see the past. The development of new information technologies has placed the educational establishment at a juncture parallel to the fifteenth century academy shortly after the Gutenberg revolution..."* (Wason, 1996)

It seems, therefore, that a twentieth century revolution parallels a fifteenth century revolution. How can this be? How is it possible that this mindset still exists? Perhaps it exists because higher education is no driven by the

[1] This discussion benefits from the excellent article "Information Technology in Higher Education: Evolving Learning Environments" by Karen C. Fox.

demands of a capitalistic society, as is private enterprise. Perhaps it is an arrogance that life will always be the same and that one does not have to change. Perhaps it is the academic mentality. Whatever the reason, it leaves society wondering if higher education in its current form can meet the demands of this modern information age. Twenty years ago industry learned that to survive it must embrace technology as an integral part of the industrial world, and today if colleges and universities are to survive they must embrace technology as an integral component of higher education.

One of the first areas that requires change is higher education's perception of technology as it relates to the mission of higher education. For the past decade, most attempts to use technology in higher education have been very haphazard: systems have been designed only to automate existing processes, computers have been thought of as strictly computational devices, and desktop workstations have not accomplished much more than to replace the typewriter and the adding machine. Today, however, technology is creating a new educational platform and is reconfiguring the way a student learns. Network learning -- accessing libraries, scholars, networks, and information worldwide — is evolving. In light of this, one important question needs to be considered — what is the mission of higher education? Since education is a discovery process, an exploratory process, its mission is to provide the widest repertoire of possibilities with which a student is faced when entering a learning situation.

Technology can provide this learning expanse, and because of it a student's educational experience will be immeasurably richer. For example, anatomy students generally hear lectures and read textbooks on anatomy and maybe are lucky enough to have a human cadaver to dissect in a laboratory; using a computer, however, they can actually dissect a human body, do procedures over and over, and even practice surgical procedures. Instead of viewing cell slides once in a laboratory or looking at still photographs in a textbook, students can have around the clock access to live slides and can perform laboratory procedures using the computer. Medical residents can have access to heart and lung sounds that they probably would never have experienced in a residency in just one hospital. With distance learning, students can view medical procedures first hand to which they otherwise may have never been exposed and listen to Nobel Prize winners lecture while sitting in their classrooms.

With many universities providing their scholarly lectures on the Internet, students can have many views of a topic and can also have electronic access to more scholars faster than publications can provide. With automated history books, students can hear and see the Fireside chats and watch Apollo liftoffs instead of just reading about them. In their article "Using IT to Enhance Academic Productivity", William Massey and Robert Zensky state the conditions necessary to make such an experience possible: "IT offers a great potential, but in order to reap the benefits, institutions will have to transform themselves in fundamental ways. Our task is to understand these changes in terms that are both practical and operational". (Massy and Zensky, 1995) This statement emphasizes the basic change to which higher education must devote itself in order to accomplish its mission.

The most important potential of technology in education is in the use of the world's increasing amount of knowledge. In all disciplines there has been a tremendous implosion of data with no real way to disseminate it; this data requires technological resources to communicate it as usable information. This communication of usable information tends to be disseminated vertically; to be useful, it must also be disseminated horizontally, crossing discipline boundaries. Traditionally, higher education has organized itself along rigid boundaries of discipline which result in a ghettoization of thought; but technology forces people to cross boundaries, to think comprehensively, to find ways to solve problems. For instance, one learning experience which could be more comprehensive if these rigid boundaries were crossed exists between two very dissimilar disciplines, physics and medieval English.

A very basic concept in the study of physics is the study of sound waves. In medieval literature Geoffrey Chaucer, in a poem written in 1379 entitled "House of Fame", gives a long, accurate description of the way sound waves travel through air. If one were researching the concept of sound waves in a traditional library setting, he would never find a reference to Chaucer's medieval poem among the scholarly treatises on physics; however, querying the Internet for references to sound waves, he would not only find the physicist's theories, but Chaucer's as well. The theories are not different, but while the physicist observes the scientific importance of the journey of sound waves through the air, Chaucer looks at this physical phenomenon through the eyes of a very practical man and a poet. By seeing this topic communicated in different ways and by crossing these distinct discipline boundaries, the student has broadened his perspective in a way that was almost impossible before technology reached this stage. In a recent Eductech report, William Graves insists that technology is the most viable tool for improving educational quality and information accessibility. (Graves, 1995) To encourage human potential by providing this wide variety of communications resources is, therefore, the vast potential of the information age in higher education.

If there is then great potential in using information technologies to benefit higher education, why is it not happening? What is the problem? What can be done to solve the problem? Massey and Zensky suggest that an overall sense of purpose is missing from higher education. A futuristic understanding at what all of these technological advances might mean or what these innovations might look like is missing. The fact that practicality and accountability for the consequences of decisions are also missing results in the haphazard approach to the use of IT resources. (Massy and Zensky, 1995) As a result of the traditional isolationist environment surrounding higher education, a vision of how to utilize technology is missing. Not only does this lack of vision exist in the mission of higher education as practical educational applications but is also prominent in the higher education system as evidenced by a severe lack of adequate administrative systems. The university leadership and infrastructure must support the endeavor to use technology to improve and evolve learning environments. Learning environments cannot evolve without the adaptation of practical educational applications strengthened by strong administrative systems. To achieve this, there should be a philosophy in higher education of delivering computing services as a public utility, such as

electrical services or telephones. In order to accomplish this philosophy, in order to make decisions that will create a collaborative learning environment, the two sides of education must meet: the fiscal and managerial must meet with the academic and philosophical. The collaboration of these two entities requires the leadership and vision of the entire university organization.

The organization of IT in higher education must be improved, and the university as a whole should have an infrastructure in place to support the potential of this information age.

Metatonia

> *It is a misfortune, inseparable from human affairs, that public measures are rarely investigated with a spirit of moderation which is essential to a just estimate of their real tendency to advance or obstruct the public good; and that this spirit is more apt to be diminished than promoted by those occasions which require an unusual exercise of it.*
>
> James Madison
> Federalist

In supporting the potential of the information age in higher education, complexity in the use of information technology must evolve into simplicity. Information systems should be as simple to use as a light switch or a telephone. If technology is to be embraced and thus indispensable to higher education, it must be that simple. IT professionals must, therefore, understand the way the user thinks: technology is broken and discarded if the user can not perform necessary tasks. In a recent CAUSE professional paper, Jan Baltzer suggests that IT must think of itself as a supplier of information to the rest of the institution, must consider the entire institution as a customer base, and must realize that IT needs the customers as much as the customers need IT. (Baltzer, 1991) If IT professionals thought of themselves as suppliers of information and thought of the users at the institution as their customers, they would make the utilization of IT services simple. For instance, something as simple as dialling into the network from home to use e-mail can require the integration of up to three processes: configuring modem software, installing network software, and installing e-mail software. To the IT professional, this seems simple; to the user, who must spend one hour installing all the software and subsequent hours reading through pages of manuals and going through three steps to log on, the task is not only difficult but also frustrating. Simplicity then is necessary and simplicity requires integration. To achieve integration, Heterick maintains that everything should appear as one system to the user and that systems should be distributed with a single systems interface. He also proposes a "single system image" as the principle element whereby coherency in information technology (IT) is maintained. (Heterick, 1988) Integrating systems into a user view of a single systems image and thinking of users as a customer base will allow the IT organization to evolve complexity into simplicity.

