Information technologies in teacher education

Issues and experiences for countries in transition

Proceedings of a European Workshop,
University of Twente,
Enschede, Netherlands, February 20-23, 1994

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Preface

Eighty-two experts in the field of education and information and communication technologies came together to a workshop, held in Enschede (Netherlands) on February 20-23, 1994, to examine issues and experiences for countries in transition.

Organized by UNESCO, in collaboration with the University of Twente and with the support of the Commission of the European Communities (CEC), the workshop on teacher education and information and communication technologies provided an opportunity to exchange ideas, knowledge and experiences in the area of teacher education and communication and information technologies (CIT) among experts of Central and Eastern Europe and experts of Western Europe. The experts came from twenty-nine countries of Europe.

The workshop's major objectives were: (a) to discover and develop bases for further partnerships among Western, Eastern and Central European CIT specialists in teacher education; (b) to help and advise policy-makers at the national level with respect to reorganizing or developing new programmes for teacher education on CIT and on its use; and (c) to prepare for the second UNESCO International Congress on Education and Informatics to be held in Moscow in July 1996.

Its programme was organized around four themes selected for the four working groups: CIT in Support of Teacher Education; Curriculum Issues relating to CIT and Teacher Education; Organization of Teacher Education and Issues within this Organization relating to CIT; and Policy and Strategic Planning in relation to CIT and Educational Systems.

UNESCO would like to express it sincere appreciation to the keynote speakers, animators of working groups, the members of the Congress Bureau and all those who contributed to the workshop and to all those who contributed to the compilation of this works In particular, the Organization would like to thank thc three editors, Betty Collis, Iliana Nikolova and Katerina Martcheva. We hope that these proceedings will be both of interest and of assistance to all those reading them. UNESCO would also like to thank the University of Twente and the Commission of the European Communities for their collaboration and Apple (Europe) for its sponsorship.

The authors are responsible for the choice and the presentation of the facts contained in this book and for the opinions expressed therein, which are not necessarily those of UNESCO and do not commit the Organization.

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Goals and Objectives of the Workshop

Main Goal

An exchange of ideas, knowledge, and experiences in the area of teacher education and communication and information technologies (CIT), between experts of Central and Eastern Europe, and experts of Western Europe.

Major Objectives

Discovering and developing bases for further partnerships among Western, Eastern, and Central European CIT specialists in teacher education.

Helping and advising policy makers at the national level with respect to reorganizing or developing new programs for teacher education on CIT and on its use.

Preparing for the next UNESCO World Congress in Moscow (1996).

Expected Results

Better knowledge of common and specific problems with respect to CITand teacher education, and insight in ways to deal with these problems.

Recommendations concerning international and national activities with respect to CIT and teacher education.

Part I.

Perspectives from the Faculty of Educational Science and Technology, University of Twente

Communication and Information Technologies as Change Agents

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Abstract

Technological developments and new training paradigms have a strong influence on society. Information technology (IT) is evolving toward an integrated communication and information technology (CIT). Training is evolving from a separately planned external activity toward an integrated learning-working activity. Education and the teaching profession have to take such developments into account. As a consequence the teaching profession is evolving from an emphasis on delivering information to an emphasis on creating learning environments.

1. Need for teacher education

There is a critical need to train more and better teachers. As Rawley (1992) indicates: "Throughout history, teachers have been held in high regard. But today teaching holds a low status. The teaching profession is generally not well paid, conditions are poor, and career paths are uncertain. In particular, it is difficult to attract qualified and highly motivated people to the profession at the primary level" (p.2).

Recently the Dutch Parliament discussed the recommendations of a report prepared at the request of the Dutch Minister of Education about measures to improve "the attractiveness of the teaching profession in the Netherlands" (Commissie Toekomst Leraarschap, 1993). The main recommendation was to bring more variation into the profession and to provide explicit career perspectives. Specifics related to the creation of more differentiation in the career of a teacher and of extra efforts in terms of inservice training.

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Perhaps information technology can help to come to grips with these problems. But first of all, we have to be sure that information technology even deserves a place in the educational system.

2. Information technology and education

Preparing pupils for their future occupations, translated into the process of passing on knowledge and skills, is the main force that drives the engine of instruction. How to do this most efficiently and most effectively is 'the' central question to be solved. Introducing technology into schools has been one of many reform suggestions to deal with this problem.

2.1 Disillusionment with technology

In his book "Teachers and machines: The classroom use of technology since 1920", Cuban (1986) sharply analyses the introduction and use of technology in education. T he following quotes illustrate his thinking:

> *'Many educators have dreamed of making instruction both productive and enriching: wishing that children somehow could learn more and faster while teachers taught less. This dream has persistedfrom the invention of the lecture centuries ago to the early decades of this century when re formers sought eff ciency through f am, radio, and television. The dream persist into the 1980s with promoters boosting desk-top computers for each student. ' (Cuban, 1986,p.3).*
>
> *'The promises implied in these aids caught educators' attention: in - dividualized instruction, relief of the tedium of repetitive activities, and pre - sentation of content beyond what was available to a classroom teacher. ' (Cuban, 1986,p.4)*
>
> *'Claims predicting extraordinary changes in teacher practice and stu - dent learning, mixed with promotional tactics, dominated the literature in the initial wave of enthusiasm for each new technology. Seldom were these innovations initiated by teachers....Reformers, more often than not, were foundation executives, educational administrators, and wholesalers who saw solutions to school problems in swift technological advances. ' (Cuban, 1986,p.4)*
>
> *'Marring the general favor and scientif c credibility enjoyed by the inno - vation, however, would be scattered complaints from teachers or classroom observers about the logistics of use, technical imperfections, incom - patibility with current programs, or similar concerns. At a later point, sur - veys would document teacher use of the particular tool as disappoint*

ingly infrequent Such surveys would unleash mild to harsh criticism of administrators who left costly machines in closets to gather cobwebs, or stinging rebukes of narrow-minded, stubborn teachers reluctant to use learning tools that studies had shown to be academically effective. ' (Cuban, 1986, p.5)

Although Cuban's book was published in 1986, his remarks are astonishingly actual and accurate in 1994. The following references are recent illustrations of Cuban's statements.

- A world wide inventory (Pelgrum & Plomp, 1993) illustrates that the introduction of computers in education has clearly flourished over the last 12 to 15 years .
- Among many others, Collis (1988) has explored, argued and illustrated the potential advantages of computer use in the teaching/learning process.
- However, at the same time, many researchers have reflected about the reasons why the introduction of computers in education has not been as successful as expected. According to Hannafin and Saveney (1993) the main reason for the failure to maximize the potential of the innovation is teachers' inability to adapt their teaching styles. Moonen and Stanchev (1993) relate the disillusionment that is being expressed to the lack of organizational flexibility within the educational system and a lack of theory about how interactive teaching-learning environments should be designed.

2.2 Reasons for the disillusionment

Cuban is right. But, how did this happen? Maybe investigators and reformers thought too much about technology so that computers became solutions in search of a problem. Maybe the teachers' expertise, built upon a 'pool of craft wisdom about children and schooling', was not sufficiently taken into account.

Often, introduction of computers in education has not started from an obvious educational need or a request by the teachers. Looking back to school reform over many decades, a pattern can be seen to occur whereby the governance and the curriculum of school changed considerably and regularly. However, changes in classroom practice have been much more modest: (a) in classroom organisation (more diversity in forms), (b) in teacher-student relationship (less formal), and (c) in instructional methods (a broader perspective). More significant is the observation that a persistent core of practice that teachers have found to be efficient and effective--traditional teacher-directed instruction, has not changed at all.

2.3 Reconsidering "change"

A part of the misinterpretation of what seems to happen or does not happen in schools occurs because the concept of 'change' is taken in too narrow an interpretation. Change is often measured in its direct relation to a specific reform-initiated input. On the other hand, change mostly occurs only after a considerable time. Neglecting all kinds of external pressures and many other unplanned events, and not given the time for changes to settle down and become measurable, adds to the misunderstandings and to the conclusion that change does not occur. Therefore educational research about change processes

in education should be of a longitudinal nature. Cuban said it very nicely: "Stability and change are interwoven into a seamless cloth difficult for the observer to disentangle at first glance, yet becoming more visible as time passes....". (Cuban, 1986,p.107).
Given this dubious state-of-affairs with respect of the impact of information technology in schools, is it worthwhile to continue efforts in this direction?

3. A longitudinal technology-enriched school project

Recently a longitudinal research project (the PRONTO Project) about the impact of computers on education has been completed at the University of Twente. The project preparation started in 1985, and the project itself was executed from 1987 through 1993. Two secondary schools in Enschede and the Faculty of Educational Science and Technology were involved.

The central idea of the project was to equip both schools with extra facilities (in hardware, software, and released time for teachers) to create a situation of a 'technology-enriched' school (TES) (Moonen & Beishuizen, 1992; Moonen & Collis, 1992). In that environment the main task of the project was to investigate the impact of a TES environment on the school as a whole and in an interrelated way. Researchers from the university, school administrators, and teachers worked closely together to formulate, discuss, and investigate several research questions. Five major questions became the focus of the TES project: (a) what are the implications of large-scale introduction of computers for the school organisation, the school curriculum and the tasks of the teachers?(b) what kind of implementation problems are occurring? (c) what type of educational software should be available?(d) how can the use of computers be integrated in the existing curriculum teaching practice?(e) what are the effects of intensive use of computers on the motivation of teachers and pupils, and on the learning results?

The project produced 25 scientific reports, 11 booklets with practical guidelines for teachers, more than 70 external reports, articles and presentations, and a final report (Moonen (ed.), 1993). In summary the conclusions of the project were the following:

3.1 From the positive side

Because of the introduction of educational and administrative use of computers in the school, many kinds of change processes have started which, when well-anchored into the school system, will lead to substantial changes. The computer thereby acts as a catalyst.

Pupils are thoroughly enthusiastic about using computers and express their willingness to spent more time with computers in schools.

When its usefulness and usability is clearly visible the use of computers, especially in its non-educational administrative use, spreads around quickly and becomes popular.

3.2 From the negative side:

Large-scale introduction of computers in education is a complex and lengthy operation. Even after many years of concentrated efforts and involvement of the great majority of teachers and the school administration, the full integration of computers into the school system and the curricula is not yet realised. After reaching a certain level of implementation, further integration seems to be stopped.

3.3 Reasons and explanations for these conclusions:

3.3.1 Reasons

The main reason why the implementation process has come to a standstill is because of the insufficient didactical expertise of teachers with respect to the use of computers in their curriculum.

Other reasons are:

- the congestion in the computer laboratory
- a small minority of teachers (10 to 15%) keep rejecting the use of computers
- there is still a lack of 'adequate' educational software. The main problem hereby is that it is difficult to deEme when educational software can be perceived as 'adequate'.

3.3.2 Side conditions

Teachers prefer to be trained in their own school environment, by their computer co-ordinator and together with their colleagues.

The implementation of computers in the school needs the support of specialised personnel: at least a computer co-ordinator and a technical support person.

Introducing computers in education needs to be backed up by an explicit schoolbased consultation structure m which the school management, teachers, and other personnel can plan and make arrangements about how to use computers in the school.

3.4 General conclusion

The introduction of computers m education has started a process that will lead to substantial changes in education. There are however, two accompanying conditions for this conclusion:

- the introduction of computers should continue to be cherished and remain supported so that it gets real chance in schools;
- how computers should be used in the educational process has still to evolve; computers still have to fmd their 'niche'.

The central reason for this conclusion is the fact that the two main actors in education, the teacher and the pupil, show an intrinsic enthusiasm for the third actor in this interplay, the computer.

Cuban said it in a different way: "After a storm has struck a beach, to get down on your hands and knees and look at the sand from an inch away will give a clear but limited view of the beach; it will not offer a whole picture of what the storm has done to the shoreline." (Cuban, 1986, p. 107).

After a long time and from a bird's-eye perspectives changes are becoming visible in schools. Therefore, inspite of the many difficulties and disillusionments, the introduction of information technology in schools has to continue. As a consequence teacher training in this area should also continue.

4. Teacher training

How do training programs prepare teachers for the introduction of computers in schools? How did training programs evolve?

4.1 Start-up

The beginning was the most difficult as there was no training to train the trainers In many cases therefore, training was provided by those who were most close to the computing profession: mathematicians and computer scientists. As a consequence there was in the beginning a strong bias toward computer science in general and programming in particular.

4.2 Content

Specific training programs were formulated, heavily loaded with topics in relation to computer literacy. A typical training program (ACM, 1983) covered topics as: (a) what computers are and how they work; (b) a brief history of computers and technology; (c) an introduction to programming; (d) a survey of the application of computers in society;(e) a discussion of social issues in computing.

In addition it was believed that all teachers should get a minimal background about how computers could be used in education.

4.3 International Co-operation

The interest in computers and education grew very fast and most international organisations felt obliged to actively participate in discussions, each of which resulted in specific recommendations, also about the teacher-trainimg component in that context. Reference can be made to OECD conferences in 1984 (OECD, 1986) and in 1986 (OECD, 1987); the Fourth Conference of Ministers of Education of Member States of the Europe Region (UNESCO, 1988); and the UNESCO World Congress in 1989 (UNESCO, 1990).

In a study prepared for the UNESCO Congress, Nalletamby (1989) concludes that "the evolving situation in which informatics and information and communication technology finds themselves today makes it difficult for a solid training foundation to be provided for teachers, and for reliable and permanently valid materials to be produced in the subject...Therefore any training programme designed to meet present-day requirements will need to be reviewed periodically and adapted to changing needs" (p. 23). Based upon his research, the following principles and guidelines in planning and organising national teacher-training schemes were formulated (p. 23-24):

- Hardware provision must be backed by an adequate strategy of teacher training.
- The priority is for in-service training but pre-service training is also needed. Equally, teacher trainers need training and their institutions need equipment.
- Teacher training and school development are not separate but inextricably linked. Training must follow identified needs but must itself be developmental, helping teachers to create new ways ahead.

- The pace of imformatics development does not allow for a leisurely catching-up by teacher training. Needs are immediate. A school-based model of training has been used im certaim countries and has much to recommend it.
- Centralised monitoring and centralised production of teaching material is an important element im ensuring quality control.
- It is now possible to acquire a level of competence which allows a teacher to retain control over teaching programs and to modify them to fit particular learning needs. But it is not necessary for the teacher to acquire programming skills as such.

4.4 Side conditions

As addition to the above, Strange, Tucker, Uhlig, and Feldman (1988) have investigated alternative approaches for teacher training in technology. They found that key elements in successful training efforts included:

- effective administrative change agents
- stable, long-term internal f mding
- provision of "psychic rewards" to teachers receiving training
- direct involvement and support by principals
- training in basic applications, not programming languages
- an informal support and training network
- easy access to technologies both at school and at home
- flexible administrative rules and procedures
- a fellow teacher as trainer, one not seen as a "technologist".

Their maim policy recommendation is that "training m the use of technologies as tools must be provided to all teachers". In a remarkable way the results of the PRONTO Project (see Section 3) coincide exactly with these recommendations.

4.5 Current situation

The current state of affairs (Hebenstreit et al, 1992) for pre-service training is that it is argued and assumed that students will get acquainted with the new information technologies in the course of their study. Not only should they learn about the technology, they should also be exposed to it as part of their own learning process in order to stimulate them to reproduce the approaches used by their instructors when they are teaching themselves.

For in-service traiming it is suggested that the first level of traming deals with introducing teachers to information and communication technologies. Teachers must be prepared to operate a micro-computer and manage distributed software. Where possible, they should also learn about networking and telecommunications. It is recognized that there is a lack of teacher-training capacity. Therefore other training approaches should be explored: use of self-learning packages, videotapes, forms of open learning. In addition teachers must be prepared for the pedagogical use of' computers. Because of timeand money constraints, a kind of "cascade"-model should be applied: some teachers of each discipline should get an in-depth training and in turn train their colleagues. However, there is little consensus on the content of the courses these selected teachers should be offered (Levrat, 1992). To compensate for the lack of training material, Levrat also suggests that multi-media packages for teacher trainers should be developed.

4.6 Problems and solutions

According to Rawley (1992) there are over 19 million teachers employed in the primary education sector world-wide, of which more than 9 million are in low-income countries. Given these numbers it is obvious that the training effort needed is enormous. The consequence of this enormity is that it is necessary, certainly from a logical point of view, to agree upon a balance between a generally acceptable and comprehensive description of the goals, the objectives and the content of training programs, and a kind of permanent and widely accessible training approach and scheme.

From that perspective, it is necessary to have a good insight into how technology and its interrelationship with education most likely will evolve. At the same time, it is necessary to explore training approaches that can handle the large amounts of trainees, not only in a physical sense, but also from a costing and financial point of view.

In the next section a future perspective of technology that relates to the above point of view is sketched.

5. Technological developments

5.1 Predicting change

From one perspective, technology is continually changing, which brings difficulties for educational planning. However, from another perspective the changes we are seeing in technology are very predictable, at least when the predictions do not exceed a reasonable number of years (5 to 10). There are many examples of predictions in the computer industry whereby in reality the technology is living up to its expectations and even doing better than was predicted (Moonen & Stanchev, 1993). The main reason for this is because most of the technological features that are necessary for the realisation of a prediction exist already in a laboratory setting at the moment of the prediction. Therefore, what is being predicted in the area of technological developments had better be taken seriously. The chance that society will be conf onted with the predicted new services and products in the area of information technology is fairly reasonable.

5.2 Coming together of technologies

Years ago, Negroponte, then the Director of the MIT Media Lab, predicted that by the year 2000 three industries would integrate their activities: (a) the print and publish industry, (b) the broadcasting and motion picture industry, and (c) the computer industry (Brand, 1988). Reading the newspapers, we can watch how this is happening right now. The emergence of multimedia is the typical example of this movement.

In addition, the telecommunication industry is joining this merging operation. In the USA, as well as in Europe, the "electronic highway" through which masses of all kind of information and communication will pass, has become the typical methapor for these kind of activities.

The most visible developments for the rest of this decade will be the continuing developments with multimedia and the merging of communication and information technologies (CIT). The irresistible push of information technology (IT) in the 1980s has resulted in an even-more powerful push of communication and information technologies (CIT) in the 1990s.

As has been apparent in the past, education will not be able to resist this new technology push. How should education, and in particular teacher training, deal with this?

6. Technology and its relation to educational objectives

6.1 Objectives and continual change

Taking a generalised point of view, the organisation of the school, its curriculum, and its instructional strategies are based upon educational goals, which in turn are based upon philosophical perspectives and developments in society. These perspectives and developments are changing over time. As a consequence, educational goals are also repeatedly changing and education thus experiences reform after reform (Cuban, 1990). The introduction of computers in education, as a specific reform movement, is no exception to this general rule. The objectives about how to use computers in schools have shifted over the years. Bork (1990) describes the consecutive phases as: (a) let's get lots of hardware; (b) let's teach languages; (c) let's teach computer literacy; (d) let's train the teachers; (e) let's use advanced hardware; (f) let's develop small programs for use in standard courses; (g) let's use authoring systems; (h) let's catalogue existing software; (i) let's evaluate the small programs; (j) let's teach students about tools; (k) let's use networks; (I) let's develop management systems.

In this framework of a changing focus the PRONTO project concluded that computers in school still have to find their specific niche.

6.2 Moving target

Schools and their goals and objectives are a moving target, which makes it difficult to agree upon general educational policy, instructional strategies, and the development of specific instructional material. The current discussion and controversy within instructional design and instructional theory (Gustafson, 1993),is a typical illustration of the pendulum movement so characteristic for education at large (Moonen & Stanchev, 1993). Also Schoenmaker (1993) points out that "although the field of cognitive psychology includes a number of interesting viewpoints, there is no unified theory supporting formal-design methods which are necessary at the level of functional and technical design in order to produce a concise, consistent, and complete set of spccifications (for learning and training material)" (p. 191).

Therefore, the choice of instructional strategies and the development of instruction/learning material should be much more based on usability and pragmatism; pragmatism based upon available and affordable resources such as communication and information technology, and based upon available teacher expertise. Integration of technology as the third intelligent partner--besides the teacher and the pupil--in the school could have a stabilizing effect on the goals and objectives of the educational system.

Philosophical opinions and societal arguments will always keep having their influence on the school's objectives and goals, and therefore create a kind of moving target. The contribution of technology to education could be that it forces that moving target to move in a predictable direction (Moonen, 1991). In that perspective, a new technology push created by the evolving communication and information technologies should be appreciated.

How do these developments influence teacher-training paradigms?

7. New paradigms

7.1 Learning when needed

In commerce and industry new paradigms with respect to training are appearing. Training and training departments should less be conceived as separate activities and units, but become more integrated with working activities and occur whenever help or training is necessary. Such activities could be labelled as activities in a context of "open and flexible" learning.

7.2 JITOL

New activities always create new concepts and new terms. A new concept to indicate these continuing learning and training activities is "just-in-time" open learning (Lewis, 1993). In this model an individual learner is allowed to communicate with a tutor or tutors, or facilitator(s), with other learners and with a series of resources when he needs to.