Achieving this objective of simplicity requires a major change in the thought processes of leadership in higher education as it relates to strategic planning and the role and organizational arrangement of IT. The

way the university thinks, feels and acts toward technology must be restructured, and the way to achieve this objective is to weave the IT organization throughout the university infrastructure.

This restructuring of the IT organization requires a metatonia — a shift of mind — because, while a change in infrastructure can facilitate the potential of the information age, only the people in the organization can transform potential into reality. It requires a shift in the minds of university leadership, of the IT leadership and staff, and of the IT customers which include faculty, staff, and students. This metatonia will require them to look at the organization in a new and different way as interdependent groups, departments and individuals rather than isolated areas of structure. Ernst suggests that to accomplish this change, institutions should place less importance on the organizational chart and more emphasis on crossing departmental boundaries, stimulating and rewarding collaboration, providing easy access to information, and having customer centered objectives. (Ernst et. al., 1994) Strategic planning should be highly visible. IT organizations should, moreover, be in a continuous strategic planning roll and should make decisions and policy in concert with administration. Heterick underscores this need for collaboration: "As the paradigm for campus information systems turns from a mainframe centered, Ptolemaic model to a user centered Copernican model, it will be necessary to define responsibilities." (Heterick, 1988) This defining of responsibilities will need to address the relationships between the university's strategic planning, the goals, and the information infrastructure. Heterick further suggests that the most recent management crazes — reengineering, total quality management, best practices, and zero defects — have all failed basically because they have not adapted the idea of networking, which is about getting as much information out in the organization as possible to allow diverse units to function as one. (Heterick, 1996) This metatonia is the ultimate responsibility of the university as a whole, and without it, any IT approach will fail.

Simplifying the using of technology and accomplishing a mind shift are, however, not achievable without strong leadership. Although the importance of networking has already been established, networking has less to do with management and more to do with leadership. Chinese history involves a highly educated figure known as a mandarin, a high civil servant who exercised immense but undefined powers without publicity or political control and who gave of his knowledge willingly. A mandarin's power was not accomplished by authority but by influence. Respect and power come from willingly providing people with a wealth of information, not from withholding it. Historically, IT leaders have sought to make their position in the organization very influential by treating the institution's information as their own to disseminate or not to disseminate at will. A better approach would be to learn from the example of the mandarin. Thomas West theorizes that the role of IT will have less to do with its place in the organization and more with the strategic perspectives, leadership and management brought to the IT function. (West, 1996) Leadership, therefore, is the mandatory base on which the IT organization must be built.

Leadership must not only be present in the IT organization, but in the whole of higher education in order for this metatonia to take place. For example, Cornell University is one of the leading universities in the country in terms of accomplishing innovative technology strategies in higher education. Many IT professionals at Cornell insist that without a "champion" outside the IT organization to provide dynamic vision and support , IT projects will fail and it subsequently becomes irrelevant how good the IT organization is. It seems that this champion's leadership projects the message that the technological advances are for the good of the university and are not just being implemented for the sake of using the newest technology. Therefore, all leadership in the university must embrace technology, and the impetus must come from outside the IT organization.

Evolution

> *There comes a time in every man's education when he arrives at the conviction that envy is ignorance; that imitation is suicide.*
>
> *Ralph Waldo Emerson*

In addition to strong leadership, strategic planning is an essential ingredient for this evolution. Although good people and good leadership are very important, they do not subtitute for good strategic planning and organizational design. Strategic planning is, therefore, an essential element in having and maintaining a good IT organization. Since establishing goals seems to be such a static approach — considering the speed at which technology is growing and improving — Heterick suggests instead that universities should take a more strategic view of the institution's computing and telecommunications future to allow for a philosophy of seizing opportunities when they exist. (Heterick, 1996) Traditional strategic planning methods work for building dormitories, but they do not work for building information technology. IT strategic planning must be adaptive to change and must be able to change continuously as new developments in technology arise. Borel explains: "We have come to understand that as we plan for the future we can no longer apply the words long term to our computing solutions, that our plans mustaining a good IT remain flexible". (Borel and Vincent 1995) Historically, unadaptive strategic planning has resulted in throwing dollars at IT when funds were available or more often when funds were in surplus; these expenditures were expected to be one time costs, like bricks in a building. This haphazard approach to the use of IT resources was like feeding yeast to bread dough occasionally; the result was an unmanageable, continuously growing problem. The strategic focus should be to very thoughtfully define the purpose of learners, educators, and their support staff and to have a cost based knowledge of technology that would enable a learning infrastructure with a focus on outcomes. This learning infrastructure does not necessarily require more money, but it does require genuine strategic thinking. The current planning strategies are not outcome based. Productivity must be measured, and the strategic planning process for technology must allow self correction and adaptation to new directions in technology. A recent CAUSE/EFFECT article suggests that strategic planning must take into account the resources and the goals. It

must find a fit somewhere in between these two, and if the planning is done appropriately, it will "stretch" the organization forward because "What holds many organizations back is not a surfeit of resources, but a scarcity of ambition". (Bleed and McClure, 1995) This debate regarding strategic planning for technology is not innovation versus tradition, but adaptation versus stagnation.

Typically, university organizational structures do not lend themselves to advancing this information age. Universities often enjoy the luxury of focusing internally and managing with departmental autonomy. Thus, the organizational structure that frequently exists in higher education is that of several fiefdoms, not a unified and sometimes not even a federal approach to organization. These fiefdoms are funded; goals are not. Heterick emphasizes how this approach to the organization of higher education must change: "The information age demands, and will enforce, a transition to empowered employees throughout the organization. The organization will be successful to the extent those employees are informed and are free to exercise leadership, and are capable of doing so. The organizations faced with the most difficult transition to the information age are likely to be those that never really bought into the industrial age paradigm — parts of the public sector with higher education and health care being the two most obvious examples". (Heterick, 1996) The new organizational structure should enable departments to be a part of the team that solves problems and allocates resources. Teams from departments should develop resources based on the goals of the strategic planning process; incentives and rewards should be based on productivity. This structure would change the traditional approach of prorating technology dollars to each department to spend at will. The planning process should still be coordinated at a central level and priorities established, but each functional entity should define its approach to achieving these goals, with IT being an integral part of the process. To change the current organizational structure requires an adjustment of attitudes, and the restructuring of the technological infrastructure of the institution must occur with a restructured IT organization being woven throughout the new infrastructure.

This new infrastructure will have at its core a distributed organization. Historically, the IT department has been one of the fiefdoms that existed in higher education; to alleviate this, IT should move from a more historically centralized organization to a distributed organization. Distributed by definition is very different from decentralized. For instance, the decentralized approach suggests that the customer for a personnel system is personnel; the distributed approach suggests that the customer for a personnel package is the entire university. Baltzer suggests that by moving to this type of organization a more trusting relationship between IT and the institution is fostered, but she also warns that this move should be done with caution in order to maintain a central planning base. (Baltzer, 1991) To avoid the chaos of undirected choices of systems in a distributed organization, computing requirements should be dictated centrally, in conjunction with the outcome objectives of the planning process. Central computing organizations, however, have difficulty addressing the diverse needs of faculty, staff, students, administration, and research. In her article

"Strategies for Restructuring IT Organizations", Suzy Chan describes how DePaul University integrated four diverse divisions of information technology into one centralized group while distributing functions across campus by creating cross-functional teams to approach problem solving. (Chan, 1995) It is essential to combine all technical processes such as strategic planning, institutional research, library, network, telecommunications, academic and curriculum support, systems, operations, hardware and software support, computer labs, and development under one roof while distributing the professionals into content areas to support user needs as servers are currently distributed throughout the network to increase productivity and speed. There should also be knowledgeable users in the various departments who can serve as the point person for vertical projects and front line support. A balance must be maintained between centralization and distribution in the planning process: while involvement from functional entities is key, so is central coordination.