7.3 EPSS and UPS

Another concept is the "electronic perfonnance support system" (EPSS; Gery, 1991). Gery describes a EPSS as a system whose goal is to provide integrated information, tools, and methodology, electronically, on demand, at the moment of need. Many variations of these new types of environments exist (Collis & Verwijs, 1994; Educational Technology, 1993).

Schoenmaker (1993) indicates that "relating training, information, and support services to performance needs has now become more urgent given the fast changes in product-market combinations which companies have to face" (p. 182). Therefore there is a need for what he calls an "integrated performance-support environment" (IPS) that has to become available to the worker and that can provide the worker with dedicated training, advice, information, and tools, when these are requested and needed.

7.4 Human requirements

This new paradigm of "just-in-time" learning and training is based on the use of existing technology and facilities, but also anticipates new developments in technology, especially with respect to communications facilities (e.g., ISDN). In addition to the availability of resource material, a number of actors play a central role in this approach: (a) the learner, (b) a tutor or expert, (c) a counsellor, and (d) a resource manager. The learner and the counsellor are part of the learner environment, the others of the resource environment.

Given the specific circumstances of the training effort that is needed with respect to information technology and education, in particular to teacher in-service training, an approach based upon these new concepts should be investigated.

8. New directions for teacher training

Following such an just-in-time approach, teachers could get help and training whenever they needed it. The training could be received in the teachers' own school environment, whereby the computer coordinator could act as the counsellor. The resources could be produced and made available through a centralized effort (locally/regionally--by a number of schools in a city or region; or nationally--initiated by the ministry of education). The important task of resource manager could be organised at a centralised level, as would be the availability of tutors/experts.

Following this approach, teachers should be able to get access to a broad range of resources, not only to be trained, but also as a database of examples of good practice. Given these examples, teachers get new opportunities to create and design their own learning/teaching environments.

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In-service Training and Information Technology from a Curriculum Innovation Perspective

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Abstract

From the perspective of curriculum innovation the teacher has a central role in implementing an innovation in educational practice. Many factors are influencing successful implementation, of which good quality products and materials provide a powerful starting point for teacher inservice training activities. As in many educational systems, teachers are free to decide whether or not to use computers as a medium in their teaching approach, it is important to take into account in the design of inservice training the problems teachers are experiencing when using computers. Finally, consequences of the curriculum innovation perspective for the design of in-service training are discussed.

1. Introduction

With reference to the use of computers in education, international assessment studies have revealed that the implementation of IT (nowadays still predominantly computers) in the classroom practice is still rather limited in most nations (Pelgrum & Plomp, 1991, 1993; Pelgrum, Janssen Reinen & Plomp, 1993). These results as well as the outcomes of many implementation studies (for a review, see van den Akker, Keursten & Plomp 1992) underscore the prediction by WaLker (1986, p. 31) that "implementation problems will determine the type and extent of uses to which computers are put in schools, not the philosophical or theoretical claims and not the objective benefits to be gained from any given use".

In line with these findings, it can be concluded that, also in the domain of IT, the teacher is the person who is responsible for implementing the curriculum as it is agreed upon (on national, regional and/or school level) in the classroom. "Educators and educational researchers consistently cite one factor as central to the full development of technology's use in the schools - the classroom teacher" (OTA, 1988, p.87).

All this provides sufficient reasons to take a closer look at the introduction of IT in education from a curriculum innovation perspective with a special attention to the role of the teacher.

1.1 Information Technology as object, aspect, or medium

In this context it is relevant to distinguish between IT (mostly still computers) as an 'object', as an 'aspect', and as a 'medium' in education (Ministry of Education, 1992). In IT as object the focus is on the technical functioning, its social implications and the possibility of employing particular applications in a useful way. Basically, this approach means teaching and learning about IT and computers; in lower secondary education often in computer education and information and computer literacy courses, but also as part of existing subjects. IT as aspect refers to IT as an integrated component in another subject, such as in vocational courses or, in general education, in science courses. IT as a medium refers to IT (or computers) as a tool or an aid in teaching and learning. Applications of IT as a medium are, for example, all forms of computer assisted instruction.

In this chapter, we will focus especially on the use of computers as a 'medium' and as an 'aspect', as these are having a great impact on the teaching and learning processes at classroom level. First, attention will be paid to the curriculum-innovation perspective of IT in education. Then the teacher's perspective will be discussed and a promising approach for integration of computers in teacher's inservice training.

2. Curriculum-innovation perspective of IT in education

2.1 Variables that influence implementation

Positioning the teacher in the center of our attention requires that we recognize several categories of variables that may influence the implementation of innovations in general (Fullan, 1991), and of changes in technology in particular (van den Akker et al., 1992; Fullan, Miles & Anderson, 1988). The (product) characteristics of the innovation itself (in our case IT in education), are very important. But before discussing these, we mention three other categories of variables that are more or less conditional for successful implementation:

- *national/state/district context:* central legislation and regulation; system of educational policy decision making; time, resources, and facilities made available for innovation; proclaimed values and aims about an innovation; attitudes of politicians, opinion leaders and administrators about an innovation;

- *school organisation:* experiences with earlier innovations; role of the school leader; procedures of decision making; available facilities (time, money, materials); internal Co-operation and mutual support; distribution of information and exchange of experiences;
- *external support:* inservice training; assistance with internal staff development; coaching and guidance for individual teachers; personal contacts with experts and colleagues from other schools.

2.2 Illustration from the Netherlands

It is seldom possible to influence all these variables in a positive direction. But their relevance can be illustrated with the developments in the Netherlands (Ten Brummelhuis & Plomp, 1993, 1994). The stimulation policy of the Dutch government in the 1980s was originally directed at IT as object of education by providing each secondary school with some computers in a lab, training some teachers to teach information and computer literacy, and subsidizing curriculum development in this area. As a result, in the early 1990s in the Netherlands more than 95% of the schools are teaching such a course in lower secondary education; similar outcomes can be given for other countries. Also successful is the Dutch policy of making use of computers as an aspect in physics compulsory. However, the freedom for the schools of organising their teaching process in the Netherlands (and in many countries) does not allow the government to prescribe to schools and teachers the use of computers as a medium. Teachers will only use computers when they are highly motivated to it, e.g., because they see the usefulness of it. The results of IEA's international comparative study of computers in education not surprisingly show that the use of computers as a medium is in all participating countries much less that the use as object (Pelgrum & Plomp, 1991; Pelgrum et al., 1993).

2.3 Stimulating IT use as a medium

Under the assumption that proper use of IT as a medium can improve teaching and learning processes, and given that the use of computers as a medium is not obvious for teachers, it is from a curriculum innovation perspective essential to develop an effective implementation approach.

2.3.1 Characteristics of the medium as an innovation

Two aspects are important here: the characteristics of the innovation (e.g., educational software and accompanying materials) itself and teacher (m-service) training (which will be discussed in the last section). Although products and materials alone are never sufficient for the implementation of innovations by broad groups of teachers, their potential influence is significant. Moreover, good quality products and materials provide a powerful starting point for teacher (in-service) training activities. According to Fullan (1991), these characteristics include:

- *need and relevance:* What is the need for and the appropriateness of the change? What is the priority of the efforts to implement the innovation relative to other concerns?

- clarity: How clear are the goals and essential features of the innovation? How clear are the practical implications for the users?
- complexity: How many components of the instructional partice are affected and how much do they differ from existing practices and beliefs? How difficult is it to learn the necessary changes?
- quality and practicality: How well developed and tested are the products? How certain is the impact of the innovation? What is the trade-off between actual benefits of the personal and organisational costs?

2.3.2 Obstacles because of weaknesses in medium characteristics

Weaknesses in these characteristics may result in major obstacles for implementation. Research in this area is scarce. From the IEA Comped study (Pelgrum et al., 1993) we know that the quality and quantity of courseware is considered as insufficient by the teachers. Keursten (1994) summarizes some problems in the quality of educational software and courseware from the available research literature (see also van den Akker et al., 1992): poor match between curriculum and software; limited application possibilities; courseware not suitable for whole-classroom use; poor documentation of software; products not or hardly evaluated, resulting in uncertainty about their usefulness and effectivity.

Such criticism has recently been underscored by Keursten and Nieveen (1992), who analyzed all (161) at that time available courseware packages developed for classroom use in secondary education in the Netherlands. Where many policy makers and opinion leaders in the area of computers in education seemed satisfied with the available courseware in the Netherlands, and could not understand why so few teachers were using them regularly, it appeared that the quality of the documentation accompanying the software was very poor.

3. The teacher's perspective

From a curriculum innovation perspective, teachers are key actors in implementing IT in education. This key role not only becomes manifest where teachers do have the freedom to decide whether or not to use IT as medium, but also in the quality of the implementation of IT as aspect.

3.1 Difficulties teachers face

The above-mentioned characteristics of the innovation are attributed characteristics and therefore difficult to determine objectively. These subjective judgements of users depend on their actual experience and situation with respect to IT and on other personal characteristics. The above mentioned problems with educational software and courseware do increase the chance that when teachers balance pros and cons of IT use, this will result in a rejection. This chance will increase, as long as many teachers experience many problems when using computers (van den Akker et al., 1992), such as:

- difficulty to select software;

- lack of technical skills in using computers and software, leading to uncertainty and low level of computer use;
- unanticipated problems with instructional roles, which have changed as a consequence of computer use (being a partner and guide of students, instead of expository teaching; thus, having learn new roles and unlearn old ones);
- many practical problems, such as many time-consuming management and organizational activities.

3.2 An infusion approach to teacher support

It is important to realize that in teacher's initial implementation efforts personal self-concerns dominate, changing via more task-oriented concerns to concerns about the impact of the curriculum on learners. Thus, where at present most teachers are still in the initiation phase of computer use, where personal 'survival' concerns dominate, courseware materials and teacher in-service training should support the teachers by anticipating as much as possible potential user problems and by offering practical advice to prevent or solve such problems. Van den Akker et al. (1992) (see also van den Akker & Plomp,1993) are suggesting that integration of computer use in instructional practice may benefit of an 'infusion' approach, which can be characterized as follows:

- teachers can start their computer use with short and well organized applications;
- successful use is strongly advanced by carefully designed and validated procedural specifications in the different courseware components;
- based on these successful experiences, teachers acquire clarity about the meaning and potential of the innovation, gain confidence in their own competence, and develop their own view of the appropriateness of the innovation for their students and themselves.

4. Consequences for in-service training

4.1 Types of change required of teachers

As Fullan (1991) has pointed out, many innovations require teachers to change on several dimensions: the use of new materials, alterations in their teaching behavior, and changes in their beliefs and attitudes. The more dimensions are at stake, the more complex the innovation is and the more difficult it is to get it successfully implemented.

When looking at the 'medium' and the 'aspect' application of IT in education, usually all the three above-named dimensions do apply. For many teachers working with IT means working with new materials (both hardware and courseware). It is often influencing teaching behavior and beliefs, as allowing students more individual and small-group work with computers (varying from doing simple exercises to problem-solving tasks using data bases, or computer-based science lab work, etc.) demands from the teacher another role: more individual guidance instead of whole-class teaching. Introducing IT in education as medium or aspect has therefore to be considered as a complex innovation.

4.2 Focuses for in-service training

If inservice training has to contribute to an effective implementation of such a complex innovation, it should be part of a more comprehensive scenario of combined measures (cf. Fullan, 1985), including:

- attention to the development of clear and validated materials;
- focused, ongoing inservice or staff development activities;
- active administrative support and leadership at the district and especially the school level;
- the development of collegiality and other interaction-based conditions at the school level;
- the selective use of external resources (both people and materials).

4.2.1 Theory underlying training

External support approaches may especially focus on a combination of the first two components: materials development and teacher and staff development. The training component in that approach should preferably reflect the widely validated model of Joyce and Showers (theory, demonstration, practice, coaching, follow-up coaching). Some elaboration of what the training should provide for the teachers (cf. Roes & van den Akker, 1993):

- clarification of the ideas behind the innovation and practical examples of what these ideas might look like in the classroom (via written lesson protocols or video recordings);
- opportunities for practice during the sessions and in real classroom situations, accompanied by structured feedback and informal exchange of experiences;
- follow-up support and (peer) coaching in adapting and elaborating proposals and materials for own teaching practice.

4.2.2 Theory underlying instructional materials

Courseware (including print materials) are better suited to serve as tools for practice and communication in training contexts as far as they:

- clearly reflect the innovative ideals;
- provide the teachers with practical suggestions for dealing with difficulties regarding lesson preparation, subject matter, teaching pattern, and learning effects;
- are empirically proven to be workable and effective.

5. Conclusion

Combining sophisticated exemplary materials and inservice training works well for the growth of individual teachers, while additional staff development activities can help incorporate the innovative practices and beliefs throughout the school organization.

Recent results of IEA's Comped study (Janssen Reinen & Plomp, 1993) once more have underlined the importance of teacher training. Teachers' knowledge and skills with reference to computer integration in the classroom are significantly related to the amount and types of training received. In particular, pedagogical/instructional aspects in teacher training are contributing to ffie integration of computers in the classroom. However, this topic is still barely covered in teacher-training activities (up till 1989). Such findings about the potential of inservice training, but also the frequency of ineffective inservice approaches that occur in reality, should stimulate us to design and test more effective strategies.

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What do Instructional and Information Technology Offer to Teacher Education? Results and the Future

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Abstract

The University of Twente offers teacher training for senior high school tea - chers of mathematics, physics and chemistry andfor teachers of higher vocational education. The profession-specif c training course for senior high school teachers is comprised of an optional two-month undergraduate preparatory period followed by a one-year graduate program. The resear - ch program of the teacher training institute shows strong interest in the use of CIT in the senior high school course program. The main issue was the design of instruction for learning to solve problems. The results of the stu - dies are used in the teacher training program. In the training courses many CIT applications are used, like practising with courseware, measurement by computers, implementing courseware in school classes.

1. Teacher education in The Netherlands

In The Netherlands separate training courses are organized

a) for teachers of elementary education,
b) for junior-secondary school teachers and teachers of junior and senior secondary vocational education,
c) for senior-secondary school teachers and
d) for teachers of higher-vocational education.

The course program for the first two groups of teachers is organised by teacher-training institutes which form a sector in schools for higher vocational education, whereas the course program for the last two groups is organised by a teacher-training institute of a university.

The training course for senior-secondary school teachers is comprised of an optional undergraduate preparatory period of two-months' duration followed by a one-year graduate program, which is divided in two periods of roughly six months each. In the first period, several classes relating to instructional technology and student motivation are taken and finished by taking exams. The second period is used for an internship with a secondary school. Those students who successfully finish the course program and the internship are licensed as senior-secondary school teachers for a subject which forms part of the secondary-school curriculum.

Because the course program for senior-secondary school teachers is offered by a training institute of a university, both research and development and the training of students form part of the program. The authors have responsibilities for the training of teachers of mathematics, physics, and chemistry.

For the rest of this paper, the term "teacher education" needs explication. The term is confined to those courses which are specifically directed to the teaching occupation, that is, directed to the acquisition of knowledge of psychology and pedagogy and their applications in teaching specific school subjects. We are aware that a complete teacher-education program also contains courses in the subjects to be taught. However, communication and information technology (CIT) applications in such courses are not typical for teacher education.

2. Research and development

2.1 Research about information technology in secondary - school instruction

The research program of the teacher-training institute at the University of Twente has shown strong interest in the use of information technology in the senior-secondary school course program. The main issue was the design of instruction for learning to solve problems. The results of the studies are used in the teacher training program. Following are some examples of this research.

2.1.1 Physics.

In the beginning of the 1980s the (stand-alone) computer was used to coach I 0th Grade students with deficiencies in prerequisite knowledge of physics. The pretest scores of some students of the schools who participated in the study showed deficiencies in metrics, trigonometry and proportions, and equations. The remedial instruction for these topics was designed as a self-instructional computer-assisted instruction. The students with deficiencies in prerequisite knowledge and skills were invited to take the remedial instruction and reach mastery. After taking the remedial instruction, the regular physics course of instruction was offered and the students were administered a kinematics test.

In comparison to a control group, short-term results were shown for the computerassisted remedial teaching. The effect was stronger if the remedial teaching was supervised. On the long term, as to the results of regular instruction, an effect can be demonstrated only for students with extremely deficient prior knowledge (De Bruijn, 1988).

2.1.2 Programming problems.

In the middle of the 1980s computer use in elementary and secondary education was planned and financially supported by the Dutch Government. It was proposed that computer science should be part of the senior-secondary school curriculum. The teacher-training institute developed projects for studying the teaching of programming in Comal and Pascal and for designing and querying a database with Structured Query Language (SQL). The solving of programming problems was the main issue.

In the first project different strategies for how to teach programming to students of Grades 10-12 were developed and tested. The "reading", the "generation", and the "completion" strategies were implemented in textbooks or in CBT-programs. A small subset of the structured programming language COMAL-80 was used. For the procedural instruction the results of the study showed that the completion strategy was superior, for the overall instruction the reading approach is recommended. Showing a concrete computer model early in learnmg and providing the students with a general design schema are important tactics for declarative instruction (Van Merri_nboer, 1990).

A similar project was developed to list syntactic and semantic bugs in PASCAL programs and to provide intelligent feedback on semantic errors. For this purpose, a PASCAL textbook and a diskette with problems was developed. Regular discussion with senior-secondary school teachers about the content of the textbook and the programs was realized. For the intelligent-feedback program, "Program Understander for Students" (PROUST), an intelligent-tutoring system (ITS) was used (Johnson, & Soloway, 1985). Co-operation and information about the use of the ITS with the designers of the program was realised by electronic mail. The ITS ran on a minicomputer which was located at the teacher-training institute. The secondary-school students used a personal computer to test the programs they designed. For datacommunication the telephone network was used. The hypothesis that immediate feedback from the ITS should be superior for the identification and repair of bugs in Pascal programs in comparison to non-immediate feedback of a teacher could not be confirmed. (Dijkstra, Krammer, & Maaswinkel, 1989).

Studying the teaching of programming was continued in schools for higher vocational training and not with senior-secondary school students because, on a national level, the decision was made not to include teaching programming in the generalsecondary curriculum.

2.1.3. Data base query problems.

The teacher-trainmg institute further started a project to study the differential effects on learning outcomes of two instructional strategies, a top-down and a bottom-up approach, in an introductory course on solving data base query problems. For this project a course book and a workbook were written. The books were available in separate versions for the two approaches. After finishing the course program an achievement test was administered. It was hypothesized that for high-ability students the top-down approach will be superior to the bottom-up approach, but for low-ability students the bottom-up approach will yield better results. For low-ability students the data support the hypothesis. For high-ability students however, presenting different problem-solving strategies did not result in significant differences in learning outcomes (Van Dijk, 1992).

2.1.4 Chemistry.

The training institute further developed computer-assisted instruction to offer students a set of heuristics to solve interpretation problems in chemistry. The purpose of the heuristics was to strengthen metacognitive skills. The students appreciated the presentation of the heuristics, but in some cases were not pleased about the dosage of heuristics. (Kramers-Pals, in press).

2.2 Co-operation with the schools for research and in practice

The overview makes clear that the teacher-training staff uses information technology for research and development purposes. The projects are carried out in co-operation with the senior-secondary school teachers who supervise the interns. The computerassisted or computer-managed programs and the course books are sometimes published or can be purchased at the institute. Thus the use of information technology serves both the research program of the institute and the course programs of the schools. For the near future the research and development program will be continued. Further developments in the co-operation with the schools can be expected if the development of software and courseware can profit from improved communication networks.

3. Training students

Applications of CIT in a teacher-education program are necessarily limited. By nature, teacher education contains primarily training situations in a social context. Below, we present an overview of the major applications illustrated by now existing or in the future desired examples from our program.

3.1. Knowledge about relevant IT systems

Teachers should know about existing IT systems applicable in their teaching situation. Our mathematics students practise with several programs in use at schools, for instance drawing diagrams, computing statistics, or designing dynamic systems. Our physics students practise with software and hardware with which measurements can be analysed.

3.2 Implementation of courseware

Prospective teachers have to learn how courseware can be implemented in school: have to learn how to evaluate courseware, how to organize groupwork with computers, etc. Students of our university have to practise the implementation of courseware. For instance, last year students wrote lesson materials, and designed and conducted a series of lessons in Grades 10 and 11 using the courseware program DERIVE.

3.3 Lesson design.

In teacher-education courses students are required to spend much time designing lessons, much more than expert teachers do. It is assumed that such activities - which require the student to specify objectives, to analyze the learning tasks, to generate examples, etc. - speed up the acquisition of pedagogical content knowledge. For such activities automated instructional-design tools are being developed that will become available in the near future. At the moment we use a demonstration version of tool based on Gagn's Instructional Event Theory.

3.4 Decision making and reflection

To further the teachers' skills in decision making and reflection, case-based teaching has become an important method in teacher-education courses. Recently, case-based computer simulations and games have become available. A new and promising development is interactive video applications to train teachers in rapid decision making.

3.5 Improving teacher-education curriculum.

The teacher-education curriculum could be improved using a computer-managed instruction strategy. As our students enter the program at different times in the year it is impossible to organize the courses in classes. Computer-managed instruction in combination with a module-based program makes individual learning paths of student possible.

3.6 Communication network

A further improvement of the curriculum could be reached if the co-operating schools could be connected with our university in a communication network. This is not just a practical possibility to speed up the messages between the schools and the university. It also can improve the mutual understanding of co-operating teachers and university faculty regarding the training goals. This small overview shows the possibilities of CIT in the teacher-education curriculum and the applications which are already available now.

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Supporting Teachers and Learners to Design Powerful Learning Environments

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Abstract

Recent developments in instructional design often involve open educational systems or open learning systems. In these modularised learning systems the learner decides what, when, how, with what, where, and at what pace to learn. Not only the control of the learning is to the learner, but also the designing of his learning environment. Learners' roles differ, but also teachers have to change their roles from instructor to guide. Information support systems have to be built in order to inform the learner about possibilities to learn. Teachers' roles have developed during times in which learning environments gradually differed Learning environments can be discerned historically into three broad categories and related roles for teachers. The first category stems from developments in behaviouristic approaches to teaching, like programmed instruction and ruled-instruction. Learning is heavily controlled by the environment that sets conditions and parameters for action. The role of media and technology is separatedfrom the role of the teacher. They are operating apart from each other. The second category of learning environments has been influenced by cognitive learning theory. More emphasis is put on aspects of adaptive instruction and on knowledge representations as a condition for learning Teachers adapt technology and are collaborating with technology in order to optimise learning outcomes. The role of technology in instruction and the role of the teacher are integrated. The third, most recent, category comprises constructive beliefs and ideas about learning and instruction. Technology is not controlling learning any more but

plays a supportive role, informing and advising the learner. The teacher's role is integrated in this supportive function, also by advising and meta - cognitively supporting the learner. In some instances the role of the teacher is amplif ed by technology. Teacher and technology are collaborating in supporting the learner in achieving learning outcomes that were not pos - sible before. In this sense, technolog,v not only supports the learner but also supports the teacher to play an effective and affective role in knowled - ge acquisition and knowledge construction and in practice of skill in the learner. This contribution describes research directed to the roles of tea - chers and students in designing powerful learning environments.

1. Learning and the evolution of apprenticeship

1.1 Apprenticeship: From central paradigm to decline

Recently there has been a growing interest in the characteristics of the task environment of the learner, its physical as well as cognitive characteristics. Traditionally, this environment consisted of teacher(s) and learners. In ancient times, learning was provided by the master who teaches the novice learner by introducing him experiences and ideas in an environment that was almost identical to the real context of performing a job. In medieval times in Europe the so-called guild system was very prominent as a vocational-training system. Learners learned professional skills by interacting with real tools also used by experts. They gradually became experts themselves through a process in which the control of the master faded. This form of apprenticeship learning has almost now disappeared in Western educational systems. It has become a small part of the curriculum of vocational-training systems, at the end of the formal training within schools. Within these systems emphasis is laid on the acquisition of basic skills and also of cognitive skills that are supposed to transfer to other situations, in particular the job context. There is no dyadic interaction of master as teacher and learner anymore. Less collaborative learning takes place. Instruction is to be given by a teacher for a class of 20 to 30 learners or even more. Learning research therefore concentrated on the conditions that make effective learning possible withm these environments, e.g., instructional strategies to be used by the teacher, communication between teacher and learners, and interaction between learners.

1.2 Technological facilitation of apprenticeship learning

Before the technological revolution came to be an important impetus within the field of learnmg and mstruction, theories of instructional design were assumed to pertain to instruction presented to groups of learners through means such as lectures, demonstrations, and texts. Alimited form of communication, almost always one-way, was permitted due to technological inadequacies and constraints. But quite recently, great progress has been made in the computation and storage capacity of technological aids and this has a positive effect on designing intelligent learning environments. Yet, the main goals to accomplish are still to promote the relevant cognitive processes and also to promote their immediate use in context. Maybe due to a nostalgic tendency to the good old times there is a growing interest in apprenticeship learning (e.g. Resnick, 1987; Collins, Brown & Newman, 1989; Brown, Collms & Duguid, 1989). Their perspective work on apprenticeship learning originates from cognitive-anthropological studies by Scribner, Rogoff and Lave (in Rogoff& Lave, 1984). The later stated that effective learning has to be situated in a context similar to the one in which the skills will be used, that learner and master or coach have to be active participants in this intellectual enterprise, and that cognitive processes are to be externalized and displayed for reflection. Success depends on the instantiation of these design features of apprenticeship in an intelligent learning environment. Learning environments can thus become effective instructional environments if the purpose of the design is to facilitate the cognitive processes by letting the learner solve authentic problems within the deEmed learning environment. In this way it is possible to create what Montague (1988) calls a working environment or functional context for learning.

1.3 Computer-based environments and new contexts for apprenticeships

Pirolli and Greeno (1988) stated that due to current technology, three kinds of computer-based instructional environments have been provided. According to these authors one class of mstructional environment "*...involves an exploratory microworld where learners can manipulate objects in a computational system that is designed to embody a set of theoretical principles.*" Another kind of instructional environment "*... involves a sort of apprenticeship in which a teacher first models behaviour and then coaches learners as they work to acquire the skill.*" As learning progresses the influence of the coach is fading and the learner is trying to solve problems independently. A third kind of instructional environment emphasizes "*...collaboration, either among learners or between the learners and the teacher on intellectual goals that they share.* "

Due to these recent possibilities learning knowledge and skills can take place in a relevant environment of their intended use, although this transmission of knowledge and culture is provided at a higher level of aggregation. Realistic environments provide a micro-world for the user in such a way that the principles of apprenticeship learning are pertinent. Highly sophisticated computer and other technological aids simulate job contexts and other real-life situations to enhance learning and to facilitate cognitive functioning. Hence, learning environments are to be studied at the various system levels on which (simulated) contexts can be created. These fimotional contexts can serve as discovery worlds where the learner controls the outcome or as instructional environments where the teacher or program control the outcome.

2. The nature of learning environments and their design

2.1 Constructivists learning and access to powerful tools

In her introduction to the book contributed to Robert Glaser, Resnick (1989) argued that current instructional theory comprises three perceptions of human learning: learning being a process of knowledge construction, learning as knowledge-dependent, and learning as tuned to the situation in which it takes place.

The consequence of adopting such a constructive view on learning is that instruction will be instrumental to the support of the construction of knowledge from experience. Functional contexts (Montague, 1988) have to be designed to provide the learner access to tools with which encountered problems can be solved. We already are familiar with learner control in multimedia environments. These environments, developed by highly specialized cognitive engineers, enables the learner to select his own trajectory through the media landscape. But a constructivist approach will offer more to the learner. User-friendly tools from which the learner not only selects his trajectory, but selects the landscape too. These provocative ideas do not match very well with current instructional design theories.

Current instructional design is directed to designing support tools that provides the designer a set of functions for making training development more efficient and making training materials more effective.

2.2 Third-generation instructional systems design

After the first generation of the behaviouristic assembly-line linear instructional design theories and the second generation of cognitively oriented instructional systems design, a third generation emerges: user-centred instructional systems design. In this third generation tools will be developed that can be of functional use for the designer and teacher, but also for the learner himself.

Third-generation Instructional design places the learner much more in focus than traditional instructional design did. It is the learner that controls the learning process and the instructional designer or teacher only set conditions for an effective learning process. If we take for instance new learning technologies, such as computer-assisted learning environments in which multimedia systems have been implemented, than we observe a tendency to let the learner manage the learning process. Formal instruction is albeit set aside.

Recent developments in instructional design involve open educational systems or open learning systems. In these modularized learning systems the learner decides what, when, how, with what, where, and at what pace to learn. Not only the control of the learning is to the learner, but also the designing of his learning environment. Even needs assessment has to do with open learning. Learners who may choose their own way of learning, will also want to know more about their own needs. In other words, they want to assess their own needs and have information about the way these needs can lae filled. Teachers have to change their roles from instructor to guide. And even information support systems have to be built in order to inform the learner about possibilities to learn.

2.3 Learning landscapes

In the third generation of instructional design needs assessment is integrated with open learning (or open instruction) systems. To fulfil this need, designers have to create educational or learning landscapes in which learners can stroll through the use of many learning tools. We may think of real landscapes in schools, companies or community colleges in which teachers in another role, as guide or facilitator, can inform learners and give them advice. We may also think of artificial landscapes in which learners learn in partnership with the learnmg technologies. Recently developed distributed intelligent technologies afford the learner a partnership with results greatly dependent on joint effort. The partnership with computer technologies and tools is very real in this respect. It entails according to Salomon, Perkins and Globerson (1991) three major ingredients one finds in human partnership: (a) a complementary division of labour that (b) becomes interdependent and that (c) develops over time. An interesting point, indicated by these authors, is that even novice learners might gain from certain computer tools that support cognitive processes. Novice learners might engage in cognitive activities out of their reach without the technological partnership in traditional educational environments. Current computer simulation within multimedia systems allows the construction of a simulated reality in which learners do not need to commit anything to memory. This kind of systems let the learner engage in intellectual activities at a level that transcends the limitations of his own cognitive system.

2.4 New roles for teachers

For teachers, new roles emerge in this era of new information and communication technologies. Simons (1991) describes different roles for teachers facing new challenges of learning and instruction. Challenges that are related to not only new developments of information and communication technology, but also to new insights in learning and instruction, and especially in the transfer of learning. The first role of teachers Simons distinguishes, is teacher as external monitor. The teacher monitors the learning process and makes explicit the decisions that have to made by the learner in order to optimize the learning outcomes. The second role is teacher as expert model. In this.role, teachers demonstrates domain specific problem solving and thinking skills, with a clear emphasis on the process of reaching outcomes and not on the outcome only. The third role is directed to meta-cognitive aspects of intellectual functioning. The teacher has the role of meta-cognitive guide that stimulates reflection and articulation of thinking and regulation processes. The fourth role comprises scaffolding. During the first phases of the instructional and learning process the teacher is the one who is in charge but gradually this influence fades and the learner is taking over the responsibility. The fifth role is directed to goal setting, to gaining self-confidence and to promoting motivation and self-control and consequently to attributing success and failure.

2.5 New roles and new learning environments

These new roles develop during times that learning environments gradually differ. To be short, learning environments can be discerned historically into three broad categories and related roles for teachers.

The first category stems from developments in behaviouristic approaches to teaching, such as programmed instruction and rule-instruction. Learning is heavily controlled by the environment that sets conditions and parameters for action. The role of media and technology is separated from the role of the teacher. They are operating apart from each other.

The second category of learning environments has been influenced by cognitive learning theory. More emphasis is put on aspects of adaptive instruction and on knowledge representations as a condition for learning. Teachers adapt technology and are collaborating with technology in order to optimize learning outcomes. The role of technology in instruction and the role of the teacher are integrated.

The third, recent, category comprises constructivistic beliefs and ideas about learning and instruction. Technology is not controlling learning any more but plays a supportive role, informing and advising the learner. The teacher's role is integrated in this supportive function, also by advising and meta-cognitively supporting the learner. In some instances the role of the teacher is amplified by technology. Teacher and technology are collaborating in supporting the learner in achieving learning outcomes that were not possible before. In this sense, technology not only supports the learner but also supports the teacher to play an effective and affective role in knowledge acquisition and knowledge construction and in practice of skill in the learner.

3. Supporting learning and instruction

3.1 Cognitive technologies

Above we described three aspects of supporting learners and teachers in learning environments. These are, (a) supporting the learning process by supporting the student in the acquisition and construction of knowledge and the practice of skill, (b) supportingn the teacher as a designer of powerful learning environments, and (c) supporting the student as a designer of his own learning environment. A means to accomplish such a supportive function is the application of tools that facilitate these three functions of support. The tools or as we prefer to call them, cognitive tools or in a generic sense cognitive technology, are mechanisms or devices to promote, support, and facilitate knowledge acquisition and construction, and the practice of skill.

3.2 Cognitive learning tools

In the book about cognitive tools for learning, Jonassen (1992) introduced tools as "… *extensions of human beings that partially differentiate humans from lower order species of animals.* " Tools have been designed for various purposes and to serve an impressive number of functions. Jonassen writes that it is the irony of education that only few tools have been designed to optimize the process of education, by facilitating learning. Learning tools are a special kind of educational tools. Educational tools are meant to facilitate the whole process of education on the level of organisation or classroom. Cognitive learning tools are specially designed to promote and support the acquisition and construction of knowledge and the practice of skill of the individual learner. These cognitive tools are to be differentiated from task-specific tools and have to be generalizable tools that can facilitate cognitive processing (Jonassen, 1992). Jonassen sets limits by characterising cognitive tools. They can be regarded internal or external to the learner. Internal by for instance cognitive or meta-cognitive learning strategies. External by "*... cognitive tools as both mental and computational devices that support, guide, and extend the thinking processes of their users.*" The tools to be described here are computer-based devices and other environments, external to the learner, that extend the knowledge acquisition and construction and skill-practice processes of the individual learner. The teacher can apply these tools in order to design powerful learning environments, but on the other hand, the learner himself, in a constructivistic sense, can apply these tools too. In both cases, the tools promote and facilitate the acquisition and construction and the practice of skill.

3.3 Cognitive tools and the application of cognition

The support of the cognitive tool to the process of thinking and other cognitive processes, domain-dependent as well domain-independent processes, is also emphasized by Kozma (1992): "*By supporting processing and compensating for limits of the system, a cognitive tool can amplify cognition. In this role the computer extends the learner's thought processes by providing an external model of internal cognitive processes. In turn, by making these internal processes more public and available for examination and reflection, the computer can help the learner improve on these cognitive processes. (...) Thus, not only may the cognitive tool aid in the learning of the particular knowledge domain to which it is applied, it may contribute to the development of general purpose learning skills and strategies.* "

3.4 Functionality perspectives

In utilizing cognitive tools, formal instruction is albeit set aside, in favour of task performance. Mayes (1992), therefore, stresses the action oriented nature of using tools: "*... essentially comprehension tasks which require a learner to analyse material at a deeper level than would normally follow from a simple instruction to learn' Deep learning results as a kind of by-product of using cognitive tools task, as it does from any such analytical search for meaning.* "

The functionality of cognitive tools can be compared to the functionality Montague (1988) referred to in describing the cognitive-based learning environments. These environments, in his view, provide a functional context model for instruction. The main purpose of learning environments is to offer the learner a functional context that enables him to use what is acquired. Montague (1988): "*The design of the learning environment thus may include clever combinations of various means for representing tasks and information to students, for eliciting appropriate thought and planning to carry out actions, for assessing errors in thought and planning and correcting them. I take the view that the task of the designer is to provide the student with necessary tools and conditions for learning. That is to say, the student needs to learn the appropriate language and concepts to use to understand situations in which what is learned is used and how to operate in them.* "

In sum, cognitive tools provide the learner a cognitive technology external to him, to support knowledge acquisition and construction and practice of skill, by facilitating and optimising cognitive processes underlying knowledge acquisition and construction and practice of skills. Deliberately planned or not, this cognitive technology is made up of knowledge about cognitive processes and conveyed to the learner by means of external devices or models. We follow Kozma by saying that the cognitive tool supports the learner in acquiring domain knowledge but also "..., it may contribute to the development of general purpose learning skills and strategies. " In some instances we prefer to use the word technology instead of tool because of its generic meaning. Obviously, the teacher plays the role as facilitator by creating conditions for optimal application of these tools, either indirectly by letting the learner deploy the tools or directly by letting the learning environment deploy the tools. As said before, in both cases the aim is to promote cognitive processes in the learner.

3.5 Cognitive tools as agents of constructivism

The view presented here about cognitive technology expresses the distinction drawn by Salomon, Perkins, and Globerson (1991) between cognitive effects with and of information processing technologies. New technologies can be applied to solve problems, e.g. arithmetic problems, but this technology can also be applied to learn to solve problems. Jonassen (1992), in his discussion about the nature of cognitive tools, refers to the distinction with and oftechnology: "*Cognitive tools represent learning with information pro - cessing as opposed to learning of them (Salomon, Perkins & Globerson, in press). Learning with technology amplif es the learner's cognitive processes while using those technologies. Computer-based cognitive tools are in effect cognitive amplif cation tools that are part of the environment. Environments that employ cognitive tools distribute cognition to the person (Perkins, 1990). Cognitive tools are intelligent resources with which the learner cognitively collaborates in constructing knowledge.* "

Jonassen (1992) defines the following descriptive epistemological system to derive at the constructive nature of cognitive tools. His epistemological system has three dimensions: Engagement (active - passive), Generativity (presentation - creation), and Control (student - teacher/system). He continues by defining the constructive nature of cognitive tools. "*Cognitive tools are constructive because they actively engage learners in creation of knowledge that reflects their comprehension and conception of the information rather than focusing on the presentation of objective knowledge. Cognitive tools are learner controlled, not teacher or technology-driven. Cognitive tools are not designed to reduce information processing, that is, make a task necessarily easier, as has been the goal of instructional design and most instructional technologies. Nor are they f ngertip' tools (Perkins, 1990) that learners use naturally, effortlessly, and effectively. Rather cognitive tools provide an environment and vehicle that often requires learners to think harder about the subject matter domain being studied while generating thoughts that would be difficult without the tool. They are cognitive reflection tools and amplification tools that help learners to construct their own realities using the constructs and processes in the environment on a new content domain.* "

3.6 Research focuses for cognition

In our research three perspectives of cognitive technology are approached, discussed, and experimentally dealt with: (a) to promote and support the learner and his selfregulative power, (b) to facilitate and to create the designs of environments powerful enough to support the learner in the process of knowledge construction and practice of skill, and (c) to support the instructional designer creating landscapes including cognitive tools, from which the learner can select his own trajectory.

The research question central to the activities performed in our current research program about cognitive technology, is: What characteristics do cognitive tools have, under what conditions can they be applied, and what design characteristics can lead to optimally design these tools, in order to promote, support, and facilitate knowledge acquisition and construction, and practice of skill?

4. Research activities

The research carried out within the framework of this program is directed to three areas of study, to concentrate (a) on cognitive tools for the learner and the cognitive effects, (b) on cognitive tools comprising the environment, and (c) on cognitive design tools for the designer to design cognitive tools.

4.1 The learner

4.1.1 Supporting cognitive processes (funded by University of Twente)

Projects related to the support of cognitive processes, pertain to the knowledge utilization by employees and by older adults. In both situations, difficulties become apparent in retrieving relevant knowledge and utilize this knowledge in new task situations. Tools have to be developed that facilitates the improvement of the cognitive processes and thereby leading to an effective and efficient utilization of acquired knowledge.

4.1.2 Generating and testing hypotheses in meaningful problem-solving (funded by University of Twente and by DELTA)

Exploration or scientific discovery is a learning and instructional approach that is well in line with the conception of the learner as an active agent of knowledge acquisition. A theory has been developed, from Klahr & Dunbar's scientific discovery as dual search', that introduces two search spaces: a hypothesis space and an experiment space. Recent work of De Jong and Van Joolingen led to an extension: hypothesis space is structured into a variable and a relation space, and hypothesis space is divided into a number of regions. Prior knowledge is regarded as the personal configuration of hypothesis space. In the studies to be carried out prior knowledge will be manipulated as its effects on learning behaviour are assessed.

4.1.3 Promoting conceptualising (funded by Dutch Organization of Pure Research)

A learner can gradually master a domain by being involved in mental models that increase in sophistication and complexity. This increase pertains to the different levels of knowledge with which a domain can not only be described but also by which the utilization of domain knowledge can be characterised. Research is directed to encourage learners to fulfil tasks that are designed to support learners to utilize the appropriate knowledge (Goei & Pieters, 1991).

4.1.4 Promoting to assess knowledge gaps and to adequately choose information (funded by University of Twente)

Two major problems users of knowledge support systems, such as on-line documentation or expert systems, often encounter, are related to the compatibility of information presented to the task performed at that very moment: (a) They often do not realize that they need help, and (b) accessing the available help is problematic. Recent research revealed that in many cases learners or performers were not supported by the information nor did they indeed ask for help. The two aspects of the problem can be elaborated: the finding the problem' and the constraining the utilisation'. The first, constructivistic, problem pertains to the inability of the performer to adequately formulate his knowledge need. He is not able to find and define the problem (the difference between what he knows and what he needs to know). In the constructivistic sense, he has difficulty in tracing the bugs in his knowledge base. The cognitive tool to overcome this knowledge problem can be formulated as triggering a cognitive conflict. This tool includes three types: surprise, perplexity, and discoordination. The second, minimalist, problem pertains to the minimal amount of information presented to the learner while performing, and to the moment of information presentation. The amount of information not only pertains to the number of information elements but the content as well, either declarative knowledge, procedural knowledge or conditional knowledge (Pieters & Van der Meij, 1994).

4.2 The environment

4.2.1 Designing hypothesis scratchpads to generate problem-solving and exploratory behaviour (funded by University of Twente and DELTA)

A theory (an extension of Klahr & Dunbar's Dual Space Theory) has been developed (Van Joolingen, 1993) in which exploratory learning is seen as a search through two spaces: an experiment space and a hypothesis space, of which hypothesis space again is divided into a variable and a relation space. The learner's search moves are supposed to be taken place within the learner's personal hypothesis space. A tool has been designed to structure and facilitate this exploratory behaviour, the so-called hypothesis scratchpad (Van Joolingen, 1993; Van Joolingen & De Jong, 1991, 1992). A hypothesis scratchpad is a software tool that provides the learner all necessary elements for composing hypotheses (variables, relations, and conditions). By selecting these elements with a mouse and dragging these to a hypothesis window the learner creates a hypothesis. In this window the learner may save hypotheses and mark them as true or false.