Culture

> *Wherever we are, it is but a stage on the way to somewhere else, and whatever we do, however well we do it, it is only but a preparation to do something else that shall be different.*
>
> *Robert Louis Stevenson*

Additional barriers that must be dealt with are the diverse cultural boundaries in any educational environment that must be crossed in order for any IT organization to be successful. The complexity of issues surrounding IT demands distribution and collaboration. These require trust; trust, in turn, requires common beliefs and values. Baltzer, however, suggests that communication is the key to bring about trust and to ensure that there are no misunderstandings, misinformation, or misconceptions regarding the use of technology within an organization, the type of technological services that can be provided, the dollars spent, the way decisions are made, or the distribution of technology. (Baltzer, 1991) The different occupational cultures must be successfully integrated to create this necessary trust and communication. Since engineers tend to focus on the technology — not the people — and thus are poor communicators, customer service is easily taken for granted. Historically, IT has been reactive to change, rather than proactive for change. In a recent Sloan Management Review article, Edgar Shein asks how an organization can promote teamwork and cooperation when the structure rewards individual or departmental competition. Shein suggests that the solution to productivity problems is not reengineering, participatory management, empowerment, or other forms of management programs but that "The deeper issue is that in most organizations, there are three different major occupational cultures that do not really understand each other very well and often work at cross purposes". (Shein, 1996) These three cultures are executives, who are more interested in the bottom line; engineers, who are more interested in designing people into the equation that out of it; and operators, who are the knowledge workers characteristic of any organization and who, in higher education's case, are faculty and students who thrive on human interaction. Peter Senge reacts to Shein's article with the following statement: "Can the discipline of a

community building potentially be employed to reverse the growing fragmentation between the executive, operating and engineering cultures to build larger communities of common purpose truly concerned with the enterprise as a whole?" (Senge, 1996) Historically, users of IT systems have had little or no trust in IT professionals and have desired to strike out on their own in the face of a huge central zed IT conglomerate. There are several general reasons for this desire. First, IT professionals over promise and under deliver, not realizing that technology is a means to an end for the user. Second, the IT professional does not realize that his job is not to demonstrate intelligence but to increase productivity. For instance, an obvious business decision — outsourcing and buying systems instead of building them — is difficult for the IT designer, who always feels he can design something better, regardless of cost or time. Third, the executives faced with the increased spending in IT resent the cost and time waste and lose perspective of the needs of the operators and the engineers. Training and movement toward a learning organization model in which the employees visualize a potential and feel empowered to effect outcomes will help cross the cultural boundaries in the organization.

Techniques

If anything goes bad, I did it

If anything goes semi-good, then we did it

If anything goes real good, then you did it

That's all it takes to get people to win football games for you.

Paul "Bear" Bryant

To transcend these inherent issues within higher education and build a successful approach, certain techniques must be practiced. In order for systems development techniques to be successful, developers must utilize a team approach to development using a leadership style similar to the one Bryant describes. In developing systems, one should have the freedom to innovate instead of the freedom to fail. The freedom to fail is safer; it requires no change, no risk. Creating systems that allow user independence is difficult for IT professionals, but the days of glass houses and ivory tower computing are over. IT professionals, by building systems with the direction of a mandarin-like leader, will see that, just as success is gained economically by allowing citizens self sufficiency, success is gained in IT by allowing users self sufficiency. This success requires training and planning as well as new ideas in terms of systems development. Ernst maintains that through training and communication independence must be made easier than dependence. He feels that, although engineers have a tendency to build systems themselves, IT should be reengineering the university's business processes instead of automating manual processes and that IT should be building information infrastructure instead of building new systems. The old methodology resulted in disparate systems with no integration. (Ernst et. al., 1994) The history of dependency has developed because of IT's tendency to develop closed systems, systems that ignore the environment. These closed systems tend toward entropy. While this is a classic problem in centralized IT organizations, it could also, if not planned

properly, be a problem in distributed organizations. The idea is that development should be to a business goal; therefore, it should involve development for business areas, not simply functional areas. For instance, a position control system in a university would involve the functional areas of business and finance, personnel, administration, and facilities. If in a distributed organization an analyst assigned to business and finance designed the position control system, it would fail with a tendency toward entropy, just as if a centralized IT team had developed it. The idea is a distributed organization with a synergistic approach to design. This approach assumes that the whole exceeds the sum of the parts and uses a diversified, distributed team to design while using a centralized method to insure integration. By maintaining a synergistic design approach and fostering user independency, systems development within an organization innovates and succeeds.

In building systems in higher education, users must be a part of the distributed team that creates the system. Planning is crucial, and teams should cross organizational boundaries. Borel and Vincent suggest that having application managers who are responsible for a specific suite of applications is an archaic approach to systems development although the client advantage to this approach is that the clients have one point of contact. The new approach is a flexible structure that insures that legacy systems are maintained and updated only when needed and that incoming programming requests are handled from one point. This approach allows staff trainability and no huge loss if a staff person is terminated. (Borel and Vincent, 1995) In order for this approach to work, however, this distributed systems approach should appear centralized to the user. IT must also change relationships with clients. People in distributed positions must have computing expertise, which is effective because they are in clients=offices every day with a home base in IT. This distribution allows close client contact with central goals, mission, and crosstraining. Markus and Keil further this idea by suggesting that users must want systems and that the user actually defines whether or not a system is successful because success is determined by user friendliness and implementation and requires IT professionals to also have good business sense: "Systems do not improve organizational performance or create business value, users do". (Markus, 1994) Changing systems development to a cross-functional, user centered activity, in which the user is actually involved in the development of the system, creates successful systems.

As shown in this article, information technology has been and continues to be underutilized in higher education, because higher education is steeped in tradition and is slow to move to innovation. Several changes are necessary for higher education to develop a successful IT organization. The perception of technology as it relates to the mission and vision of higher education must be embraced with a futuristic understanding of the potential of technology in higher education. The mindset of IT professionals must be that of supporting the potential of the information age in higher education by evolving complexity in the use of information technology into simplicity. A flexible process must be developed to combine leadership and the involvement of IT in a good strategic planning process that sets priorities in accordance with mission and allocates resources to accomplish

objectives. Traditional cultural boundaries between the fiscal, managerial leadership and the academic and philosophical faculty must be crossed to create a collaborative learning environment. These challenges should be accomplished by using a team approach with leadership that is willing to be accountable for failures and to give credit to others for successes.

THE USEE-2000 PROGRAMME

The acronym USEE (pronounced as *you see*) stands for Upgrading Science and Engineering Education. This programme represents an attempt by UNESCO to encourage/facilitate the use of ICT in higher education. It is the proposed answer to numerous requests by member states seeking advisory support in the area of ICT in higher education applications.

Interdisciplinary nature

The USEE programme integrates the CII scope of activities within those offered by other UNESCO sectors, particularly the basic sciences, engineering sciences and technology, and education to help enable a technology-mediated education system.