4.3 The designer

4.3.1 Advice systems for designers (funded by DELTA)

In the SMISLE-project (System for Multimedia Integrated Simulation Environments) an Advice System will be developed that comprises all the pedagogical advice an author may need. It intends to provide authors with information that may helpful for the decision-making process in designing computer-based multimedia simulation learning environments. The SMISLE Advice Module consists of a number of separate, but interconnected modules. The main modules are: the MEASURES module, containing information on the SMISLE instructional measures; the ADVICE RULES module, containing a rule base which can infer hints for using instructional measures on the basis of characteristics of the simulated domain and of the target learner population; the BACKGROUND module, containing background information on exploratory learning with computer simulations; and, a GLOSSARY containing definitions of specific SMISLE terminology. This ADVICE MODULE will be used in a number of studies, as a design tool to be evaluated, and as a experimental tool to provide evidence about the process of designing by the author.

4.3.2 Design tools for complex teaching-learning environments (funded by Organisation for Provision of Labour)

Work simulations can be characterized by their preferred knowledge acquisition processes and the tasks to performed in order to trigger those processes. The theoretical framework for categorizing and designing work simulations is based upon a framework meant for designing computer simulation. De Jong (1991) distinguishes four major characteristics of computer simulations that can establish a design model for simulations: a formal model, learning objectives, learning processes, and activities. The processes taking place in the simulation have to be based upon a model. In computer simulations a mathematical model will be used. In work simulation a more qualitative version of a model will be implemented. Objectives pertain to the following categories: acquisition of knowledge of the model, practising relevant technical and social skills, and practising knowledge acquisition skills. The learning processes include the following cyclic phases: authentic acting, reflecting, abstracting, and exploring. The activities reveal the essential cognitive processes and activities necessary to fulfil assignments within work simulations. Design tools will be developed based upon this framework (Pieters & Brouwer, 1992).

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New Possibilities for Teacher Education Through Computer-Based Communication Technologies

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Abstract

Computer-based communication technologies are bringing new possibilities into teacher education in many different ways. As with distance education more generally they can facilitateflexibility in time and place of learning, but the range of persons and resources that they can bring to the teacher's computer screen are introducing many new scenarios into what is meant by "teacher education. " In this review, we briefly consider nine cases of such new scenarios. We also consider issues common to them and conclude with a suggestion of a problem area for teacher education in contemporary Europe in which currently available computerbased communication technologies could play a particularly important role.

1. Setting the scene: Distance education for teacher education and computer-based communication technologies

1.1 Traditional needs stimulating distance education for teacher education

Distance-delivery methods for teacher education are well established throughout the world. For over 30 years such methods have been in formal operation (see Perraton, 1993, for a comprehensive overview). In many countries, distance-education methods were taken up in order to rapidly expand the teaching force in response to public demands for more schools and teachers. The establishment of the Open University in the UK in 1969 lead the way to legitimatisation and institutionalization of distance education as a higher-education delivery method; now many such formal institutions exist worldwide.

1.1.1 Motivations for distance-delivery of teacher education.

Ministries of Education have supported distance-delivery methods for teacher education for at least three general reasons: (a) to reach students who could not otherwise attend traditional training, thus adding more flexibility of location to teacher education; (b) to reach students who cannot or do not wish to attend full-time training, either because of already being in the work force, or for family or personal reasons, thus adding more flexibility of time to teacher education; and (c) to, at least in theory, introduce economies into teacher education by reducing overhead costs. Teacher-training institutions in many countries have had similar motivations for introducing distance-delivery methods, and have had the added motivation of hoping to tap a broader base of students in the process.

Thus, distance-education methods have:

> *...been used in rich and poor countries, for experienced and inexperienced teachers, at primary, secondary and tertiarv levels, to provide a general education and to improve pedagogical skills,vto overcome what was seen as a short-term crisis and to serve as part of a regular system of continuing education (Perraton, 1993, p. 3)*

1.1.2 Various delivery methods for distance education.

Distance education is traditionally defined as an educational process in which a significant portion of the teaching is conducted by someone removed in space and/or time from the learner. Historically, most distance education, not only for teacher education but more generally, uses the method of sending printed lesson materials through the mails to the students, who work in a predominately self-study manner to complete activities based on the printed materials. Typically then the student mails the materials back to a tutor, who reviews them and provides some form of feedback, again often through the post.

However, many variations on this general model exist and are increasingly present in distance education. Some variations are organisational, in terms of intermixing some face-to-face contact among students and tutors with the self-study periods. Other variations relate to the addition of communication and interaction possibilities outside of face-to-face contact, most typically via the telephone but also through local "study center" support in which helpful humans are available, although probably not one's tutor or classmates.

A large area of variation in the method of distance education is that of the instrumentation or learning materials being used to support distance learning. Many distance-delivered programmes that started with only print as a delivery medium quickly augmented their leaming materials to include audiotapes, videotapes, computer soltware, and learning kits of specialized equipment. Experience quickly proved that distance-delivered teacher education that relied on a single medium "were most likely to fail and to be closed down" (Brophy & Dudley, 1982).

A major need in distance education is that of providing human communication and interaction as well as well-designed learning materials. Thus communications technologies have gradually become established as part of the delivery infrastructure o distance education. Duning, Van Kekerix and Zaborowski (1993) note the following five phases of technologies in support of distance education:

Phase 1: Print (correspondence)
Phase 2: Print and audio (radio, audioconference, cassette)
Phase 3: Print, audio, and video (television, satellite, videoconference)
Phase 4: Print, audio, video, and computer (computer-assisted instruction, electronic mail)
Phase 5: Blend of technologies

In the next section we look the current position with respect to communication technologies from a perspective different from the historical one underlying the above list.

1.2 Communication technologies and distance delivery of education

1.2.1 Traditional forms of communication and their support technologies.

In general, in a distance-education situation, communication can he thought of relative to who and how many persons are wishing to talk to each other, and if they wish to be talking at the same time. We can define this as one-to-one, one-to-many, or many-tomany patterns of communication. The communication can be synchronous, (that is, occurring at the same time and interactively for all participants) or asynchronous (occurring at different times for different participants). Thus, two persons talking on the telephone is a common example of one-to-one synchronous communication, while a tutor leaving a message on a telephone answering service for any student who calls in that he is not available but that the next assignment is due a week later than originally announced is an example of one-to-many asynchronous communication.

1.2.2 Broadening the range: current forms of communication and their support technologies.

There are many other dimensions upon which modern communication in distance education settings can be categorised:

- We can communicate by voice or sounds (audio); by text; by pictures, graphics, video, and television; and by combinations of these. Thus modern communication technologies allow the passage of different media or combinations of media over a distance. Pictures, sounds, text, even some amounts of video, can all be converted to a digital form, which means that they can be sent from computer to computer.
- In addition, different combinations of communication technologies can be used in tandem: two-way audio connections (such as via telephone lines) can be combined with television-broadcast of video, and/or with interconnected flows of computer data.. Thus individual or groups can communicate via text and/or visuals and/or

sound synchronously or asynchronously, depending on what communication technologies are available.

- Furthermore, the boundary between communication and information is now an overlapping one, as what one reads on one's computer screen may be the typed message from a classmate or tutor or a document from a set of resources provided for the distance-delivered learning situation or a document from a library or data base.
- Also, the way the signals are transmitted or carried can vary, in dimensions such as terrestrial (cables and wires) vs broadcast; or bandwidth.

There are now a large number of books and other references on communication technologies and their application in distance learning; as an excellent summary, see Van Den Brande, 1993. In this report, we shall only select a subset of possibilities. In addition, our focus will be on this subset's application to teacher education rather than on their technical characteristics.

1.3 Limiting the range for this paper: Some definitions

1.3.1 Restricting the analysis to computer-based communications.

A very large book could be written on the different possibilities of modern communication technologies for distance-delivered teacher education. Here, for space purposes, we will limit ourselves to situations in which all participants interact, at times that they choose (thus generally asynchronously, although it is possible that they all choose to interact at the same time), through direct use of a computer. Thus we will not include uses of television, such as television with one-way audio or with two-way audio; and thus not video conferencing or audio conferencing or audiographic conferencing. We know full well that communication technologies already allow video and audio signals to come directly into and through one's personal computer and that broadband communication channels such as ISDN will allow parallel flow of different data streams, but we will restrict ourselves to the type of situation that the majority of teachers could hope at the present time to confront relative to communication technologies--that of sitting at their own standard computers, with the computers connected to other computers and networks via a modem or via a direct connection to a local-area network.

1.3.2 Pertinent definitions.

With this limitation, we conclude this introduction with a list of pertinent definitions, which we will use without further technical discussion in the rest of this paper. Further elaboration of the definitions can be obtained in resources such Bishop (1990) (from whom a number of the following definitions are taken, pp. 69-70); Collis (1993); Collis & De Vries, 1993; and Van Den Brande (1993).

Asynchronous communication: two-way communication in which there is a time delay between when a message is sent and when it is received.

Bulletin Board Service (BBS): A computer service that allows remote users to access a central host computer to read and post electronic messages and to upload and download files, all through a common menu.

Communication and information services for education: A service that organizes on-line communication and information-handling options and offers them in a integrated way to its users, and that generally supports the users of the service; sometimes called a "Network" or an "on-line service" (or many other names)

Communication technologies: technologies to transmit data signals over a distance

Computer-based communication: Making use of a computer as the platform for processing and transmitting information over a distance to and from another computer. The data may have originated as human communication or as electronically stored information .

Computer conferencing: Allows individuals at different locations to communicate directly with each other through computers, usually about a common theme, in a way that simulates some aspects of a face-to-face meeting; often with someone serving as the leader of the discussion (called the moderator), and sometimes with special computer software (called conferencing software) which makes it easier to keep track of what has been said by the various participants

CMC: computer-mediated communication. Similar to computer-based communication, but with the expectation persons talking with one another provide the major source of data for the communication

Electronic mail (e-mail): Electronic networking system that allows users to send and retrieve messages and files via computers.

Internet: An interconnected network of networks, extending all over the world, and supporting basic functionalities such as e-mail, file transfer, remote login and a common addressing protocol, so that a user can connect to literally millions of other users as well as thousands of collections of electronic resources and many different varieties of communication

Modem: A device that converts digital computer signals into analog format for transmission.

Network: A partly physical set of communication connections that allow widescale interconnectivity. "Network" is also used to refer to humans interrelated to each other through shared interests and communication channels

On-line data bases: Collections of digitally stored information accessible via communication technologies to an individual at a remote location

2. Examples of computer - communication technology in initial teacher education

Initial teacher education generally occurs in an institutional setting, with the student teacher dividing his or her time between formal courses in the higher-education institution and practical experiences in a school setting. Computer-communication technology (called from now on in this report, for convenience, CCT) is bringing new experiences and possibilities into both aspects of initial teacher education. In this section, we briefly discuss these new possibilities under three general headings: (a) extending and enriching the traditional course environment in the initial teacher-education institute; (b) extending and enriching the communication and contact between student teacher, supervisor, and sponsoring teacher m the school; and (c) and bringing new sorts of partnerships in the initial teacher-education situation.

2.1 Extending and enriching the traditional course environment in the initial teacher-education institute

2.1.1 Enriching the traditional setting

It is now becoming typical to install a local-area network within any higher-education institution, including teacher education institutions. An example from the Liverpool Polytechnic (Stanley, 1991) shows some of the benefits:

Networks in Teacher Education Institutions: An example from the UK

- Libraries of exercise files available at all times on the network
- All software is available at any of the 26 computers located at different places in the institution
- The system menu provides a common and familiar user interface to the many different services and packages accessible through it
- Collaborative working can be facilitated, through students being able to indi vidually contribute to a common task
- Joint and co-operative production of reports and projects
- Opportunity to leave and receive messages (Stanley, 1991)

Comes and Kirkwood (1992) give a similar example, from the United States. They note how students in initial teacher education can make use of the integrated information and communication resources at their institution (Ball State University) to access each other, the instructor, electronically stored library resources, external data bases and discussion groups, all from their rooms. The same communication system connects all the 200 classrooms at the University, so that transfer of text, voice, and/or video data can occur as it is wanted during class instruction.

This example can be extended to connect the multiple sites of an institution or to allowing a student, via a modem, to access the network from a remote location without always having to come into the institution. Hedberg and Harper (1993) give examples of this in Australia.

2.1.2 Reaching new groups of students.

There are many examples of CCT being used to bring initial teacher education experiences to groups of students who find it difficult or unattractive to come to traditional institutional settings. One such initiative is going on the UK, where the Open University is hoping to attract university graduates into a distanee-delivered programme of initial teacher education. The programme will be part-time over 18 months, entirely offered by distance methods, with every student receiving a computer and modem as part of the programme so that regular communication can occur between the student and the OU tutor, both while the student studies at home and when he does his required practice teaching in a school. The teacher-mentor in the school is also included in the computer conferencing (for information, contact F.Banks@Open.Ac.UK).

The LOTE Project in Australia is another example of the use of CCT to reach new groups of clients for initial teacher education. In the LOTE Project, the emphasis is on the development of modern language teachers, especially in remote areas. The same materials are also being used for teacher inservice in the same remote areas (Hedberg & Harper, 1993).

2.1.3 An institutional BBS.

Another example of the use of CCT in initial teacher education is that of the institutional BBS (bulletin board system), facilitating student and instructor interaction through the sending and reading of messages. One such system is that of the School of Education at California State University (Slovacek & Doyle-Nichols, 1992). A BBS was set up and a users guide was created, modems were given on loan to the students, and a fax board was installed in a computer on a cart for classroom demonstrations. Students could obtain a variety of types of information about their courses, could upload files and assignments, could connect to the Internet system, and could communicate with each other and their instructors. Usage increased steadily, with students becoming more and more likely to send messages to their instructors with regard to their assignments. This was seen to be important, not only to improve course performance, but also to "breaking down the barriers" between students and faculty.

2.1.4 Providing new types of course assignments.

In many initial teacher-education institutions CCT is being used to provide new types of course activities and assignments. The following example is an illustration:

Using CMC in a Teacher-Education Course on Critical Reading:

Students used a conferencing environment (called the "Round Table") to enter their comments and responses to various cases made available in the course or directly through the system

The Round Table software offered various options: a message facility with a flashing signal to show that a message was waiting; a pencil icon to be used to open a space for writing a comment; an "instructor area" where instructions on the cases to be read, an explanation of the issues in the cases, and key vocabulary could be found; a "brainstormer area" where students could enter their observations and link points electronically; an "argument analyzer" in which a structured organization was required Thor comments; and an "overview" function, where students could get a repeat of the entire conversation that had gone before, either in entirety or by scanning the first lines of the students' various comments

Students used the system to engage in these discussions whenever and from wherever they wished within a certain period.

The students were highly enthusiastic about the activity, and invested considerable energy in the discussions (Pugh, 1993)

These are just a few of the many examples of the use of CCT to enrich coursework in initial teacher education. Using CCT to enrich the practice-teaching aspect of initial teacher education is also proving to be a powerful application.

2.2 CCT and improved communication and support during the practical experience

It is now becoming common in many regions for CCT to be used to link students, instructors, and supervising teachers in regular communication during the practiceteaching component of initial teacher education. Such electronic linkage eliminates the frequently long stretches of time between visits of the faculty instructor to the school setting because of difficulties in time and organization to plan a visit to the school. Such a problem becomes critical in remote areas. The following is a typical illustration:

Using CCT for "Teleapprenticeships":

At the University of Illinois (USA) faculty, student teachers, and teacher-mentors make use of regular computer conferencing

Sometimes both student teachers and teacher-mentors entered reflective comments on their own teaching

Wide-ranging e-mail discussions are held concerning classroom experiences and their relation to theory; this occurs on a daily basis while student teachers are in the practical situation, through the loan of laptop computers and modems

Student teachers shared their lesson plans and experiences with each other on a daily basis and got quick feedback and comment from both their teacher-mentor and faculty supervisor, who could enter their observations at times convenient to themselves but within a short time after the practice lesson

Student teachers very much appreciate the rapid feedback, the on-line discussion among themselves and their supervisors, and the chance to keep in touch with each other when "in the field" (Levin, Waugh, Brown, & Clift, 1994)

2.3 New partnerships

A particularly powerful application of CCT in initial teacher education is in the facilitation of now sorts of partnerships in learning experiences for the student teachers. The PLUTO Project (see, for example, Libotton, 1989) is a major example. This project, with industrial support, linked as many as 19 initial teacher training institutions in 14 European countries with each other and with schools in their regions for various on-line collaborative projects, so that the student teachers could get a feeling of what such projects can offer to education and also a beginning sense of a didactic for such projects. In another example, of a smaller scale, 31 fifth- and sixth-grade children in Canada participated in an on-line project with 17 student teachers in California. The student teachers not only got to experience the management of an on-line activity while still on their own campus, but also had to develop strategies for tasks such as evaluating children's writing, and tailoring their language to be appropriate for discussion with a child. The on-line setting let this be done under the supervision and comment of the faculty instructor, something much harder to replicate in the full-scale practice-teaching situation (Zinck, 1989).

3. Examples of CCT in in-service teacher education

As was the case with initial teacher education, there are many new possibilities emerging in in-service teacher education through CCT. In this section we give some examples relative to CCT in in-service courses. In the following section, we extend the concept of in-service teacher education to include less-structured and more on-going sorts of professional development.

3.1 CCT-supported courses for in-service

CCT can augment a course which meets occasionally in a face-to-face warmer, or it can be the major vehicle through which the teachers involved participate in the course.

3.1.1 Combining face-to-face and CMC.

There are many examples of in-service courses which relieve some of the time and travel burden on teachers by replacing some of the time to be spent in the course in a face-to-face basis with study done at a distance, using CCT. The following is an illustration:

CCT Support for In-service Teacher Education in Catalonia

Teachers want to participate in various in-service programs, but find it difficult to move from their homes and working centres to Barcelona and to pay for their travel and expenses

Thus CCT became not only a topic to teach about in some of these courses, but also a training communication channel

The region had set up a Network and its associated service, with on-line data bases of educational resources for teachers to use in their lessons; the Network also supported a computer conferencing system called AGORA

Teachers received a variety of materials: text materials, a computer-based tutorial on how to use the on-line system, complementary readings and software on disk, and a user handbook

Face-to-face meetings were also held, to give the teachers instruction in how to use the different media and particularly the conferencing and e-mail options (Simon, 1992)

Other examples similar in various ways to the Catalonian illustration can be found in many countries. In the USA, for example, the "Mathematics Learning Forums Project" involves a particular institution (the Bank Street Center for Children and Technology and Graduate School of Education) leading a series of 24 on-line seminars in which teachers across the country can take part. Each on-lme seminar lasts about two months. Participating teachers are first sent videotapes to give them "a vivid picture of the aspects of teaching about which they are learning", as well as various print materials. In the on-line conversations that go on throughout each seminar, faculty at the Bank Street institution will guide their teacher-students as they try new teaching strategies in their classrooms. The teacher-students will discuss with each other, via computer conferencing, their experiences with the new teaching strategies. Approximately 750 teachen are participating in the on-line seminars (Honey, 1993).

3.1.2 Supporting distance education through an "information network"

The LEARN Project in Denmark is a good example of a situation *n which CCT is being used in a comprehensive way to support a number of distance-delivered teacher education courses, involving not only Danish teachers but teachers in other countries. The next illustration gives more detail:

LEARN: Comprehensive Support of Distance Education

LEARN is a Network Service offered so co-operation with the Royal Danish School of Educational Studies and Computer Resources International

LEARN provides a number of facilities which make it easy for students, tutors and administrators to perform distant education

From the student's point of view, LEARN is seen as a software package which makes it easy for the student to get and send mail, assignments, and other course materials; which includes an integrated text editor for editing responses, notes, and e-mail; which offer menu-driven access to various file-handling tasks; and which support a BBS and various communication options. Students study off-line.

From the tutor's point of view, LEARN is an environment in which it is easy to add and take away materials and edit the BBSs

From the admilistrator's point of view, LEARN offers facilities to register students, teachers, courses, enrolments, available materials, etc., on the host

The general model for LEARN is: retrieve material on-line, logoff and work off line on materials? go back on-line to send materials back or discuss the materials

Six in-service courses are currently taught with LEARN support (Larsen & Malmberg, 1991)

3.2 Extending the in-service course with subsequent on-lineinteraction

One very powerful application of CCT to in-service teacher education is to extend the contacts and interaction that have been made in a face-to-face in-service course after the course is over. There are many examples of this model, such as the following:

CA WP On-Line: Extending an In-service Course

The CWAP is a method for improving the teaching of writing which involves a 90-hour Summer Institute or a 30-hour site-based course. The method has been delivered to over 3,100 teachers on the USA

A major intention of the method is that the participants become expert teachers of teachers after they finish the course, but this expectation means that there is much contact and follow-up needed after the course

Thus a computer conference was established, called CAWPOn-Line, specifically for the teachers who had finished the method training.

The Service offers e-mail, 45 "general discussion centres" (conference topic areas), file transfer, access to an on-line information resource that provides access in turn to data bases and offier resources

Approximately half the potential users do in fact become high users of the Service, predominately the e-mail aspects (Fine, 1993)

This example leads into the last category of CCT and teacher education: that of support for on-going professional development.

4. CCT and support for on-going professional development

By on-going professional development we mean a variety of activities, with a common characteristic that the teacher chooses the activity him or herself, not because it is part of a course assignment, but because the teacher finds it helpful and/or stimulating. Sometimes these activities may be directly focused on a particular problem or task; other times they will be more diffuse, a response to a feeling of general interest, or more theoretical, such as the desire to reflect over one's professional practice. In this range of activities, CCT also can play an important role.

4.1 Supporting the teacher's information needs

Teachers more and more often are turning to on-line Network services to their specific information needs. Sometimes information comes from stored collections of materials, other times from specific persons. But in either case, an on-line Service, or access to the Internet itself, is increasingly popular among teachers. Honey and Henrjquez (1993) in their survey of US teachers using telecommunications found that the responding teachers valued very highly the on-going sorts of professional support that they could acquire through CCT activities. Teachers indicated they appreciated accessing educational research, downloading curriculum materials, accessing libraries, and researching subject-specific data bases.

4.1.1 "CISO" services.

In many countries and regions there is a particular Network Service specially organized for teachers. In The Netherlands we are calling these "CISOs", which comes from the first letters of the Dutch words for "Communication and Information Systems for the Educational Sector" (Collis, Veen, & De Vries, 1993). In research which we have recently carried out, we have analyzed "CISO"-type services in countries throughout Europe and beyond. We have found that the majority of European countries, US states, and other Western educational jurisdictions have such a service, usually supported by the Ministry of Education, but with many variations on partnerships.

A CISO-type service can be described by its functionalities - what it offers its users, or by its organisational and strategic aspects. An example of the first approach is shown in the following illustration:

A Network Service for Teacher Education and Support:

In the state of California in the USA a Network Service called OTAN has been established. OTAN stands for Outreach and Technical Assistance Network. The Service is focused on support for teachers working with students have special needs.

OTAN combines a computerized communications system with -regional resource libraries that disseminate commercial and teacher-made materials, including training packets with accompanying videotapes, resource documents, and public-domain software.

OTAN is both an electronic archive and a distribution source for materials, reports, and studies.

Options to choose from in OTAN include: The Master Calendar, Who's Who, Department of Education Information, Resource Centres, Current Articles, Course Outlines, Curricula Resources, Lesson Plans, Public Domain Software, Demo Software, Legislative Information, Reference Materials, Educational Funding Sources, Job Opportunities, On-Line Discussions, and an Upload Area (U.S. Congress, Office of Technology Assessment, 1993)

Sometimes such educationally oriented on-line services emphasize the support of information searching as was the general case with the OTAN example above. Other times the focus in more on communication (see, for example, a Norwegian example, Braatane, 1993). In many cases, the Service offers both, and teachers react enthusiastically (Collis, Veen, & De Vries, 1993).

4.2 Smaller-scale support systems making use of CCT

The above illustration involved a Service organized to serve a broad public, via access through public telephone lines. There are many other sorts of "electronic performance support systems" being used by teachers for both the support of their work and also their on-going professional growth, that usually are based in one computer system but allow connectivity to external networks. The following is an example:

A Teacher Toolkit: Performance Support Involving CCT

In British Columbia, Canada, a software environment has been created for teachers to help them in their work. This integrated environment continues many different sorts of aids useful to them in categories such as: Accessing and developing lesson strategies; Recording, evaluating, and reporting student progress; Planning and scheduling; and Accessing and developing resources

Options often involve automatic use of CCT to connect the teacher to collections of information or resources available not in the computer itself but in district or regional centres

Teachers can add material themselves to the regional collection. They can also use the Toolkit to make contact (simply through the click of an icon that looks like a telephone) to a specialist in a regional centre or to colleagues in other schools (Hoebel & Mussio, 1990)

Such performance-support environments are becoming very popular, and have many variations. Often they may include access to an interactive videodisc of visual resources, for example of video clips of different sorts of lesson activities in actual classroom settings. The boundary between getting information and learning overlaps when a teacher uses such a resource.

4.3 On-going teacher education through computer-supported networkng

By networking in this sense we mean that teacher becoming part of a supportive and interacting group of colleagues who interact with each other, giving each other support and ideas. Computer-based communication technologies are rapidly enlarging the range and composition of the groups with which a teacher can network. The following illustration shows this kind of networking:

LabNet: A Network to Develop a Professional Community of Practice Among Science Teachers

The LabNet Project in the US was a three-year, multi-part project whose overall goal was to improve classroom science teaching. But building a "professional community of practice" among teachers involved in the project was seen as a major aspect

The; 562 teachers involved were from 37 US states. They interacted with each other occasionally in face-to-face small groups in their own regions but most generally through computer conferencing

The goal of the conferencing was to increase the teachers' self-reflection about their classroom practice, but they also used the computer conferencing to exchange ideas about classroom activities and to interact with professional scientists who were also part of the Network community

Occasionally teachers would be sent new sets of software and learning materials and then would use the computer conference to receive instructional help from Project Leaders and to support each other in their problems and experiences in trying new computer-based activities in the science classroom (Gal, Ruopp, Drayton, & Pfister, 1993)

This illustration shows a Network for professional development being guided by a professional project-leadership team and integrated with a range of other types of inservice activities. There are many examples of Network communities, with varying degrees of formality and of associated in-service activity. We saw an example above, relative to the teaching of writing; there are examples in many disciplines and in many countries. Often a special feature of such a Network community is the presence of persons who the teacher in his or her ordinary practice would never have the opportunity to meet. For example, physics teachers in California involved in such a Network were able to electronically interact with the authors of the textbook they used in their teaching with on-going questions about the text and its support activities. "Telementoring" relationships are developing of a type not likely to occur in the teacher's ordinary range of contacts (Wighton, 1993). Such use of computer conferencing for networking among teachers is being seen as a major stimulus for teachers' professional development, as

> *...teachers, like students, [who participate in co-operative on-line commu - nitiesg acquire knowledge, develop teaching/learning strategies, increase self-esteem, and develop meaningful relationships with their peers" (Riel, 1990, p. 452)*

5. Anticipating constraints and seeking the most effective possibilities for CCT and teacher education

5.1 Anticipating constraints

The illustrations above have only touched the surface of many new types of teacher-education experiences now being facilitated by computer-based communications throughout the world. But such activities, like all innovations in educational practice, bring with them many different constraints to their implementation. There are predictable problems in many areas:

- Finding sufficient support and financing to connect teachers to an appropriate and affordable telecommunications infrastructure
- Organizing and managing a Network Service so that it offers timely and well-conducted information and communication settings for teachers
- Helping teachers learn how to use such an environment
- Providing adequate access to such an environment so that teachers can use it for sometimes lengthy periods of time as they engage in discussions and look for resources on-line
- Designing software to support teachers' on-line activities
- Anticipating the amount of time and the steps that will be needed for teachers to adopt such an innovation into their practice
- Searching for strategies to moderate on-line discussions so that they proceed productively
- Searching for ways to locate and organize resources that will be obtainable on-line
- Helping teachers have the time and motivation to engage in reflective, selfdirected learning activities outside of a formal in-service structure
- Motivating faculty in teacher-education institutions to become aware of and to participate in electronically supported communities of practice

Each one of these points is being addressed by various research projects at the Faculty of Educational Science and Technology at the University of Twente, as well as in many other locations throughout the world (see, for example, Collis & De Vries, 1993; and Collis, Veen, & De Vries, 1993).

5.2 Identifying effective applications of CCT for teacher education in the current European context

In order for a complex innovation such as the use of CCT for teacher education to gain acceptance and momentum, some sorts of applications of it must be identified that are most likely to capture support (we call these "trigger events", Collis & De Vries, 1993). In the current European context there seem to be at least two such types of applications that could be good candidates for stimulating the use of CCT in teacher education. One application relates to developing the European dimension in education, and the other to strengthening language teaching.

5.2.1 Developing the European dimension.

Throughout Europe, both the Community and more broadly, there is a great interest in developing the "European dimension" in education. The new Community Programme "Socrates" is based on this motivation. A major way this occurs is through exchanges, both of teachers and of students. But despite the efforts of many different programs such as ERASMUS to stimulate such exchange, doing it physically is not possible ilor the majority of teachers and students, or for the majority of faculty at teacher-education institutes (Delmartino, 1993; Miller & Taylor, 1993). Constraints on mobility are financial, institutional, and practical. On-line activities via CCT can compensate for physical restraints. Networking can become a powerful parallel activity to physical exchanges in the European context.

5.2.2 Focusing on language teaching

A particularly important educational need in Europe is the development of multiple-language facility, not only among students, but also among their teachers, and teacher-educators. The 1994 "Expolangues '94" language-teaching exposition, held in Portugal, attracted more than 30 000 visitors. Projects and activities involving distance-education methods for language teaching and the support of language teachers are in operation at the international level (see Berlitz & Fischer, this volume), the national level (see, for example, the Danish project "Foreign Language Learning in Relation to New Technology and to Strategies for Teaching On-Line" (Lorentsen, 1991), and the professional level.

There is a particular need for language upgrading among teacher educators and foreign-language teachers in Central and Eastern European countries. In these countries the wide-spread lack of knowledge of Western European languages is prohibiting integration into many activities with a "European dimension". Thus it would seem that a concentrated focus on a variety of applications of CCT for co-operative teachereducation activities involving Western European languages could be a particularly productive strategy. The Workshop "Teacher Education and Communication and Inforrnation Technologies" is an excellent setting for exploring how to go further with foreignlanguage strengthening as a "trigger event" for the use of computer-based communication technologies in teacher education.

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Part II.
Overviews

Perspectives on Teacher Training Related to Information Technology in Central and Eastern European Countries

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Bulgaria & The Netherlands

Abstract

Mass-scale teaching about different aspects of Information Technologies (IT) has been a reality for nearly cz decade now for school systems in almost all Central and Eastern European (CEE) countries. These countries are in a period of transition towards a free market economy and a process of decentralisation is on the way in all spheres of social life including education. The CEE countries currently face similar problems, e.g. a deep economic crisis, turbulent political life, rising percentages of unemployment, low living standards, and as a consequence - shortage of funds for educational purposes. This paper analyses the experiences in IT in Education in the CEE countries so far. It is mostly based on the Bulgarian case though available data for other CEE countries are also provided. Special attention is paid to teacher training as a key problem for successful integration of IT in education. Some perspectives on teacher training as related to IT are considered on the basis of the current trends in the development of the CEE countries.

1. Information technology in education Some observations for Central and Eastern European countries

1.1 The beginning

The introduction of IT in the educational systems of the CEE countries has a long history and tradition. For instance in Bulgaria the first steps were made in the late 1960s when optional informatics courses were taught in some specialised mathematical and vocational schools. In 1979 the Research Group on Education started a large-scale project for developing an educational system based on IT and its integration into the other school subjects. Teaching programming in the schools of the former USSR stared in the early 1960s (Ershov, 1987).

In the mid-1980s national programs for introducing computers in education were approved in almost all of the CEE countries. The procedure for introducing computers into the secondary schools in Bulgaria, the relevant stages, objectives and tasks, were part of a complex Program approved by the Higher Council for Education at the Ministry of Education in 1985 (Pisarev, 1986).

The introduction of a compulsory school subject "Fundamentals of Informatics and Computer Engineering" in all former USSR schools began in the 1984/85 school year (Ershov, 1987). (For most of the Soviet schools, however, it was not supported by practical experiences in a computer lab.)

A national initiative for introducing IT in education in the Romanian schools was launched in 1984/85 when the national production of personal computers began (Diamandi, et al, 1993). The beginning of nation-wide introduction of computers in Latvia was in 1985 (Kangro, 1994).

Now almost all secondary schools in Latvia have at least one computer lab with 12 computers and a teacher's workplace. The National School Computer Program announced in mid-1980s was the largest investment program in the history of Hungarian education which could be compared with some other irrational budget decisions such as the "aluminium project", the Danube dam, because of the extraordinary price which was paid (Csako, 1990).

1.2 The first results in Bulgaria.

During the first three years following the adoption of the Program huge investments were made in Bulgaria, which resulted in some promising achievements (Stanchev 1990):

- more than 16 000 school micros were delivered to about 1000 schools;
- a 120-hour course in informatics was made compulsory in all secondary schools for the 10th and the 11th grades in thc 1986/87 school year;
- two concurrent sets of textbooks in informatics (for the 10th and the 11th grades) were published to support the above course;
- teachers' manuals, as supplements to the informatics textbooks, were published;
- a large number of study aids and other materials were also published;

- about 17 000 teachers completed an one-week (36-hour) computer literacy course; 2300 finished an one-month course; 650 - a three-month course, and 350 - a one-year course;
- a chair for teacher training in informatics was established at the Department of Mathematics and Informatics, Sofia University, in 1986. Similar chairs were created in teacher-training colleges throughout the country;
- research units in the area of education were established in some of the higher education institutes.

1.3 Approaches to IT in education

Two basic approaches for informatics education are applied in the CEE countries: informatics as a separate school subject and IT integrated into the other school subjects. The first approach is still dominating, though a tendency for deeper integration of IT across the curriculum could also be observed (Pelgrum, Reinen, & Plomp, 1993). The IEA Comped Study results show that there has been a less-than-expected advance in the use of computers across the curriculum as tools for teaching and learning in all countries participating in IEA research (IEA, 1994). This is especially true for the CEE countries.

The national informatics curricula in the CEE countries is based mainly on teaching programming (Ershov, 1987; Kalas & Blaho, 1994). Thus programming became a kind of national sport for the young generation in these countries (Kalas & Blaho, 1994). (As a negative side effect some young Bulgarian programmers are known as the best producers of computer viruses in the world.)

Most of the CEE countries introduce IT in the upper secondary schools, although some tendencies toward introducing it 'as early as possible' are also available. For example, an experiment for introducing computer games for developing children's thinking abilities was organised in Hungary (Karoly & Koros-Milkis, 1991)

The Research Group on Education (RGE) carried out an experiment for integrating IT across the curriculum for all school ages in 27 schools in Bulgaria (Nikolov & Sendova, 1991). The RGE researchers consider IT not simply as an ordinary school subject but as a tool which might enrich both the content and teaching methods in all school subjects (Sendov, 1987). The RGE experience was used afterwards in the development of a set of integrated mathematics and informatics textbooks offered as an option for all schools in Bulgaria (Sendov, et al, 1988, 1989, 1990, 1991).

1.4 A glance into the future

The dynamic changes in the CEE countries are posing new problems to their educational systems. At the same time a great educational restructuring is hardly possible because of the deep economic crisis f om which these countries are suffering. One of the main directions in the recent changes in the educational systems of the CEE countries is that the decision-making power is shifting from the government towards the local educational councils and authorities, school principals, and teachers. These changes are being carried out in a legislative environment full of contradictions, where the new principles exist together with some old ones. A number of private and specialised schools emerged and broke down the state monopoly in this area too.

Despite of the great economic and social problems the CEE countries are facing, they are trying to preserve and even extend the positive experience they have already gained. This effort is stimulated by the enormous students' interest in IT. A good example for the new initiatives in the CEE coumtries is the project "The Informatisation of PreUniversity School System, 1992-1995" launched by the Institute of Educational Studies in Romania. This project envisages introducing IT at all school levels and in the preschool education as well (Nicolescu, 1994).

An ambitious project of "Computerisation of the Study Process in Latvia" is co-organized by the Ministry of Education and the University of Latvia (Kangro, 1994). A project "Information Technologies in School 2000+" has started in Bulgaria, inspired by the UNESCO "School 2000+" Project. However all this initiatives would be hardly realised without substantial international support.

2. Information technologies and teacher education in the Central and Eastern European countries

2.1 An overview

Most of the CEE countries recognise the quality of teacher training as a key factor in a successful IT integration in schools (Ershov, 1987; Kalas & Blaho, 1994; Pisarev, 1986; Kangro, 1994; Nicolescu, 1994). The teacher-training programmes are dedicated mainly to teachers in informatics and mathematics (Kalas & Blaho, 1994, Nikolova & Nikolov, 1993). The strategy for "training all teachers" which is applied in most of the developed countries is still not widely followed by the CEE countries.

There are some exceptions though. The RGE applied this strategy in 27 schools in Bulgaria from 1979 to 1991 (Nikolov, 1984; Nikolov & Sendova, 1988; Sendova & Nikolov, 1988). A similar approach is now being followed in Latvia where studentteacher in different subject areas are being trained to integrate computers in education (Kangro, 1994). For example, the language teachers are trained to use authoring tools to prepare their own pieces of educational software.

2.2 Teacher training in Bulgaria

Teacher training was a part of the widely announced national programmes for the CEE countries. In the Bulgarian case the programme for improving teachers' qualifications in computer technology and programming defined a variety of activities related to the pre- and in-service training of teachers (Stanchev, 1990). The qualification courses for in-service teachers were divided into four levels:

- First level - duration of training one week, total time: 36 hours. This course was intended for all teachers and management staff in the education system.
- Second level - duration of one month, total time: 140 hours. Intended as general introduction in computer technology for non specialist teachers.
- Third level - duration three months, total time: 440 hours. Intended to prepare teachers to teach computer technology and programming in secondary schools.

After a successfully completion of the course, participants are entitled to teach computer technology and programming.

- Fourth level - duration of one year, leading to a qualification certificate, total time: 940 hours.

The Teacher Development program in Computer Education at Sofia University offers both pre-service and in-service teacher-training courses (Nikolova & Nikolov, 1993). The in-service teacher training program includes a three-month and a one-year full-time course. The topics of study are divided into the following main groups:

- *Background in Informatics*
  - *Systems and Algorithms,*
  - *Introduction to Programming (Pascal)*
  - *Computer Architecture*
  - *Operating Systems*
  - *Problem-Oriented Languages (Logo and Logo Environments)*
  - *Programming in Basic*
  - *Programming in Prolog*
- *Application Software*
- *Methodical Aspects of Computer Application in Education*
- *English Language*

At the end of the year the teachers have to defend a final thesis.

After successfully completing the course, every teacher gets a certificate, which allows him to become a teacher in informatics or a computer consultant at school. He also gains certain credit to move one level higher in the teachers' hierarchy. The preservice teacher training generally covers the in-service training scope and offers some more tutorials and courses aiming at extending the teaching practice in school of the students involved.

2.3 Teacher-training institutions

The teachers training in IT in the CEE countries is carried out by universities, higher-education institutions or specialised teacher-training institutions (Stanchev, 1990; Kangro, 1994). As a rule the equipment available at these organisation is quite better than those in schools. Thus an advanced and modern style of teacher training could be followed bearing in mind that the teachers would teach the same way they were taught. However only few of the teachers can later apply at school what they have already learned (Nikolova & Nikolov, 1993). For instance one of our best students, who graduated with a qualification of teacher in informatics few months ago and was very enthusiastic about her new job, honestly confessed after a month of teaching at school that she was so disappointed that she would never become a teacher. The reality she faced there was very different f om the one she experienced at the university.

3. Analysis of the problems in teacher training in information technology

3.1 Some general problems

One of the main problems when making decisions regarding the form and the contents of teacher training in IT is the lack of well-established theory and methodology in this field (Lally, 1989). While the curricula in mathematics, language, science, etc., have tradition and experience on which to base their educational methods and tools, there are no corresponding roots in informatics teaching. Also, the rapid changes in the field of IT soon makes the informatics curriculum out-of-date. To be a good teacher one must be able to adapt to the rapid changes.

The teachers who apply IT should devote much more time and efforts than the other teachers. The general view is that there is a need for teacher training based on "learning to learn" and "lifelong learning" strategies. The teachers should be free to improvise, to make changes in the curriculum, but it is still hardly possible in the CEE countries where the 'instructive' approach to teaching is still widely applied. In order to provoke the teachers' "grass-root" initiative a relevant system of stimuli needs to be established as well. These main obstacles are especially valid for the CEE countries together with a great number of problems, specific for them.

3.2 Some specific problems

Although teacher training is generally declared to be a key factor for a successful integration of IT in education, it seemed to be neglected by the executive educational authorities in the CEE countries. Most of them were looking for some short-term effects such as rapid introduction of computers at schools, introducing a compulsory subject "Informatics" in all secondary schools, etc. Most of the practising teachers passed short-term in-service teacher-training courses only. However these courses do not help much the teachers very much to successfully integrate IT in education. In some cases a non well-trained teacher can provoke a negative reaction in the local community - students, other teachers, parents.

The lack of a careful selection of hardware and software was also a major obstacle for a successful IT integration at school. Though great number of computers were supplied to the secondary schools in Bulgaria their reliability was poor. In 1988 one of the authors took part in a national inspection of the effect of introducing computers at schools and saw a strange picture - there were big piles of non-working computers and peripherals in schools which at the same time had difficulties with the supply of some basic consumable items.