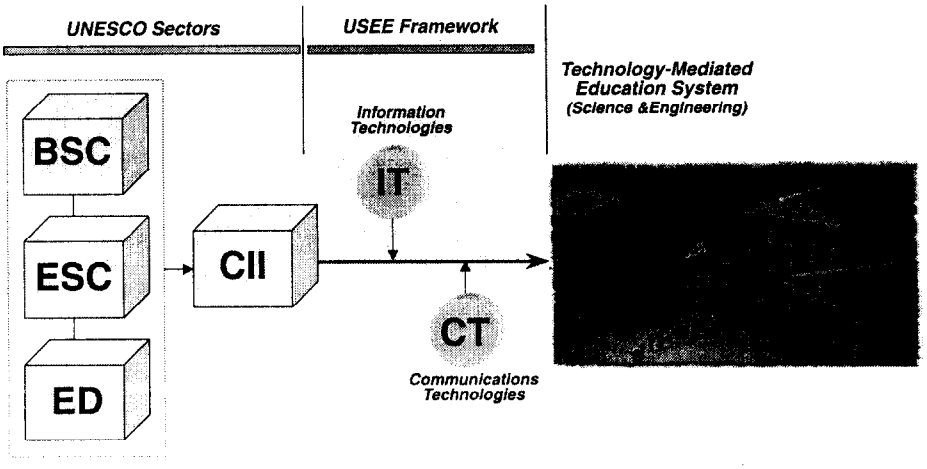


Fig. 4. Inter-sectoral nature of the USEE-2000 programme

Classical usee — lessons learned

The USEE programme started in the mid nineties within the UNESCO Cairo office. The so-called "classical USEE" involves three primary components: (1) faculty training workshops, (2) advisory support as well as (3) course development faculty grants. A review of the outcome illustrates that the first phase of the USEE programme did succeed in *raising the awareness* among regional faculty regarding the potential of emerging ICT technologies in relation to higher education reform. However, the effective integration/utilization of ICT in education was not achieved in any significant way. Hence, it was imperative to go back to the drawing board.

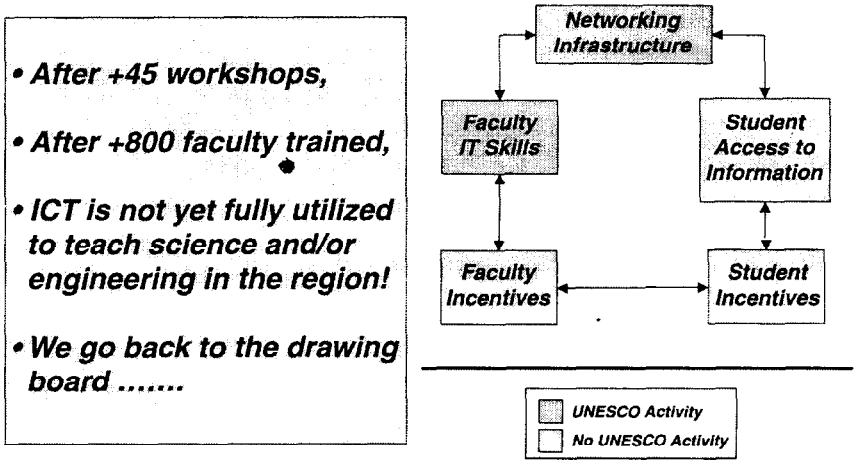


Fig. 5. The "loop" for successful utilization of ICT in higher education

Further examination shows the "loop" which must remain *closed* in order for ICT to be effectively utilized. As illustrated in Figure 5, further efforts are required in the areas of networking infrastructure, student access to information as well as faculty/student incentives. The classical USEE programme focused, in its majority, on improving faculty skills and awareness. However, networking infrastructure was greatly lacking in higher education institutions as well as student dorms and homes. This difficulty is a serious obstacle facing any real application of ICT in higher education. At the same time, major policy reform is required in relation to higher education regulations in order to facilitate the modern learning models. The reward mechanism for faculty members remains entirely based on research record while creative and novel IT applications are not considered in promotion cases. Similarly, curricular revisions are needed in order to maximize the gain from ICT integration in higher education and to also provide a direct relationship between the use of information technology and students' evaluation. Hence, creating the necessary incentives for students.

It primer faculty training workshops

The core component of the new USEE-2000 is the "bread-n-butter" IT-Primer workshops. The workshops are designed in such a way so that basic skills are taught to faculty towards the development of web-based courseware. Emphasis is set on tools to *convert* or *reuse* existing course material rather than developing courseware from scratch. Moreover, the IT Primer workshops introduce software packages which are widely available, cheap or free of charge in order to ensure that faculty can easily acquire them.

The design of the IT Primer workshops bears in mind that a resource web site(s) will be established for the benefit of faculty. Thus, courseware *assembly* from existing materials is a main area addressed during the primer workshops. Typically, an IT primer begins with basics of Microsoft Office components (in particular, Word and PowerPoint). This is followed by a review of the built-in Word-to-HTML or PowerPoint-to-HTML converters and their inherent limitations. The workshop proceeds to introduce the integrated

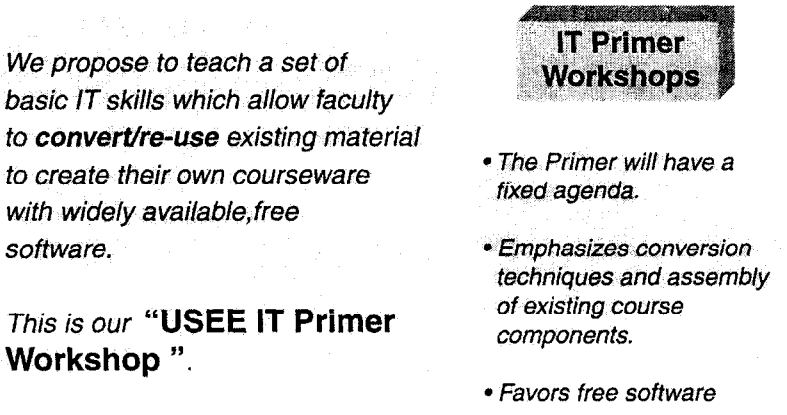


Fig. 6. A briefing on the IT-primer faculty training workshops

web development environment offered by Microsoft, known as FrontPage. FrontPage allows for group authoring of courseware, development of structured web sites in WYSWYG mode as well as allowing for remote authoring and/or publishing. The Adobe Acrobat technology is introduced and later followed by a coverage of the famous courseware assembly and administration software known as WebCT.

Usee web resource server

In order to help faculty build their own, first-rate courseware while spending minimum effort on development tasks, we maintain a regional, public domain, web server on which we compile topical digital libraries of courseware objects. Such objects include lecture notes, audio/video clips, interactive applications, powerpoint presentations, problem sets, etc.

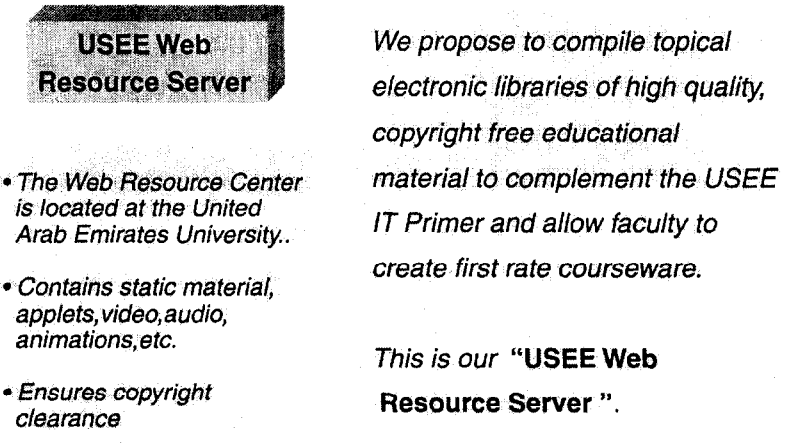


Fig. 7. A briefing on the USEE web server for higher education

The structure of courseware objects risiding on the web server is selected so that faculty can construct complete and state-of-the-art courseware in their respective disciplines (within science and engineering) using the software called WebCT which is introduced during the IT primer

workshops. This process of courseware assembly resembels the typical steps associated with classical course development from ingredients found in printed textbooks. Only here, the printed text books are replaced with a more flexible and much richer set of resources.