Most of the teacher-training courses being offered give the teachers the basic skills of using computers, but the real knowledge of how to integrate them into school practice is often missing. This problem is left to the teachers to be solved on their own. However, it seldom happens. Also - the teachers do not really take part in the development of the teacher-training programmes. There is a little room for curriculum negotiations between them and the teacher trainers.

Another obstacle is the lack of motivation in most of the teachers to apply IT in education. They do not receive additional payment or reduction of the teaching load despite of the fact that they spend more time for lesson preparation. Some reasons for lack of motivation could be found when analysing the social, cultural and economic circumstances in the CEE countries. IT is still missing f om the culture of most of adults. The effects of IT applications have not yet been felt in many aspects of economy and family life. The lack of telecommunication facilities puts the trainers and trainees in a situation of isolation from the outside world. Sometimes the computer-education environment has to be artificially created, as an island in a world which still does not have IT as a natural component.

The 'shaky' status of the subject "Informatics" is also a great problem for the teachers. The policy makers keep seeking its proper content and the proper grade level at which it should be introduced. For example there have been at least three 'shifts' of informatics teaching in Bulgaria since 1986. It was in the 10 and the 11 grades in 198S, in the 9 and the 10 grades - in 1988, and finally - in the 11 and the 12 grades now. Additional difficulties appeared on the basis of some inadequate decisions of the Ministry of Education for the status of the new subject and the number of hours allocated for it into the school curriculum (Azalov, Todorova & Assenova, 1991). The informatics curriculum showed some pitfalls as well.

3.3 The SEA Comped study

3.3.1 General findings

The Study showed that the integration of computers at schools is being impeded mainly by the following obstacles (IEA, 1994):

- lack of good educational software;
- restricted access to computers at schools; and
- teachers do not receive enough support and do not have the necessary training for computers to play a meaningful role in the classroom.

The Comped data (Pelgrum, Reinen & Plomp, 1993) as well as informal interviews in Bulgaria and the authors' personal impressions show that despite of the valuable research, positive experience and interesting projects and initiatives, the real situation in the Bulgarian schools is not at a satisfactory level. The situation in the other CEE countries could hardly differ much.

3.3.2 Comped findings in CEE countries

It is a good achievement that 97% of the Upper Secondary Schools (USS) and 73% of the Lower Secondary Schools (LSS) in Bulgaria use computers for instructional purposes. This is also true for all USS schools in Latvia and 90% of the USS schools in Slovenia. The median number of computers in computer-using schools is relatively high - 17 for LSS and 18 for USS in Bulgaria, 13 - for the USS in Latvia, and 14 - for Slovenia. But it is far from the situation in the USA - 47 computers in the USS. However the quality of the existing hardware is very low in Bulgaria. The 16-bit computers in the LSS are only 3%, and in the USS - 4% in Bulgaria. This percentage is higher for Latvia - 10% and much higher for Slovenia - 76%. Very few schools in the CEE countries have local area networks and an access to Internet or Bitnet is still (almost) impossible for ordinary schools.

3.3.3 Special problems in Bulgaria

There are several typical problems in Bulgaria. For example the majority of the computer teachers report that they face problems like: "insufficient peripherals available" (58% in LSS and 62% in USS), "difficulty with maintenance" (66% in I,SS and 74% in USS), "limitations of computers" (64% in LSS and 70% in USS), etc. The low level of reliability of the Bulgarian-made Apple II compatible 8-bit computers "Pravetz" should be mentioned as well. Although the availability of educational software is reported to be relatively high, 64% of the computer co-ordinators in LSS and 67% - in USS find that "insufficient instructional software" is among the major problems. The amount of legal software used at schools is very low, but after the Law for Copyright and Author's Rights has been approved by the Parliament the situation is expected to be dramatically changed. The quality of the educational software available or which is possible to be run on the school computers is also very poor. For instance the "favourite" type of software is tutorial or drill-and-practice based (more than 60% of the computer coordinators in LSS and USS report that). This software is usually written by teachers by themselves or by other teachers or students. More than 90% of the teachers in USS and 50% in LSS have never used any other programming language but BASIC (Nikolova & Nikolov, 1993). The application of simulation, statistics, authoring, item banks, gradebook, communication, etc. software is still used at a very low extent.

4. Need of a new approach

4.1 Comparative studies

No significant comparative study on computers in education has been undertaken in Bulgaria so far. The IEAComped Study, Stage 2, gave us a great opportunity to draw up a realistic picture about application of IT in Bulgarian schools and to compare it with the situation in the other participating countries (Pelgrum, Reinen & Plomp, 1993). All of the CEE countries participating in the Comped study: Hungary, Poland, Slovenia, Latvia, and Bulgaria, could benefit significantly if the national authorities further take their decisions in IT in Education relying on a careful analysis of the Comped data. They could also rely on a substantial international support. A promising step in this direction is the joint initiative of IEA, UNESCO and OKI (Hungary) for establishment of a regional educational research network in the CEE countries. A similar network can be established in the field of IT and teacher training as well.

4.2 Educational standards

Establishing internationally accepted standards in IT in teacher education in the CEE country is urgently needed. The requirements for all teachers approved by the International Society for Technology in Education (ISTE) based on teacher-training standards (Thomas, et al, 1992) can be a good example. Having met these standards the teachers are supposed to be able to:

- discuss issues related to the use of technology in society;
- use fundamental vocabulary and operations of computer/technology-based systems;
- use application tools for personal, academic and instructional productivity;
- use IT as a tool for problem solving; and
- prepare instruction that integrates the use of information technology appropriate for varying environments and diverse student populations.

Another example is the Trotter report containing some recommendations for the UK teacher-training courses (Davis, 1992). The students should be trained to:

- make confident use of a range of software packages and IT devices appropriate to their subject specialism and age range;
- review critically the relevance of software packages and IT devices appropriate to their specialism and age range and judge the potential value of these in the classroom;
- make constructive use of IT in their teaching and in their particular prepare and put into effect schemes of work incorporating appropriate uses of IT:
- evaluate the ways in which the use of IT changes the nature of teaching and learning.

Similar recommendations have been made by the Association for Teacher Education in Europe (ATEE) (Gorny, 1985).

A shift to an approach of whole-school stafftraining should be envisaged as well. Otherwise the teachers can't find adequate support, either at school or outside it. Sometimes their work in integrating IT in school is evaluated by people who are not even computer literate.

4.3 The role of the universities

A close relation between teacher-training institutions and t,he schools should be established. Thus the practising teachers could rely on constant methodological support. Any teacher-training institution needs a network of school settings where the students being trained could observe 'demonstration lessons' and have some practice at school. However the support of such a network and finding enough stimuli for the teachers to practice is still difficult. Also, there are few examples of successful IT applications in school which might be clearly referred to. An important task of national and international importance is to firmly support the teachers who successfully apply IT in education. They usually show a great enthusiasm, overcome many problems at the cost of their personal and family discomfort. No wonder that they often give up after a year or two. Supporting the emergence of teachers' interest groups related to IT in education and building teachers' network would be highly positive.

Cascade-model teacher training in which a group of trainers is trained first, who in turn train other teachers/trainers, has showed some good results in the industrial countries and has been adopted for some Third World countries as well (Hawkridge & McMahon, 1992). Applying such an approach in the CEE countries is also desirable. However an appropriate infrastructure at a national level should be established in order to support such training. The CEE countries could rely on their own highly qualified experts and teacher trainers.

The "Educational Technology Tool-Kit" approach (Hill, 1989) is based on distributing flexible sets of reference materials (papers, books, magazines) reflecting experience which has shown to be effective. This approach might be developed further by adding educational software packages. Distance education based on telecommunications opens new perspectives to the teacher training in the CEE countries.

4.4 Hardware and software

Special attention should be paid to hardware repair and support. For instance a great number of the computers available at schools in Bulgaria are out of use because of their low reliability and lack of resources for their instant repair.

The teachers who have computers for private use have a great advantage. However few of the teachers f om the CEE countries can afford buying their own computers. Offering an opportunity for teachers to have a computer for a private use and for self-learning would have a very positive effect on their further professional development. An obstacle to realise this is that, as in the Third World countries (Hawkridge & McMahon, 1992), computers are considered to be a public resource which has to be used publicly.

A 'shopping-list' approach to educational software selection is also highly desirable as a strategy to be applied by teachers. Although the CEE countries seem to be far from this stage, mainly because of the lack of resources located at schools, the teachers should be trained in educational software evaluation.

A strategy of wider teacher involvement in educational software development could be a step towards a real integration of IT across the curriculum. This strategy corresponds to the recent software engineering methods relying on closer involvement of users in software design, prototyping and evaluation (Bodker & Gronbek, 1991; Wilkie, 1993).

4.5 Conferences, seminars, projects

Teachers need their own forums to present their positive achievements - conferences, seminars, workshops. There is a great need of increasing communication between teachers and creating opportunities to share ideas, teaching and learning materials, software, etc. The advent of telecommunication can definitely improve the situation.

The involvement of teachers in national or international research projects related to IT in education could be considered as special form of teacher education as well. For instance the RGE project in Bulgaria was based on an active teachers' participation (Nikolov, 1984; Nikolov & Sendova, 1988; Sendova & Nikolov, 1988). Participation in the ITEC project was beneficial for all teachers f om the experimental schools (Collis, 1993). The best policy probably is to allow and make sure that every school is turned into a research laboratory for IT in education.

5. Conclusions

On the basis of the above said the following suggestions could be made:

- a new strategy in IT and teacher training taking into consideration the new economic and social circumstances, should be developed;
- the CEE countries have to adopt relevant educational standards for IT in education and especially for teacher training;
- a strategy for supplying up-to-date hardware to schools should be followed;
- a network of specialised regional, national and international teacher-training centres where teachers would be able to ref esh their IT knowledge, to share ideas and experience, to keep in touch with new trends in the field, to receive educational software, and to rely on constant and competent help, should be established;
- international projects, conferences, seminars, and other form of co-operation between the CEE countries and developed countries should be established. Programs that proved to be successful should be renewed or continued. For example - the International Program "Children in the Information Age" in Bulgaria.
- an organisational f amework for co-operation in IT in Education and teacher training between the countries f om Central and Eastern Europe should be established as well. The initiative of IEA, UNESCO and OKI-EK, Budapest, might be considered as the first step in this direction. Another promising initiative is the International seminar on Teacher Education and Communication and Information Technologies: Issues and Experiences for Countries in Transition organised by UNESCO, the commission of the European Community, and University of Twente

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Computer Networks in Teacher Education: Realizations in the Framework of the Pluto Project

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Abstract

Recent history is being characterised by some surprising and unpredictable changes, which have influenced the world map and the relations between societies, cultures, and countries. As the world changes at an ever-increasing speed, education will become more essential than ever. As a consequence of this, we will be confronted with a type of education which will no longer reproduce our cultural inheritance. If education does not want to create a large discrepancy with other social activities, then it will have to orient its tasks to transformation and creation of culture. These fundamental changes in education imply consequently radical changes in the teaching profession and in teacher education. In the recent overview reports (UNESCO, OECD) emphasis is also being put on the use - and training for - educational technology as an element of the improvement of education and of delivery of education. For more than a decade now, the ATEE Permanent Working Group on Teacher Education and Information Technology has been concentrating on this evolution and is trying to anticipate it adequately. Working group members study, at different levels of application, the intelligent and accurate integration of information technology across the curriculum of school and teacher education programmes. Much of this work has been realised in a collaborative European setting: recent projects have made it possible to include East European countries in the network Has a basis for discussion during the workshop I want to present two case studies as a result of the ATEE. Working Group's activities. Background theories and concepts as well as specific project involving the Czech and Slovak republics and Bulgaria will be presented in the paper session and subsequent workshop

activities. In this paper, one particular project as an example of multi - partner, multi-national activity will be examined in detail.

1. Introduction: The Pluto Project

"PLUTO" is the acronym for " Project to Link Universities and Teaching Organisations". This project links universities, teacher-training institutions, different groups of teacher educators and student teachers, and classroom practitioners (in-service teachers and their pupils) in European countries. The resulting network is realised and carried out by new information and communication hardware and software. The general approach of project can be described as "collaborative distance learning" in a technology-rich learning environment.

2. Origin and evolution of the project

2.1 Birth of the idea of a Pan-European Electronic Network for Teacher Education

The origin of the project can be found in ATEE Working Group 4 " Teacher Education and NICT" in 1984-85. During a session of brainstorming on the theme of more cooperation and shared projects between European institutions of teacher traming, several ideas for co-operation activities were expressed by the group members. Some examples:

- Teacher trainers of geography were thinking of exchanging data from satellite weather stations, and with their students, building up common geographical databases...
- Language teachers were proposing language exercises in written language between group of students in different countries...
- Teacher trainers from faculties of educational and social sciences were imagining a global electronic network as a carrier for joint projects to help their students understand daily life in other countries as well as microelectronic systems...

As a global result of this brainstorming, the idea was growing to use and study NICT applications as tools which could help to realise these educational and training initiatives. The idea of pan-European electronic network for teacher education was born.

2.2 Setting up the Network

A university in Manchester, UK (in 1985, Manchester Polytechnic, now Manchester Metropolitan University) became the co-ordinating node of the project and Dr. Whys Gwin developed the general strategies.

During the first years of its existence several group members of Working Group 4 had been experimenting - also technically - with possible computer networks connecting their teacher-education institutions. Bascd on this cxpcricncc, thc option was taken up of using the European Academic Research Network (EARN) as a carrier for the project.

An overview of the "experimenting group" of institutions during the first years of the Pluto Project looks like this:

Manchester Metropolitan University, UK
The University of Falun/Borlange, Sweden
Zahle Seminarians and the Royal Danish College, Denmark
The University of Braga, Portugal
The University of Oldenburg, Germany
The University of Vienna, Austria
The Free University of Brussels, Belgium
The Institute for Science Management and Informatics, Hungary
The Programa d'Informatica Educativa and the University of Barcelona, Spain
The University of Reykjavik, Iceland
The Polytechnic of Midden Nederland, The Netherlands
The University of Paris XIII, France
UNESCO, France
The University of Patras, Greece.

Each of these groups had the responsibility for some aspects of the project activity, in collaboration with one or more other institutions of the network.

All of this joint activity created much diverse collaboration in the PLUTO Project. As a result of its experience in general and in setting up the project, the Pluto Project succeeded in getting financial support at the European level (through COMMET II and TEMPUS projects).

3. Leading principles and goals of the project

Knowledge and information have never before developed as is the case nowadays: quantity, quality and diversity are changing each moment. More knowledge is being produced in a quicker way and by more sources, people are being informed at higher and higher speeds, and we have become accustomed to "real-life" information.

These facts are challenging for education. More than ever, future citizens will need the necessary skills, abilities, and attitudes to deal with this large quantity of diverse and high-speed information in order to be able to make the distinction between essential and superficial knowledge, subjective and objective information, and to be able to draw moral judgements derived from these distinctions. Therefore we opted in the PLUTO Project approach for "content-free" applications; for systems (software) that makes it possible to deal, handle, and select information in an open way instead of software that contains information in a closed system.

Based on these leading principles the overall educational goals of the Pluto Project can be described as follows:

- The first is to introduce into teacher training, skills in the use of information and communication technologies which, we may cQnfidently expect, will be commonplace by the end of the century.

- The second, and ultimately the more important, goal is that of identifying those new forms of classroom activity, and changes in the learning environment, which are brought about by the use of the new CIT.
- The third is to establish practical collaborative projects which practice these activities and to disseminate the results of these into the larger teacher-training environment through a widening of participation in the network.

4. Some realisations at the PLUTO Brussels node

4.1 Student teachers compare their curriculum

The following is an example of some of the sorts of activities that are being carried out within the Pluto Project. This particular exercise was realised by students in initial teacher education for primary school and their professors in Brussels (Karel Buts Teacher Training College) and in Manchester (Disbury School of Education). The activity took place during the students' course tome spent on Information Technology. The whole PLUTO activity in this framework was also a case of "School Based In-service Training". (This case is described in detail *n Engels, 1993).

Before the real "networking" took place, students received a short introduction in the use of the PC and word processors; the log-on and log-off procedures for EARN; the use of a terminal emulation program and the "mail - receiving-downloading" procedures. After a first exchange of personal information about the different class members, the students became interested in comparing their initial teacher-education curricula. This was not only done by comparison of the "objective" description of the different curricula, but also on a subjective basis: the students described how they perceived as students the* study and practice tasks. Dur*ng a period of six weeks they exchanged weekly one or two sets of information.

Each information exchange treated a specific part of the initial teacher-education curriculum and was also an opportunity to describe feelings and attitudes towards the teacher-tra*n*ng situation, the staff members, the children, etc.

The following is an example of a note from one of the Manchester students:

...Although we all study different f rst subjects with TESS as our second subject, we will try to explain what our typical day is like:

Tuesday

9.30 *First subject lectures (in our case Modern Languages: French and German). Here we study the methodology of teaching*

11.00 *We have coffee break for a half an hour. This means rushing downstairs to queue in the canteens.*

11.30 *Our f rst subject lectures continue until 12.30 when we have an hour for lunch.*

13.30 *TESL: We discuss the different approaches to teaching second-language learners and compare our own experiences in schools.*

15.00 *We have yet another coffee break for half an hour*

15.30 *We continue our lecture until 16.30.*

It is very difficult to describe a typical day as we have extra lectures, such as Multi-culturalism, Profiling, Anti-sexism, Anti-racism, Careers Advice and of course, School Visits.

Everybody is now preparing for the next teaching practice in two weeks time which will last for seven weeks. Thankyou for keeping in touch. Good luck with your studies.. .

Liz, Tracy, Fiona (Modern language), Lesley, Sue, Sally, Nicole, Bryn, Craig, Davey, Nick and Graham (our tutor).

For the Brussels students it was also a language exercise as English is not a course of the teacher-training curriculum. On request of the students, their colleagues in Manchester also corrected their English language and sent back the corrected copy.

Following are some examples of corrections made in the text:

Original message from the Brussels students:

At the training school

8.20 As every Tuesday we all are ready to observe a demonstration lesson. Today there is a change in the time table. The demonstration will start at 9.10. Christof, our (l)only boy, will give a test lesson in the f rst year (children 6-7 years old). It will be a lesson vocabulary: "We bake biscuits"

Our inexperienced bakers have some little diff eulties, but f sally all progress positi - vely. If the biscuits were delicious, that remains a question: we have not had the time to taste them.

9.10 The subject of the demonstration lesson in the second year was the study of plane forms. This lesson was good structured and very pleasant for us and for the second class children.

10.00 We make a pause

The corrected message from the Manchester students:

Dear P2-class,

We are sending you a correction of your text but please note: many of these are simply stylistic devices and are not always wrong! We hope you willf nd this useful.

At the training school

8.20 As usual on Tuesday we are all ready to observe a demonstration lesson. Today there is a change in the time table. The demonstration will start at 9.10. Christof, our one and only boy, will give a test lesson in the f rstyear (children 6-7years old). It will be a vocabulary lesson: "We bake biscuits"

Our inexperienced bakers have some little difficulties, but finally all progress positively. Whether the biscuits were delicious remains a question: we have not had time to taste them.

9.10 The subject of the demonstration lesson of the second year was the study of plane forms. This lesson was well-structured and very pleasant for us and for the second-year children.

10.00 We have a break

Further analysis of information exchange allowed the students to discover cultural differences and approaches.

Example:
The Brussels students for example tried to make a little joke, writing:

...Christof, our (l)onely boy, will give a test lesson...

Their Manchester colleagues seemed not to understand the double meaning of it...and corrected:

...Christof, our one and only boy, will give a test lesson...

4.2 Collaborative work at the primary-school level

A second example is this project, especially devoted to primary schools (which are also practice schools for some of the participating teacher-training colleges). The project partners were the following institutions:
At the Co-ordinating Institution level:

Manchester Metropolitan University, Didsbury School of Education
Free University of Brussels, Department of Educational Sciences

At the primary-school level:

Limeside Primary school, Limeside, Oldham, UK
Project Vale Primary School, Heald Green, Cheadle, UK
Alice Nahon Primary School, Putte, Belgium

With the assistance of the coordinating institutions for the use of e-mail links the schools developed many joint activities throughout the whole curriculum and over the whole school year. The global title they gave to their exchanges was "European Awareness". The exchange was realised by text, produced on computer by children of the 3rd and 5th years of primary school, and sent via the network to their friends in the UK.

In addition, the participants produced databases and graphics in relation to a number of topics of their interest. The activities, related to the project, are integrated into the curriculum. In the Belgium school some older children from lower secondary classes took care of the translation.

Some examples of the children's work:

a) Written materials:

...Answers to your questions.