A primary resource found on the USEE web server is the "topical web courseware index" (WCI). You may think of the WCI as "scientific Yahoo engine. The WCI provides faculty with a complete review of scientific web sites all over the world which is not yet found anywhere else.

Usee training kits

The third component of the USEE-2000 programme involves the production of an array of training kits for wide distribution among regional faculty. The rationale here is based on maximizing the impact-to-cost ratio of UNESCO efforts. For this purpose, we try to produce training kits on topics related to the utilization of information technology in educational applications. The kits are made available on a variety of media so that it could be used by the largest group of regional faculty. For instance, we produce kits on CD-ROMs, video tapes, web-served, satellite broadcasts as well as printed versions of the kits.

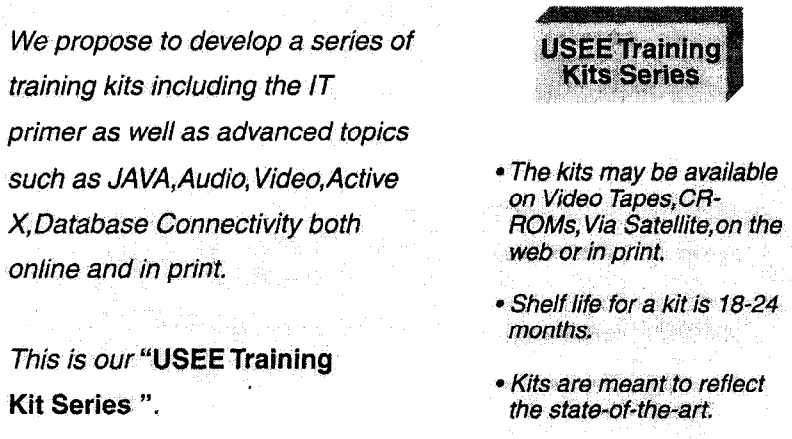


Fig. 8. USEE-2000 Training Kits

As an example, the UNESCO Cairo office has already started to build a video library of short courses aimed at faculty of science and engineering. This is done through collaboration with the Egyptian establishment governing the NILESAT satellite. A TV crew joins the UNESCO team and instructors of an in-class workshop to tape the events of the extensive USEE workshop. Later, the taped version is regularly scheduled on NILESAT's specialized channels for higher education which reaches audiences all over the Middle East. Parallel efforts are underway to produce web-based tutorials of various workshop topics. Such tutorials will be made available on CD-ROMs as well as on our regional web server. Aprinted version of the tutorials will be also available for wide regional distribution.

Usee-2000 centers of excellence

The fourth component of the USEE-2000 programme seeks the effective dessimination of information and experiences through the region. This is done through the selection of partner institutions in which we develop USEE centers (you may think of them as nodes or embassies) of excellence.

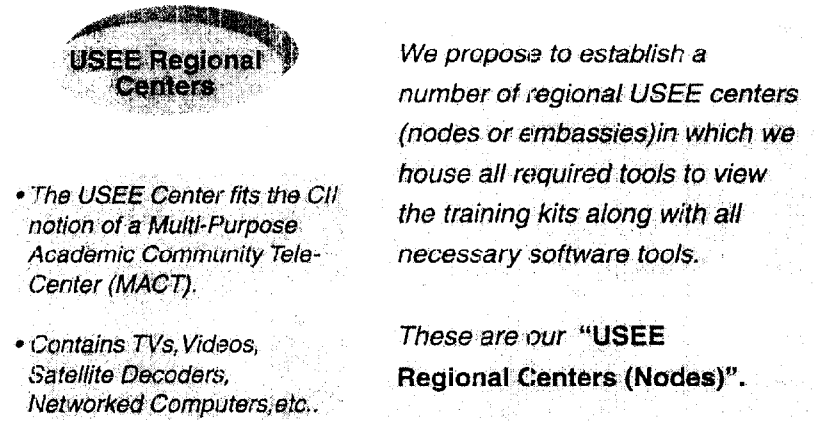


Fig. 9. USEE-2000 Regional Centers of Excellence

A USEE center of excellence is envisioned to provide a state-of-the-art computing facility with a fast Internet connection. A complete library of various media complements the computing facility. Trained USEE graduates are then asked to serve in such centers for the benefit of national faculty in the country where the center resides. The centers are to be co-financed by UNESCO and the partner institution with an eye on being self-sustained in following years. Those centers are expected to form a network of IT focal points in the region which, in turn, serves to expand the domain of influence of USEE activities beyond the discrete set of locations where workshops are held.

REFERENCES

1. Lynne Markus and Mark Keil. "If We Build It, They Will Come". Sloan Management Review, Summer 1994.
2. Peter Senge. "Letter to the Editor". Sloan Management Review, Winter 1997.
3. Ronald Bleed and Polley Ann McClure. "What Information Managers Need to Understand about Higher Education Enterprise". CAUSE/ EFFECT, Winter 1995.
4. Susy S. Chan. "Strategies for Restructuring IT Organizations". CAUSE/ EFFECT, Fall 1995.
5. Sue Borel and Natalie Vincent. "Transitioning Technology — Changing the Culture at Syracuse University". CAUSE/EFFECT, Fall 1995.
6. Thomas W. West. "More Lessons from the CIO Trail: from Butch Cassidy to City Slicker". Reflections on Leadership. CAUSE Professional Paper Series, No.15, 1996.

7. Robert C. Heterick, Jr. "Maybe Adam Smith Had It Right@ Reflections on Leadership". CAUSE Professional Paper Series, No.15, 1996.
8. William F. Massy and Robert Zemsky. "Using Information Technology to Enhance Academic Productivity".
9. William H. Graves, A Question for the Future. "CEO: ACampus of the Future or Future of the Campus"?. The Edutech Report 10, No.12, March, 1995.
10. Tom Wason. "A Gutenberg Juncture: Changing the Model of Instruction in a New Technological Environment". The Monitor, August 15, 1996.
11. David J. Ernst, Richard N. Katz and John R. Sack. "Organizational and Technical Strategies for Higher Education in the Information Age". CAUSE Professional Paper Series, No.13, 1994.
12. Robert C. Heterick, Jr. "A Single System Image: An Information Systems Strategy". CAUSE Professional Paper Series, No.1, 1988.

THE SYSTEM ANALYSIS OF DISTANCE LEARNING

Prof. Michael Zgurovsky,
Rector of National Technical University of Ukraine "KPI",
Prof. Nataliya Pankratova,
Deputy director of Institute for Applied System Analysis Ministry of education and science of Ukraine and NAS of Ukraine

SITUATION OF EDUCATION IN UKRAINE

The demand for higher education and mastering by advanced technologies grows in the world with exponential rate. The UNESCO gives the following data on quantity of people associated with higher education: during 1970–1991 it has increased 2.5 times, and till 2015 it will increase 1.5 times. But at the same time the opportunity of provision of traditional educational system with resources reaches its limits. Now only each eighth person of the appropriate age in the world can get higher education while twenty years ago each seventh had such opportunity.

The world experience proves, that intensive development (increase of quantity of educational establishments; increase of number of students studying abroad; increase of quantity of the foreign teachers working under contracts in national system of education) only requires continuous and progressing growth of training expenses (both state and private). But the ultimate goal of satisfaction of demand on high-quality education doesn't become more achievable. There are educational problems that traditional system of training cannot solve on principle. The paper is about granting the future specialists in knowledge, which did not exist 2–3 years ago at all.

Situation of the middle section of the education is still worse by many parameters. Features of the modern economic situation in Ukraine result in actual sharp reduction of budget expenditures on education [1,2]. The investment of the private capital has not been systematic till now and hence does not give a significant positive effect. It is necessary to notice that Ukrainian society is confronting now with such unknown in Ukraine before phenomenon, as, for example, illiteracy of youth. The main reason is the sharp reduction of educational resources, especially in rural areas. Obviously, such situation is typical for underdeveloped countries and represents the direct threat to the national safety of our country.

The opportunity for the principal solution of the above-stated problems can be provided by the rational combination of achievements in modern pedagogical practice with the newest information technologies. Distance learning (DL) can provide the development of such combination. The world experience already knows some stages of development of DL. The present stage and forecast development in the nearest future consists in creation of a national uniform network DL (NUN DL). The technical potential of telecommunication networks available in Ukraine and essential high level of traditional system of higher education give opportunities for minimization of investments to achieve the following results:

1. Fast satisfaction of growing demand of students on qualitative higher education;
2. The formation of long-term programs focused on expansion of opportunities for each institute-participant of the NUN DL with the purpose of achievement of only such educational standards that correspond to a world system of higher education in the XXI century.

Advantages of NUN DL are proved by the world experience and consist in the following:

1. Training costs will be significantly smaller — students will study according to international standards while staying at their institutes, using telecommunication networks to access information resources of other countries.
2. The increase of the level of education in local higher schools, which will obtain methodological, organizational and other support from all participants of the network.
3. The diplomas of all higher school participants of the network will be equivalent and will comply with the international standards.
4. The opportunity of individual (depending on person's abilities) education irrespective of its arrangement is provided for each student.
5. Realization of advancing education — a possibility of obtaining knowledge that has been needed during the last 3–5 years and that does not have any traditional training courses.

Thus, implementation of distance learning in Ukraine has to solve the following problems:

- the preparation, retraining and improvement of professional skills of experts for achieving new goals in reforming economics and transformation of society;
- the realization of possibility of completion programs of habitation, of simultaneous habitation in several higher schools for the students;
- the completion of abilities for the habitation of persons in locales;
- the completion of abilities for the habitation of persons with physical problems;
- the achievement of the high quality of habitation, which complies with the requirements of world standards;
- the reduction of social stress among youth (first of all unemployment);
- the simplification of attraction of foreign citizens to study in Ukraine;
- the implementation of elite education for talented children regardless of their social position.

THE SYSTEM MODELLING OF THE DISTANCE LEARNING PROCESS

We consider the DL as deepening of the knowledge in profession and widening it into interfacing areas with the aim of their rational combination. This is the concept of the DL. The transference of the DL into other national educational systems demands provision of the system analysis of this problem. Due to multiaccept and interdisciplinary of this process, its

adequate investigation is possible only on the basis of systematic analysis. In the same time, the essential preliminary identification of the process of learning in terms of the specified basic notions of the learning process and it components is needed for the usage of systematic analysis.

Hence follow the new requirements for the system education. The main of them are [3]:

- fundamentality, which implies the orientation of education in the detection of deep bases and systematic intercouplings between the miscellaneous processes of surrounding world;
- integrity, which supposes the implementation in the education of the common cycles of fundamental disciplines, systematically integrated by general goals and directed towards the acquisition of fundamental interdisciplinary knowledge;
- individualization of learning essence which consists in the orientation of education on interests and all-round elaboration of every person.

The realization of the data requirements is impossible without the elaboration of the international data system of education, without mutual interchange by the educational programs of world level, without the elaboration of the international system of educational services. According to the series of resolutions of UNESCO, it has enhanced its role in solving the problems of information and communication technologies implementation in education and the preparation of staff.

Taking into account the economical situation in Ukraine, the introduction of IT must correspond to the next conditions:

1. Accessibility of the technical education. Its component are:
   - low payment;
   - domiciliary education;
   - use of technical support;
   - different kinds of property in the educational institution.

2. Complexity is "Learning by living" by single methodology of the scientific and humanitarian education.

3. Decentralized structure with third-party interrelated networks:
   - Informational;
   - teaching and methodical;
   - educational.

We will consider the distance learning on the basis of system methodology. We will consider interaction <man $\Leftrightarrow$ object $\Leftrightarrow$ environment> in process of practical activity [4]. In given case the determining feature of problem is incompleteness, indeterminacy, uncertainty, fuzzy and inconsistency of initial information. Yet another the feature of the problem of systematic interaction <man $\Leftrightarrow$ object $\Leftrightarrow$ environment> is indeterminacy and the ambiguity of goals. The solution of many problems in process of practical activity demands the finding of rational compromise. And such procedure is subjective, since the criterion of comparison and the preferences of alternative variants are chosen of making decision face (MDF). Hence follows that in one and same initial data the differential MDF can obtain solutions which substantially are differentiated between each other in

general case on suppressing the majority indicators. Thus, in practical activity appears the need of the analysis of interaction <man ⇔ object ⇔ environment> (scheme 1) from more general position, than this is considered in mentioned schema. In other words, is demanded to carry out analysis as with another, of higher standpoint, up over of considered plane higher the flow diagram of interaction. Given analysis, essentially, is analysis of qualities and efficiency for conventional strategy and the strategies of actions man in system <man ⇔ object ⇔ environment>. This problem must be solved by the systems analyst. That is why we shall come to next flow schema: interactions systems analyst and systems <man ⇔ object ⇔ environment>. In this schema analysis is demanded to produce from the position of comparison, of the relative assessment of effect obtained in considered system with similar effects competitors, as well as with general tendencies and the perspectives of the elaboration of production, of market is bargained off and demands of consumers.

Appears the natural question: why cannot man perform this problem (implementator, user, investigator or another person) in the context of schema 1, why is it essential to analyze the interactive data from another position, from position of systems analyst who hacks interaction in the context of schema 2? Really, any literate implementator, manufacturer performs query analyzer consumer, forecasts and estimates the actions of competitors, estimates the market is bargained off and demand, develops the corresponding strategy of actions with allowance for these factors and native goals and abilities. And not less, exists the practical necessity of the realization of the systematic analysis interaction on basis of the scheme 2.

Such necessity by many factors is dictated. We shall mark only two of the most significant. First of all any implementator, any manufacturer forms the native system of criterions, indicators, assumptions in the problem solution. That is why such system of criterion is subjective, and, consequently, and corresponding assessment is too subjective. Due to such approach implementator or manufacturer who specializes in specified class production, frequently has exaggerated the meaning of its positive attributes, of abilities and perspectives and belittled meaning as of its blemishes, so of and abilities, of attributes and the perspectives of competitive class production.