Dear teacher and children,

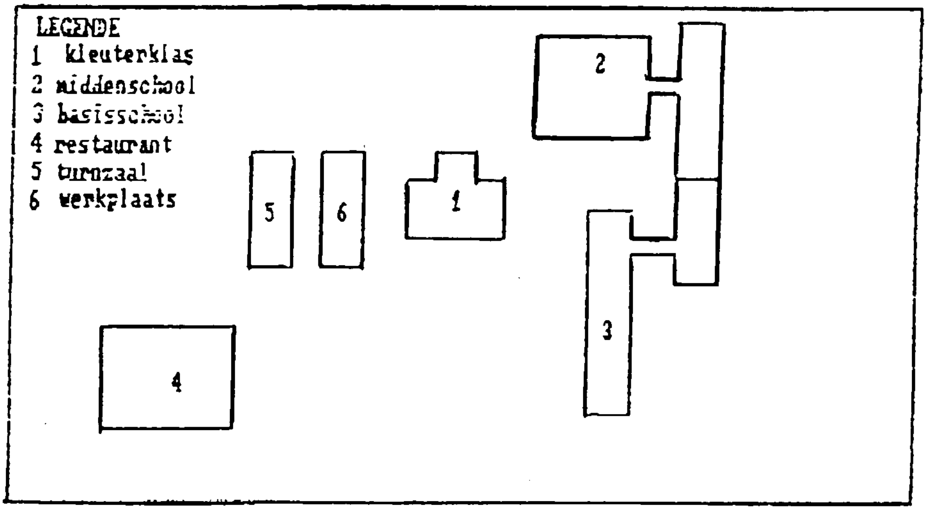
We received your letters with reactions and questions about the box. We will try to answer all your questions.

1. Mannekens Pis

This 60 cm high bronze statue, made in 1619 on request of the city, is the symbol of Brussels. They call the little man the oldest citizen of Brussels. Mostly he stands there naked. Sometimes he wears a costume. The little guy has a wardrobe of more than 300 suits, most of them on display in the museum of the city.

b) Graphic work (a ground plan of the school, made with a graphics program)

"Alice Nahonschool (Eef en Jill)"



c) data base (a presentation of the class in data)

Name	***Date of birth***	***Pets***	***Brothers/Sisters***	***Favorite TV-program***
Jamie	*1981.09.24*	*hond, vis, ham*	*1 zus, 1 broer*	*De match*
Gemma	*1981.10.01*	*vis*	*2 zusters*	*Casualty*
Kevin	*1981.10.19*	*geen*	*1 zuster*	*De match*
Anrew	*1982.01.06*	*1 konijn, 3 vis*	*1 broer*	*Nightmare*
Lisa	*1982.01.08*	*geen*	*1 broer*	*London's Bur*
Neil	*1982.01.22*	*hond*	*geen*	*D Simpsons*
Paul	*1982.01.30*	*hond, goudvis*	*2 broers*	*Mr.Bean*
Graig	*1982.02.06*	*2 honden, 7 vis.*	*geen*	*Grandstand*
David	*1982.02.11*	*geen*	*1 zuster*	*ITV Sport*
Sally	*1982.02.26*	*kat*	*1 zuster*	*London's Bur*
Christopher	*1982.03.12*	*2 karjes*	*1 zuster*	*BBC Sport*
Michael	*1982.03.13*	*kat, vis*	*2 zuster*	*London's Bur*
Dawn	*1982.03.16*	*1 kat*	*1 broer*	*Ruth Rendel*
Simon	*1982.03.18*	*2 honden, 2 kat*	*geen*	*Woof*

5. Perspectives and conclusions

During the academic year 1992-93 the PLUTO-Project activities got the interest and support of school directors and inspectors of the Independent Council for Community Education. This will provide us the opportunity to continue the primary school work and to start with classes at secondary level and at a teacher-training college. With the support of the Free University of Brussels, a full-time research assistant co-ordinates and investigates on a scientific basis the developments of the project in the near future.

Our experiences using the network at different occasions and for different learning objectives makes me call PLUTO a "living" network. We indeed could register that for all the participants (pupils, teachers, teacher trainers, and co-ordinating staff members) the network has become part of their learning environment and life, due to development and growth in several domains.

On the product side, knowledge of, and about:

communication activities (mailbox, mailing, receiving, consulting, downloading));
text (on- and off-line);
common databases, spreadsheets, and graphics produced;
network servers and public-domain libraries.

On the process side, techniques, procedures, methods, and abilities were developed in:

terminal and keyboard manipulation;
writing texts with word processors;
developing strategies to build databases;
classification of received data and infornation;
structuring the information in function of the ongoing learning process;
motivation and thinking during the exercises.

In relation to the attitudes, a remarkable development was expressed by the participants concerning:

contact and exchange of ideas with people from other countries, cultures, and societies;
he discovery of cultural differences;
the appreciation of social feelings.

These findings seem to fit our stated general objectives:

" ..bringing into being is the possibility of a global community of present and future teachers and their educators, working together and learning from one another, while at the same time developing the technological skills they will need in the school of the future.

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Teacher Education and Communication and Information Technologies: Implications for Faculties of Education

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Abstract:

Communication and Information Technologies change not only learning and teaching They change the profession of a teacher in many aspects. Teacher education is therefore a key point for the future years, and for inte - grating CAT into Education. We will describe the evolution of teacher edu - cation in France, stress the diff culties of developing CIT in teacher educa - tion, make some proposals in order to improve it and ask some questions in order to make recommendations for future reflection. The two major ides are to make technologies easily available in the daily life of a future tea - cher, and to make the trainers not only give courses about "how to use COT" but actually use it as a way for learning something new.

1. Effects of Communication and Information Technologies: A global perspective

Communication and Information Technologies (CIT) and teacher education cannot be examined without having in mind the context of CIT and education. It means that we should first examine the effects of CIT not only on teacher education, but on society, on the disciplmes, contents and curricula of education, on teaching, and on learnmg.

This task is not the purpose of this paper, but it is a preliminary condition to this paper. CIT should not to be considered as a supplementary tool to add to the current set of pedagogical tools. It has fundamental influences on knowledge itself, on teaching and learning. The different disciplines are evolving very quickly because of the new technologies: fundamental concepts are changing; the way scientists and specialists work is changing; the treatment of data, the new possibilities for experimentation, for simulation, for modellmg, offer new developments to many sciences. Teaching is also influenced by new technologies, and CIT offer many different possible activities for education. Computers may be used in many different ways: as a modern "blackboard" in the classroom, to show and demonstrate things; as an individual tool in the classroom, for each pupil to personally manipulate concepts and tools; as a personal tool for self-directed out of the classroom (self-training, self-evaluation, etc.). A considerable amount of different software is now available, and can be integrated into pedagogy, not only added to traditional activities. And learning is widely influenced by new technologies, even if we do not know precisely how! Educational research, didactics, and psychology, are providing new knowledge about how one learns and acquires new concepts and new processes.

It seems to me that having a global perception of these phenomena is a necessary step for future teachers, even if they do not go into details about the influence of CIT on teaching and learning.

2. CIT and change in the profession of a teacher.

CIT is influencing not only education, but also society in all its aspects. The evolution of teacher education cannot be examined independently of the global evolution of the society. Before considering teacher education, it is necessary to have a view of what kind of teachers we want to produce. This needs much reflection, to be done in each country, in order to determine what the profession of a teacher is now, how it will evolve, and what are the competencies teachers need.

2.1 Changes in the role of the teacher

The profession of a teacher is changing, and the roles of a teacher are more and more diverse. The school of tomorrow will be organized according to many different pedagogical styles: different types of rooms, of equipment, different types of groups of pupils. The way teachers work has already begun changing: they not only come to school to deliver their courses; they now increase their work in teams with colleagues, they increase their work in offices and labs at school, they increase their use of new resources in schools.

Because pupils are more and more diverse, teachers have to intervene in many different ways, and to use different pedagogical styles and different kinds of activities. They must work sometimes with small groups of pupils, sometimes individually. They may work not only in the classroom, but also in other rooms of the school as resource centres, laboratories, etc.

The teacher has to be counsellor, advisor, organizer, leader, manager... He or she has not only to master the knowledge, but also to master and manage the teaching and the learning.

The personal work of teachers is also evolving: they are more and more involved in the elaboration of pedagogical tools; they work and reflect together with colleagues;

they build their own competencies and abilities. Teaching can no longer be considered as an art: it is a profession, and we must train professionals!

2.2 Training for professionalism

Both because things will evolve continuously, and because of the professional nature of the competencies a teacher needs, it is not possible to give the future teachers all the knowledge and competencies they will need during their career during their initial training. One must give them: basic and fundamental knowledge and abilities and the ability to evolve and adapt all through their career.

This implies consequences for initial education of teachers, in terms of contents and methods, and on in-service training. Pre-service education must give long-term tools; in-service training is more and more becoming an important component of the profession of a teacher; it is no longer an optional "plus" teachers can ask for, but a fundamental and necessary part of the profession.

The evolution of teaching is not only the consequence of the evolution of technology and hardware and software. It is also a consequence of the evolution of pedagogy, under social influences, and because educational research is producing more and more results. Thus, we have to combine both the new possibilities of technology and the new knowledge we have about teaching and learning, in order to produce adapted tools and products, and competent teachers. Technique is not going to replace pedagogy: the use of CIT needs certainly more pedagogical reflection, and more pedagogical training.

3. CIT and education today.

3.1 Is CIT already a significant part of education?

Is it possible to say that CIThas penetrated education ? It is clear that one hears comment about CIT almost everyday in schools and faculties, it is clear that a lot of material is now available. But I think that two main difficulties are still present:

3.1.1 Integration difficulties

Too often, CIT is simply "added" to what existed previously. A computer room has been added to other classrooms. A computer chapter has been added to the books (or computer parts in some chapters, or computer exercises to the list of exercises!). Computer activities are added to the other activities in the classroom (but they are timeconsuming, and the teacher must then hurry up to recover time to go on with the curriculum!). The question of integrating CIT in teaching and in learning is still widely open. We need a reflection about integrating CIT in each science and discipline, integrating CIT in the pedagogical strategy of the teacher, integrating CITin the learning of each pupil, integrating CIT in the school, integrating CIT in the profession of the teacher.

3.1.2 Generalisation;

Many things have been done with CIT, many experiments have been conducted. Many teachers are involved in new technologies, but is mainly because of their personal enthusiasm and willingness. We all know teachers who spend their nights and weekends exploring new software, preparing new activities, designing new tools for their classes. We now need CIT being the purpose not only of these particular teachers, but of all teachers. Generalization is a major problem today! We need adapted strategies: in order to make all teachers use CIT, we need simple ways of using it, simple use of hardware, simple access to software, simple pedagogical tools. But we need, mainly, adapted training.

3.1.3 Limited penetration

Certainly, CIT has penetrated education not as much as one thought some years ago. And the main difficulties are certainly not hardware (size and prices are decreasing, power is increasing!) nor software (the development of educational software is now wide and open, after some years with too-closed products). Integration will need much more reflection and research. Generalization raises the question of teacher training.
Both pre-service and in-service training must be addressed, if we want a real generalization. In this paper, I will focus mainly on pre-service training.

4. Teacher education: The French experience

4.1 Reform of teacher education in France

In many countries, the question of teacher education is being raised. As the role of a teacher is more and more complex and difficult, teacher education is considered as a key step in the evolution of the educational system. In France, a large reform of teacher education has been made in the last three years.

4.1.1 Previous system

In the previous system, primary and secondary teachers were trained in totally different institutions: Primary teachers were trained in "ecoles normales" (two years at university, then two years in the "ecole normale"). These "ecoles normales" had almost no link with universities, and constituted an isolated world. Secondary teachers were first trained for four years at university (only in their subject), then recruited by the state through a competitive exam (with no professional component), then they got one year with practice in schools and pedagogical training, under the responsibility of inspectors. Their pedagogical abilities were not taken into account when recruiting them.

4.1.2 New system

The new system is very different. In each region of France, an "I.U.F.M." (Institute Universitaire de Formation des Maîtres - University Institute for Teacher Education) has been created. The I.U.F.M. trains both primary and secondary teachers (but not the same way!). A11 future teachers have to take three years at university, then two years in the I.U.F.M (as a consequence, the salaries of primary teachers are now the same as secondary teachers).

4.2 Goals of the new training system

The training aims at several coherences:

4.2.1 Coherence between knowledge and pedagogy

It is not enough to acquire first scientific knowledge, then the pedagogical ability to transmit it. Pedagogical matters influence the knowledge, and didactics cannot be separated from the contents. A teacher is not only a specialist of his or her field, plus a pedagogue; the professional competencies need a strong coherence between the two, and also some "knowledge about the knowledge" (history, epistemology, applications); some knowledge in other fields (psychology, sociology, philosophy); and knowledge about the educational system.

4.2.2 Coherence between primary and secondary education.

Even if the professions are different and need different abilities and training (in France, secondary teachers teach only one subject, while primary teachers teach all subjects of primary schools), it is certainly an enrichment to make future primary and secondary teachers meet, have a part in common courses, and be educated in the same institution, by the same staff. It is useful to take into account the unity of the pupil at different ages, and the unity of a scientific concept at different levels.

4.2.3 Coherence between theory and practice

The theory of pedagogy cannot be well acquired without practice: it is necessary to encounter the true problems in order to elaborate the tools for solving them; Conversely practice is enriched if enlightened by theory, which provides elements for observation and analysis, and gives "long-term" tools to teachers. Very often, young teachers ask for "recipes" for how to teach and manage their class; the articulation between practice and theory allows the building of a more deep professional ability.

4.2.4 Coherence between training and research.

We would like teacher education to evolve together with the progress being made in educational research, and taking them into account; and conversely we would like research to be not only theoretical, but applicable and producing usable tools and products. This is a mission for our institutes!

4.2.5 Coherence between pre- and in-service training

Pre-service education cannot give teachers all that they need for their profession, and in-service training must be developed as a natural component of the profession of a teacher. Certainly, in-service training should be reinforced for beginners, during their first professional years. And the methods and contents of pre- and in-service training should be well co-ordinated. Common work between pre- and in-service trainers is a necessity!

4.3 Characteristics of the I.U.F.M.s

The I.U.F.M.s have two major characteristics:

- They are university institutes. It means that their "daily life" is like that in universities. The staff includes professors and lecturers, and also secondary teachers. They participate in educational research. They develop scientific activities together with their educating tasks. The institutes are strongly linked with the universities: they exchange staff, and they have common activities. Universities are widely involved in the scientific part of the training.
- They are professional institutions. They have to prepare students for a profession. This needs strong professional content in the training, and strong links with "the floor", which are the schools in which students may have practice periods.

4.4 Consequences of the new system in France

This new system has now some consequences:

- In France, we had a serious lack of teachers and of students willing to become teachers, especially in the northern half of the country. It is necessary to recruit about 30,000 teachers per year in the six next years. In the last two years the number of applicants has increased in a spectacular way (more than 20% every year), so that we are now reaching the optimal number of students in the I.U.F.M.s (about 75,000 for the whole country). The unemployment in France is certainly the major reason, but the new training system is also an important factor.
- The "path" for a student to become a teacher is now clear and readable. It is not only "by chance" or because they have found nothing else that they become teachers. It increases the willingness of students towards the profession of a teacher.
- The idea that teaching is really a profession, which needs appropriate abilities and appropriate training, has now penetrated the public's mind; it is not only because you are good at mathematics that you will be a good mathematics teacher! The necessity of a professional, pedagogical, and didactical education is now widely admitted, even if the debate "knowledge against pedagogy" is not closed in France.

opportunity of the major changes in the French system for implementing new ways for CIT implementation in teacher education. Many reflections about this task have been made, many experiments have been tried, but the major work is still to be done. It is now one of the priorities for us. We will discuss how we are proceeding in the next section.

5. CIT: Implications for faculties of education

5.1 Training for the future

The development of CIT in faculties for teacher education must take into account all the new trends of education, teaching, learning, and new technologies. The question is not how to train teachers as we did yesterday with the tools of tomorrow, but to train the teacher of the future. And it is not easy, because we do not know all the characteristics of the teacher of tomorrow! We can only guess some evolution, and try to give future teachers some basic knowledge and some fundamental competencies, and give them the aptitude to evolve and follow the future evolution.

5.2 Including CUT in training: Core principles

In my Institute, we already have included CIT in our programmes. The first temptation was just to add new technologies to the existing programmes. The difficulty is to integrate CIT into teacher education. Some general principles must be considered:

- Pedagogical aspects of the use of new technologies cannot be separated from knowledge about new technologies. Interactions between the two must be set up.
- Of course, CIT in teacher education is a matter of practice: teacher students must actually use CIT, but practice must interact with theoretical aspects.
- It is not enough to give techniques and recipes to the students; one must make them "learn something through CIT".
- CIT has to be considered both as a medium/tool, and as a subject in itself.
- There is no or one right use of CIT in education, but a very wide diversity of possible uses. One must give future teachers a view of this diversity, so that they can make their own choices, and build their pedagogical strategies according to their choices, to their pupils, to the knowledge they will have to deliver. Being aware of the diversity is a fundamental aim.

5.3 CIT and the teacher-education curriculum

CIT appear in many different ways in our curricula:

- modules for basic initiation to computers and computer science;
- use of computers for word processing, databases, etc.;
- modules for didactical use of new technologies (these modules are centered on a discipline, and study the use of new technologies in order to improve the teaching and learning of this discipline);
- presentation and experimentation with educational software;
- modules for video techniques;
- use of video for analysing the behavior of a student in a teaching situation;
- initiation to the use of CIT for documentation, resources, etc.;
- production of a personal work ("memoir"); some of them have chosen a theme related to CIT; all students are invited to produce a word-processed document.
- self-service: free access to computers for personal and individual use;
- software library.

5.4 CIT faculties and goals for staff

We have also developed CIT facilities for our staff. And we offer in-service activities for teachers, related to CIT.

5.4.1 "Proyect for the Development of CAT in the Institute"

We are now trying to establish a "Project for the Development of CIT in the Institute". This project is based on two major ideas:

- Equipment, computers, etc., must be very easily reachable, everywhere and when you need it. CIT will not develop if you need to think in advance that you will use them, if you need to reserve a special room, to look for the key, etc. Every student, every teacher, must be able to have an instant access to equipment.
- Rather than giving courses about how to use CITin education, we prefer making our professors actually use CIT in their teaching at the Institute, in every subject, and integrate them to their practice. It is well known that future teachers will teach not the way we tell them to do, but reproducing the way they were taught themselves. Therefore, the way we teach in the institute is a determinant for our future teachers. We would like them to experiment by themselves that you can learn something new through CIT; not learn about CIT, but learn something in your subject, something you feel you would not have so well acquired without the new technologies. Of course, this is not easy to do in a large scale, and raises the difficult question of the training of trainers.

5.4.2 Equipping the Institute

The first point needs a plan over several years, in order to equip correctly the Institute. We do it in two ways:

- In the Institute: We are trying to assemble several types of equipment, in order to make a variety of situations available. We equip specialized rooms: computer rooms (with 12 to 20 computers); multimedia rooms (for example, the language lab and video rooms). We have a large room (400 seats) equipped with all the facilities for using CIT But we also equip, in parallel, several ordinary rooms, so that a professor can use new technologies in a spontaneous way. We have asked our staff what they would like to find in a room, and we prepare packages including overhead projector, computer, and video, and make them available in a number of rooms. As the equipment may depend on the subject, we are devoting some rooms to given disciplines. The next question will then be to link this equipment to an internal network, so that common resources and information can be accessible from any room.
- Equip each student with a computer: Together with companies and banks, we have designed a plan, proposing that each student acquire a personal computer of good quality, with appropriate software, at a low price. We now offer several types of equipment (PC or Mac, microcomputer or notebook,...), with basic software (word-processor or integrated package - we are studying the possibility of including one educational software in the package). It seems to be a success.

5.4.3 Moving towards a multi-disciplinar,v approach

The second point is much more difficult. It requires changing the minds and the habits of our staff, and it requires making pedagogical choices.

As in universities, our staff is grouped in departments, according to their disciplines. We have a "New Technologies Department", which is in an unusual position with respect to other departments: this department groups computer scientists and also persons from every discipline, who want to work together about new technologies. But at the same time, all the departments are working with new technologies, and investigating the use of new technologies in education.

5.5 Implementation strategy in the Institute

5.5.1 Make facilities broadly available

Our first aim was to make CIT facilities available for every member of every department, and to make the departments develop their work using these facilities. First of all, of course, departments were given rooms, equipped with one or two computers. This allows each professor or teacher to use a computer in an "everyday" way: text processing, file processing, etc. It allows also collective work (for example, sharing experiences about software).

5.5.2 Developing tele-working

A specificity of I.U.F.M.s is that they are split in several sites. My Institute has five Centres, in five cities: Grenoble, Valence (100 km from Grenoble), Charnbery (50 km), Bonneville (140 km), and Privas (140 km). It is time consuming and expensive to make our staff meet often. So we had to develop tele-working. We now have an internal network which allows communication (electronic mail, and circulating texts and documents) and which we are trying to extend to multimedia communication.

5.5.3 Attracting participation

As everywhere, a part of the staff was spontaneously willing to use these facilities; but for others it is much more difficult. We must "attract" them, through easy and not frightening activities. The different steps to do that can be:

- personal use of computer for simple bureaucratic activities (text processing);
- the computer as a communication medium, to work together with colleagues;
- then, CIT as a tool for teaching.