As a second factor that determines necessity systems analyst, let's mark the following. To value quality of conventional strategy and the strategies of making decision it authenticity and validity in the context of the conventional system of the criterions of scheme 1 is conceptually impossible. This immediately follows from mathematically strictly valid law of Gedel's. According to given concept for the assessment of quality and efficiency, conventional strategy and solution techniques as to the specified system of criterions it is essentially to pass on to the more powerful system of criterions, which complements initial system by new criterions and opens the ability of the use of the more powerful device of assessment. Namely such ability provides systematic analysis as to scheme 2.

Carried out an analysis lets us make the following conclusion. Systemactical of activity man determines the necessity of systematic analysis on differential levels the hierarchy of the analysis of interaction

as within system <man ⇔ object ⇔ environment>, as well as on higher level: <systematic analyst ⇔ man ⇔ object ⇔ environment>.

According above the place of a system analyst in a modern investigation can be represented by the relationship <man ⇔ object ⇔ environment ⇔ system analyst> (scheme 2, fig. 1).

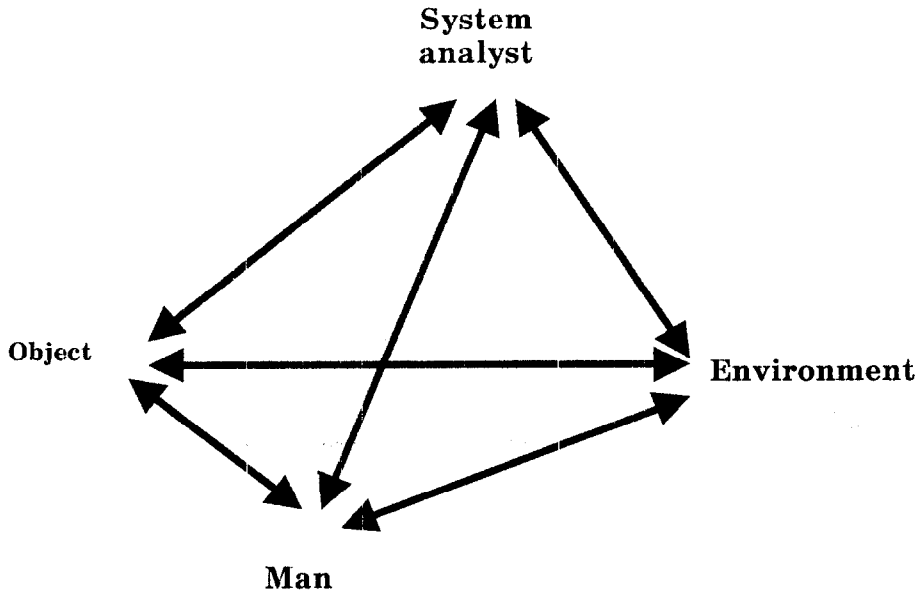


Fig. 1.

This schema can be interpreted as <trainee ⇔ DL system ⇔ Internet ⇔ system-analyst> in our study (fig. 2). The "object" is a DL-system, which is considered as software and hardware environment plus an ideology that its creators put in the environment. Such an interpretation is explained that: "every developer forms his own system of criteria...that is why such a system is subjective". Further, in our case, the "environment" is Internet, which forms a uniform information and communication area. Notice that a "success" or a "failure" of a given DL-system is only defined by market. This is why in our case the role of a "man" is connected with a user of knowledge that are distributed in Internet in forms of electronic courses (subjects), electronic encyclopedia and other URLs (Web-sites). We will name such a "knowledge user" as a Trainee, for determinacy.

Accordingly, the role of a system analyst in DL-market is reduced to forming a set of criteria of correspondence among DL-realizations and a paradigm of the DL as a concept. The DL-paradigm has to be defined by system analysis of a traditional (national) education system and its reform by the DL problems (above).

The usage of the device of systematic analysis is based on the decomposition of the traditional teaching system and next its composition in terms of specified basic notions with receipt of the distance learning systems. With this goal the generalized model of the process of traditional teaching is built enabling to learn the features of the traditional teaching

its forming — apperception, perception and diagnostics which it is necessary to take into account in the process of distance learning as well as to analyze the possible directions of automatization.

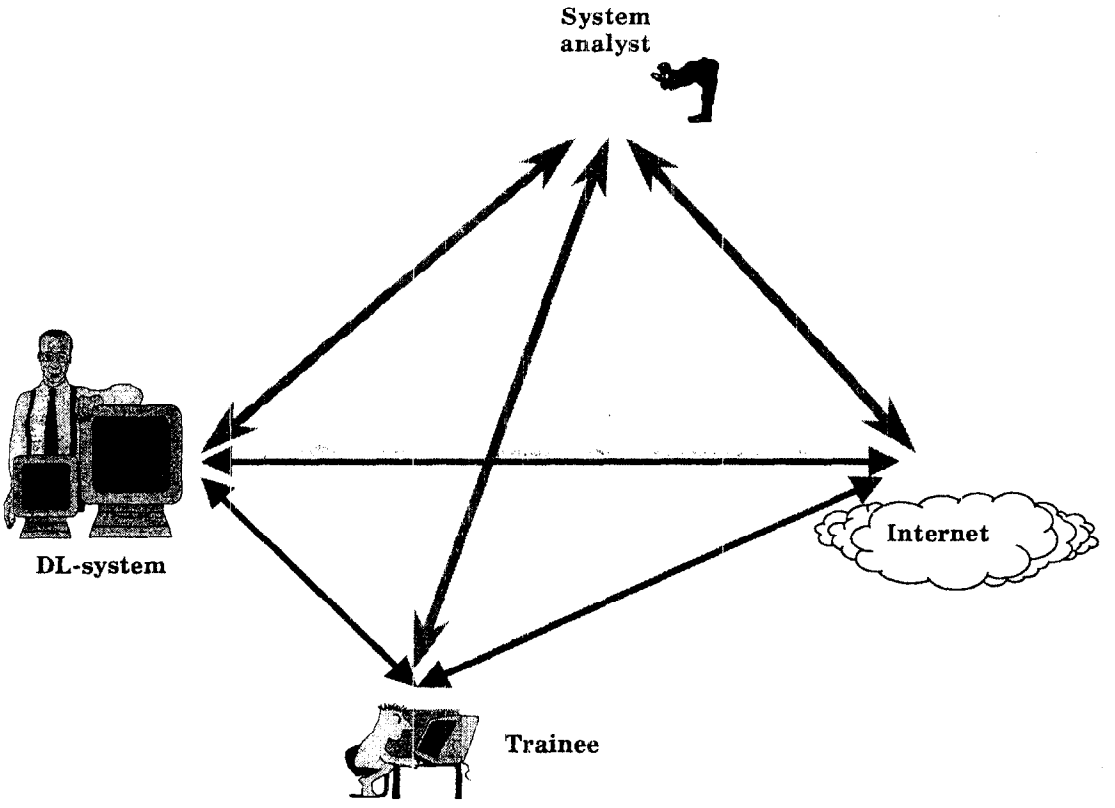


Fig. 2.

The general idea of the basic components introduction and carried out on their basis of modelling consists in the construction of the three-level model system for the process of learning which to begin with logic are decompressed from above to downwards (decomposition), and second are "attached" friend in friend "beneath-up" 9 (fig. 3).

The model of top level is the generalized representation of the learning process in the form of relationships between its basic components: apperception, perception and control (diagnostic).

The model of medium level is the formalized representation of main procedural basic objects — "goals", "situations", "problems" and corresponding procedures of their solutions.

The models of bottom level are of software architecture. Currently the realization of similar architectures is built on the basis of usage of so-called "intelligent agents", and in circumstances of the Internet — Internet-directed intelligent agents.

Apperception in distance learning is the required link (or module) which preconditions the understanding by learning the new material, according to past experience. Apperception is a cognitive process of understanding preconditions of learning and creation of the intention or readiness of a person for getting knowledge.

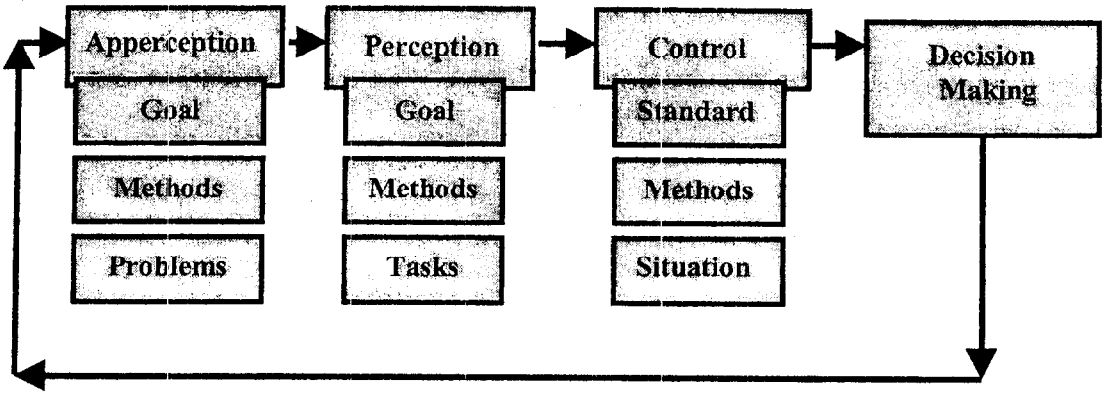


Fig. 3

Perception unlike apperception is described by normative model and generally is determined as the process of the displaying of integral image imparted by unity constructions and by the known attributes of teaching object reflected in training course. Perception is a cognitive process of getting of new information and its generalization, forming the scientific concepts, lows, fixing and perfecting the knowledge and skills.

During perception the trainee constructs or improves the subject field on the basis of problem area, which is built on apperception, namely, if the subject field has not yet been formed, that action of trained result relatively problem area. That's why the perception may be presented by normative model.

The DL-system has two main aspects: information and procedural. These aspects appeal to the traditional model of an educational process. Relation between an apperception, perception and diagnostics can represent the traditional model of an educational process.

An apperception in the DL-system is connected with an "associated information" which a Trainee had before getting knowledge from an electronic course and from Internet on one's own.

A perception is connected with electronic course ("learned/studied information") and by a motivation as a result of an apperception. In this way it is desirable to define a special index a "problem solving potential" (PSP), which can be described as an index of "utility of URLs information" used for given electronic course.

A Trainee's skill, which he/she can show in finding in Internet an information with adequate useful level for a given problem we define as "media-competence".

In this way we consider, the distinguishes between ordinary education systems which are connected with a "competence" of concrete course and DL systems which can be connected with many courses in Internet. The main goal of a DL system is to train a Trainee to get information from Internet with high level of PSP for given problem.

A diagnostics is a result of testing a Trainee on his own skills in media-competence. From a procedural point of view an apperception and perception

have similar goals, but an apperception has to define the problem, and perception has to define a set of tasks, which aggregate this problem. For getting an evaluation of a Trainee's level of knowledge a diagnostics compares Trainee's answers with a set of a posteriori standards. Such standards are created with a help of goals of an apperception and a perception.

The main aim of a DL-system is to build for Trainee a feedback from controlled "situation" to initial "problem" by means of tasks.

THE IMPLEMENTATION OF THE DISTANCE LEARNING PROCESS IN UKRAINE

The implementation of the distance learning process is carried out in Ukraine by means of project "URAN" (Ukraine research the Academy Net). Behind the project of construction of a national telecommunication network for establishments of science and education in Ukraine with access to INTERNET lies the creation of a computer information infrastructure in science and education spheres.

The project implementation will allow to provide:

- an access to the INTERNET for universities and institutes in Ukraine;
- the implementation of methods, tools and telecommunication technologies in fields of sciences and education;
- accumulation and efficient use of dispersed information resources in field of sciences and education.

The main task of this project is creation of a national base Net (backbone) that will unite all education institutes, will provide access to the INTERNET and all educational networks.

We hope that the realization of the project will give an impulse for the new level of development of education and science.

For the implementation of solution project is created User association for the telecommunication network of the establishments of science and education, members whom be legal faces — universities and the institutes of National Academy of Science Ukraine. Association Executive body is the Center for European Integration as well as accountable to it regional centers (Kiev, Donetsk, Dnepropetrovsk, Lviv, Kharkiv, Odessa).

The realization of this Project will provide the qualitatively new level of the elaboration of education and sciences, at expense of:

- the high level of access and rates of the allocation of information resources;
- the completions of abilities of lead scientists, teachers and students with engineers and scientists from the different places in Ukraine and abroad;
- wide access to national, regional and foreign computer data bases, knowledge bases, catalogues and libraries;
- wide access to unique software including up-to-date (and expensive) systems of licensed software;
- the shared discussion on problems and decision making;
- the use of the arrangements of telecommunications for habitation and increase experience.

In the field of management education and science networking will provide:

- the more effective coordination of research and design and educational programs;
- rapid exchange of management information between organizations;
- acceleration of implementation of the new effects of research and design.

For the fist time specific economical, organizational, social and market backgrounds for starting the practical implementation of distance learning are created in Ukraine. The distance learning is implemented on the basis of the next principles:

- the system is formed as a system of advancing education focused on preparation and formation of information society;
- the training technology is based on the usage of telecommunication networks and information technologies and resources;
- rational coordination of methodological and organizational efforts of distance learning in different departments;
- organizational support of educational process by the state (concessionary terms for use of communication and information technologies);
- realization of a number of educational levels with different directions and tasks (students of universities, group of improvement of professional skills and training for a new profession, students of remote schools (rural areas), demobilized military men);
- using experience of the organizational and methodical distance learning of Russian federation and other countries.

Proposed system of distance learning which is based on systematic strategy should promote effective professional training on the chosen specialty, and allows to receive diploma of one from the recognized foreign universities with Ukrainian diploma simultaneously.

REFERENCES

1. Zgurovsky M.Z., Pankratova N.D. Problems and tendencies of development of information technologies for education in Ukraine // the Bulletin IASHS, Moscow, No.3, (9), 1999. P. 122–131.
2. Pankratova N.D. General tendencies and a system problems in development of information technologies // The Problems of Control and Computer Science, No.1, 1999. P. 58–68.
3. Policy in the field of education and new information technologies. The national report of Russia in the Second International congress of UNESCO. — M. 1996.
4. Pankratova N.D. The tendencies and problems of development of system analysis as a science discipline // In proceeding.: "The modern IT and a system analysis — the way to information society". Institute for Applied System Analysis of the Ministry of Education of Ukraine and the National Academy of Science of Ukraine, Kiev, 1998. P. 9–18.

MEETING OF EXPERTS

"EDUCATION VIA THE INTERNET"

AND THE WORKSHOP

"INTERNET USAGE IN EDUCATION"

Proceedings

Printed by
Belarus State University,
National Institute for Higher Education

http://www.iite.ru

ISBN 985–6299–48–9