We try to attract people by showing and demonstrating them interesting products, by establishing links with other institutions. But we must make them evolve, from new technologies as personal tools to CIT as collective and social tools, and from CIT as a personal tool to CIT as a pedagogical tool.

5.5.4 Staff training

This needs also to plan training activities for our staff: We are now designing a systematic programme for that. It is based on the knowledge of the tools, and on the integration of CIT in every discipline.

5.6 Goals for future teachers

5.6.1 Global reflection and core experience

The next step will then be to have a global and systematic reflection about CIT in teacher education in general. This can be organised according to three main orientations:

- Make the future teachers aware of the social and cultural aspects of CIT For example, analyzing the role of TV, of images and media, of the effects of video on

pupils and on their relation to knowledge; understanding of the great changes which occur in society because of the evolution of computer science...
- Make the future teachers master the technical tools (be able to use an overhead projector, a computer, a video, etc.; be able to use simple software as word-processors, file-processors, graphic software,...; be able to understand some of the elementary concepts of new technologies).
- Make the future teachers be able to integrate CIT in a specific disciplinee's teaching and learning methods. This needs to work in many directions: The influence of new technologies on the discipline itself, its evolution, its role in the society, its applications; the specific resources existing in a given discipline (videos, software, tools for experimentation, etc.); different possible uses of CIT for teaching; influence of CIT on learning.

5.6.2 ClT and links with practice

A specificity of teacher education is its necessary link with practice, with classes in schools. All our students spend several weeks in schools, for observation, for "accompanied practice", or even for teaching with full responsibility. It is an essential component of their training. And it is an important field for CIT:
- future teachers can observe the use of CIT in schools;
- they can experiment with ideas and tools they encountered in their training at the Institute.

But we are trying to go further:
- *For expanding experience:* CIT can be a means for enlarging the situations students encounter. For example, videos were produced in France, showing a set of classroom situations, and giving teachers and students tools to analyse these situations.
- *For communication and contact:* CIT can be a tool for communication between students and between students and their professors during the periods they spend in schools. When they are in schools, our students are under the responsibility of their trainers, who sometimes visit them, and of counsellors, who are teachers in the school, tutoring the teacher-students. Students prepare their practice periods at the Institute, and after the practice period there are activities for analysing the situations and problems the students encountered in the schools. But we would like to have a more interactive way of interaction between theory and practice. Electronic communication can facilitate a daily link between students and trainers. We dream of a large "permanent tele-conference" with students and trainers sharing their difficulties, their ideas, their solutions.

5.6.3 CIT and links with research and innovation

Teacher education must be linked to educational research and innovation. This is especially true for CIT Faculties of Education must reinforce their participation in educational research, in particular in the field of applications of research and of production of adapted pedagogical tools. There exists very few products (software, videos,...) especially adapted to the needs of teacher education.

New tools needed:

- Tools for teacher education in groups, in different domains (disciplines, psychology, knowledge of educational systems, knowledge of the pupils, evaluation, etc.);
- tools for teacher self-training and self-evaluation;
- tools for documentation and resources;
- tools for distance and telecommunications-mediated teacher education;
- etc.

New media environments needed:

Multi-media and hyper-media offer new perspectives for developing products. But much of work has to be done before simple and usable products are available for teacher education. "Multimedia labs" and "hyper-labs" are now being developed in different institutions.

Partnerships between faculties of education and schools should be encouraged: common efforts for equipment and development can be done; and it allows rich cooperations in teacher education, large resources, links between "faculty training" and "practice", and links between in- and pre-service training.

6. Some questions.

Some questions may be stated at the end of this paper, as recommendations for future reflection:

1) *CITinfluences society, sciences, teaching, and learning How can this be taken into account in teacher education ?*
2) *Try to determine how the profession of a teacher is evolving, and elaborate the professional characteristics of a teacher: What is his or her role, what abilities, what competencies does he or she need ? In particular, which competencies related to CIT?*
3) *Which competencies may be acquired during pre-service education ? Which ones must be acquired in in-service training ?*
4) *What does "integration" of CIT into education mean? How can it be done ? How can we integrate, not only add, CIT in teacher education ?*
5) *What proportion of the teachers actually use CIT in education ? Why do the others not use CIT ? What are the main obstacles to generalisation ?*
6) *Examine the consequences for CITfor the general principles of teacher education: coherence between knowledge and pedagogy, between theory and practice, between training and research, between Are- and in-service training.*
7) *How can we not to only give future teachers "recipes" for how to use COT, but give them deep and long-term tools and abilities ?*
8) *Which key points must be included in the curricula for teacher education, with respect to three main dimensions: social and cultural aspects, technical and hardware aspects, didactical and pedagogical aspects ?*
9) *Have all future teachers doing a personal project including a CIT component. What sorts of evaluation criteria are appropriate?*

10) *The question of trainers: Which tools do they need ? How to make them want to work using CIT ? Which training do they need ? How to design systematic pro - grammes for trainers training ?*
11) *Which kinds of equipment are necessary in a Faculty of Education ?*
12) *How to use CIT in order to facilitate communication between teacher trainers ?*
13) *How can one provoke the step from individual to collective work using COT ?*
14) *How can ClF facilitate the link between theory and practice in teacher education? How can CIT improve the practical part of teacher training ?*
15) *Which kinds of research does teacher education need with respect to CIT ? Which products do we need ? How can we develop applied researches in the field of CIT in education.*
16) *Are there specific ClT products for teacher education ?*
17) *Make each Faculty of Education have its own ClT project?*

When approaching these questions, have in mind that we must not train "teachers like yesterday" with the tools of today or tomorrow, but that we must prepare a new kind of teacher: the teacher of tomorrow, for the pupils of tomorrow, in the school of tomorrow!

Teacher Education and Communication and Information Technologies: A Reflection on Emerging Possibilities for Collaborative Projects

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Abstract

In this paper, a reflection on the nature of collaboration and the synergetic involving collaboration, communication, and multi-media is expressed . The author, the director of a laboratory researching learning supported by computer and information technologies which is also the largest educatio - nal producer of CD ROM in Europe, sees the basic human needs of colla - boration and communication at the core of new learning environments.

1. Collaboration as a human endeavour

ULTRALAB is a large research centre based at Anglia Polytechnic University. We work alongside an education department to seeks ways of harnessing technology and applying it to learning. The team at ULTRALAB are eclectic and our activity is collaborative by intention, both within the lab and with partners around the world.

We are collaborating with computer companies like Apple and Kaleida, with telecommunications companies like British Telecom and Northern Telecom, with the entertainment industry like Sega and the BBC and with fellow university research centres and researchers around the world. We have a number of reasons for regarding future collaborative endeavour with considerable optimism and these reasons include philosophical, economic and technical.

This paper seeks to remind us of the need for collaborative endeavour, review the issues for debate and examine the enhanced opportunities for collaboration that technology is currently providing.

1.1 Why do teacher educators collaborate?

Firstly, why do teacher educators with an interest in learning technology need to collaborate at all? There are a number of valid and pragmatic reasons but also some personal and social ones. The reasons include:

- We collaborate to broaden the base of research activity both in the collection of data and to improve the speed with which we can observe, question, hypothesise and test.
- We collaborate because many of our research centres are too small, too nationally constrained and rely on too narrowly defined research populations - both culturally and economically.
- We collaborate because the economies of scale we can achieve can be greater than the cost of collaboration. Where quantification of these economies of scale is possible it is always simple to achieve institutional support.
- In teacher education we collaborate because national models of teacher training are facing the increased international mobility of teaching professionals. We cannot work alone to develop new strategies to meet this shared change.
- We collaborate because it is socially and intellectually stimulating, and delightful, to do so.
- We collaborate because the market for learning technology is not yet mature whilst learning technology requires a large market to achieve any hope of recovering investment. The only viable size for a market in learning technology in teacher education is currently the world market - not the local, regional or national one. In the UK for example there are barely 100 colleges offering any kind of institutional teacher education.
- And finally, we collaborate pragmatically because, as a result of all the reasons listed above, funding organisations expect and seek collaboration as an essential element of many research funding requirements!

1.2 Collaboration in time and space

However, the nature of collaboration has, over the years, been less than satisfactory. Working together has two dimensions - time and place.

1.2.1 Located and synchronous

We have relied most commonly on synchronising the two and considerable funding has been made available for many of us to travel and work in each other's centres. Of course this Located and Synchronous collaboration ('a' in Figure 1) is often enjoyable socially and professionally but in many other ways is unsatisfactory:

- the real cost, and especially the opportunity cost, of such programmes is very high,
- they only marginally broaden the base of research activity because they militate against large scale collaborations, and
- because maintaining high-quality professional and social relationships after a visit is so difficult this also militates against long-term collaborations.

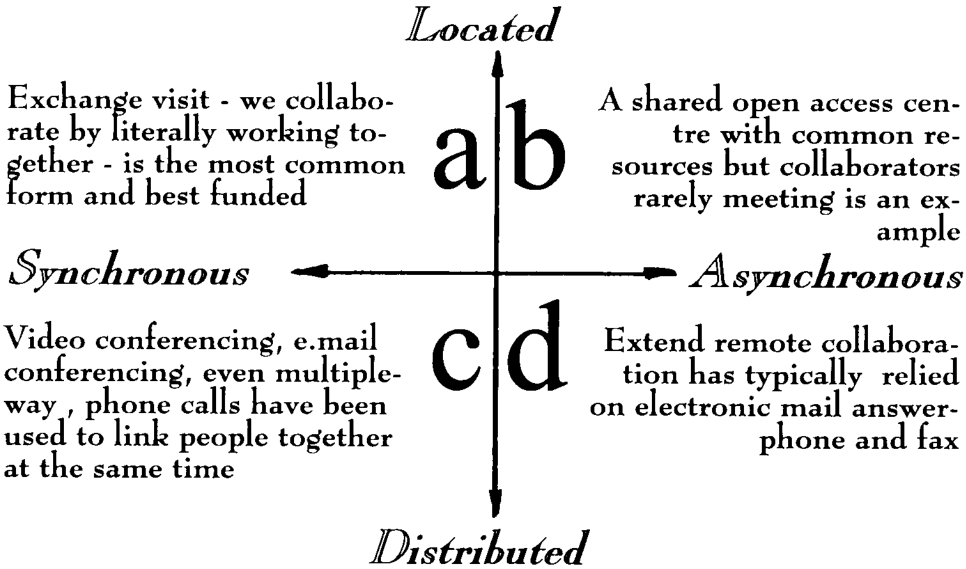

Fig 1. Collaboration, expressed in terms of time and space

1.2.2 Located and asynchronous

Similarly, b' in the diagram below offers collaborators the opportunity to visit a common resource but to rarely be there at the same time. For example at ULTRALAB we have the National Archive of Educational Computing which is a large and useful research resource visited by individuals, often with a common purpose, but rarely meeting. This is unsatisfactory because of the loss of both social interaction and the stimulus of peer presentation, critical friendship, etc. However for both economic and pragmatic reasons much funded collaborative activity seeks to generate one such resource, for example a multimedia development studio - as a key element in collaborative endeavour

1.2.3 Distributed and synchronous

Probably everyone at this conference will have experienced some form of collaborative activity in Quadrant 'c' of the diagram above, perhaps audio or video conferencing. Most of us will have found it an unsatisfactory experience but will have enjoyed the excitement of a new technology the first time we conferenced remotely'. Many cultures have good jokes about how inefficient committees are as a model of collaborative endeavour: m the UK we say for example that a camel is a horse designed by a committee. For many reasons of time, expense, and convenience the metaphor of collaboration that video (and audio, or simultaneous e-mail) conferencing encompasses is that of a "distributed committee". All the failings of a committee accompany it, with the additional disadvantage of the poor opportunity for gestural annotation and the lack of good social interaction (for example the informal socialisation that precedes and follows the traditional form of committee meeting).

1.2.4 Distributed and asynchronous

This leaves Quadrant 'd' of the diagram above as a vehicle for collaborative endeavour, and although the developments within this "asynchronous, distributed" sector have been typically disappointing to date, it promises (because of emergent technical developments addressed below) the greatest potential for future collaboration:

- it should enable long-term and large-scale collaborations, even where time zonesa-re wildly different,
- it should be relatively cheap as emergent technology in telecommunications enter-san era of domestic and mass market penetration,
- it should have relatively cheap opportunity costs - we should be able to continueour "day job" at the same time,
- it should offer enough social signifiers' in aural and gestural annotation to makethe pseudo-social experience of asynchronous, distributed communications sufficiently pleasant to want to be repeated,
- it should delight the technological "pioneers" that make up much of the community of teacher educators with an interest in learning technology.

2. From multimedia to communication

Why should we be optimistic that asynchronous, distributed communications will "come of age" and offer a useful channel for high collaboration between us without too much inconvenience? The reasons lie in the speed of change of communications technology. If "Multimedia" was the fashionable word in technological conferences in the early 1990s "Communications" is the current fashionable word for the middle and end of the 1990s.

2.1 Multimedia as a norm

Curiously there is a difference between these two generic terms that both describe emergent technologies: Multimedia as a term recognises that computers can finally offer most of the key elements of our information lives: text, sound, speech, hearing, video, graphics, animation. With people we do not have a special term to describe individuals with all the channels of their information world intact - we never say for example "Stephen is a multimedia person", we assume all these information channels to be in place and only have words to described an individual's lack of some of those channels - we say "Stephen is deaf" or "Stephen is blind". It would be more consistent if we talked about "normal" computers being multimedia workstations and had special labels like "deaf" or "dumb" computers when they are not. You can sense this change already beginning as the climate of expectation changes to accept multimedia as the norm.

2.2 Communication as a qualitative dimension

However, computers have always offered some form of communications (however bad) and, as with people, it is not the presence of communication but rather the quality of it that attracts our interest and our vocabulary. We say "She is a wonderful communicator" or "I find it impossible to communicate with that man". Multimedia ceased being interesting in its own right once we got it; at that point, what multimedia could facilitate became interesting: learning, entertainment, information dissemination, communication. And in each case we continue to be interested because quality is continuously evolving along a continuum towards excellence. Multimedia has acted as a "gating factor"; its sudden evolution has enabled a leap along the quality continuum and a great stride towards excellence.

It is interesting to consider as a case study the historical development of technologically driven communications backbone as an illustration:

> In the late 1960s, the US Defence Department's Advanced Research Projects Agency (ARPA) created a network of telephone lines connected to large research institutions in government, education, private enterprise, and the military to allow researchers to exchange computerised information. Over the next decade and a half there was significant growth in number of user researchers. As computer technology became a little more accessible researchers outside defence and computer science began to use remote terminals and telecommunication networks to exchange messages and share computing resources from their laboratories, offices, and even from their homes. Each research centre using the network supported many users, and each local centre was connected to the overall network; inevitably, both the number of nodes in the network and the number of users at each node proliferated. At the regional, national and international levels the number of networks in government, business and education similarly proliferated, as of course did connections to ARPANet's "backbone" of lines.
>
> More significantly, the type of data researchers wanted to exchange began to change. Initially, simple text-based electronic mail was sufficient, but collaborators were soon looking to exchange high-density data like sounds, CAT scans, other graphic images, even video. By 1987 the ARPANet had all but ground to a stand still and the last of its state-of-the-art 1970s data lines were laid to rest. ARPANet's successor was NSFNET, funded initially by the National Science Foundation, another US government agency. NSFNET's original lines ran at 28 times the capacity of ARPANet and they lasted just three years, before being replaced with more lines offering yet another 28-fold (and even shorter-lived, doubtless) improvement. Meanwhile, growth of the Internet - which partly resides on the NSFNET backbone - has been almost exponential and currently stands at around 20 million users, with traffic growing at 20% per month. In 1989, users were impressed as the number of networks attached to the NSFNET and the Internet increased from 346 to 997!

The Internet and the anarchic way that it has evolved illustrates well the pent-up need to communicate; we are essentially gregarious by nature. Fashionable vocabulary -

phrases like "Surfing through Cyberspace" - suggests that communications and fashion have become linked in a way that is exciting for collaborative endeavour between our institutions because fashion and capacity add up to opportunity. The Internet grew out of a mixture of defence, hobbyist, and research communities and a parallel development of "video on demand" and "media enhanced telephony" is poised to revolutionise domestic communications in the way that the Internet is beginning to revolutionise research communities.

3. And for teacher education?

Where does this all leave teacher education? In short, with a fist full of opportunities; the challenge is no longer "what can we do" but more "what do we want to do" and in presenting this paper a series of possibilities will be developed interactively with the delegates. The outcome of that discussion will be indicative of the opportunity that emergent technology has offered us.

Where we are limited only by our imaginations, it will be interesting to see how bold we can be.

Part III.

Case studies

The 'Yale Key' to Progress in Using Communication and Information Technologies: A Case Study about Introducing CIT in a Municipal School System

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Abstract

To open a Yale lock you need the right key to place all pins in the right positions. Introducing CIT in schools depends on many factors all of which also have to be 'in right position' at the same time:

It's not enough just buying equipment
It's not enough just training the teachers in using new equipment.
It's not enough just buying some programmes.
It's not enough just changing curriculum.
It's not enough ...

Only when you combine and co-ordinate the efforts in many different fields will the 'lock' open, and you will have progress and benefits from CIT in education. This paper discusses the factors of importance to the introduction of CIT in the school, based upon experience made in the education system of Aalborg, Denmark.

1. Background

1.1 The 'Folkeskole' (the primary and lower-secondary school) in Denmark

There are nine years of compulsory education in Denmark, and apart from a few private schools, the municipal 'folkeskole' is responsible for the this education. Normally, the pupils start at the age of 6 (in principle voluntarily) with one year in a pre-school class at their district school. It is characteristic of the Danish school system that the pupils in a class often remain together throughout the school attendance; however this gives sometimes limited possibilities of choosing various subjects at various levels during the last grades.

At the end of Grade 9, the pupil may register for an examination to obtain a leaving certificate, but this is quite voluntary for the pupils. After this, the pupil can continue in either the 'gymnasium' (the upper-secondary school), commercial school, technical schools, or attend an apprenticeship-training programme. However, the pupils may choose to stay in the 'folkeskole' for a 10th year and perhaps pass an examination after this, either at the same level as for Grade 9, but also at a higher level, if they choose so.

The 'folkeskole' is municipal, implying that all grants come from the municipality. In principle, guidelines for a curriculum, indicating what is to be taught, apply individually to each single school, but in practice the guidelines published by the Ministry of Education are followed to a large degree. Thus, there are only few and no substantial differences between schools all over our country, and all examinations are substantially identical.

1.2 The teachers in the 'folkeskole'

All teachers in the 'folkeskole' have had their education at one of the approximately 20 teacher-training colleges in the country. It is a comprehensive education, in principle qualifying the teacher to teach all subjects in all forms of the school. The education consists partly in a series of basic subjects (such as Danish, mathematics, Christian studies, writing, creative art, music, and physical education), and partly in subjects such as educational theory and practice, psychology, curriculum studies, etc. Finally, two main subjects are chosen among the basic subjects to be studied more deeply.

Beyond these subjects, the student teacher attends a long series of courses in various subjects, for instance, also in educational computing.

The problem exists, however, that due to the decreasing number of children, still continuing, there has been a relatively slow staff replacement in our schools, which means that although computing has been introduced in the teacher training, many schools cannot profit hereof because there is no need for new teachers. The teachers are civil servants and can only under certain special conditions be transferred between schools. This fact, among others, implies that a continued in-service training is very important.

1.3 The self-determining school and teacher

As mentioned above, each individual school may have its own curriculum in the various subjects, and according to tradition the national guidelines are open frames, within which the individual teacher may choose the ways and means to fulfil them concretely. Tile teacher has extensive freedom of choice in respect to teaching materials and methods, provided the Education Act and the frames of the guidelines are observed. This implies that the Danish teacher is accustomed to the responsibility of making choices and decisions as to books and teaching methods. In practice, this freedom to the schools as well as to the teachers indicates that changes cannot easily be introduced in the school by national authorities through orders and regulations. In fact, you will have to convince the schools and the teachers of the benefits of introducing something new, before actual steps will be taken in practice.

1.4 The Education Authority of Aalborg

The municipality of Aalborg has 37 'folkeskoler', 27 of which comprise classes at all levels, whereas 20 small schools only have classes up to and including the 7th form.

There are approximately 1500 teachers and 15000 pupils, and the annual budget of the school system of Aalborg is approximately 600 million Danish kroner.

The Education Authority of Aalborg has been one of the pioneers in Denmark with respect to introducing educational computing in the schools, and since the mid-1980s all schools have been equipped with computers. It has always been a matter of principle that all schools, and all teachers, should have equal possibilities of access to computer equipment.

1.5 DAKS - 'Dataafdelingen ved Aalborg Kommunale Skolevsesen' (Educational Computing Centre, City of Aalborg)

The Education Authority has established an educational computing centre which is responsible for purchase of equipment, maintenance, in-service training, support, development and adaptation of programmes, and much more.

DAKS also offers selected software packages at special discount prices to the schools, and furthermore a relatively comprehensive programme library with public-domain programmes has been collected.

The staff of DAKS consists of the municipal inspector for educational computing and six teachers, working part time in school and part time in the computing centre.

2. The Task

2.1 Bottom-up start

The use of computers in schools in Denmark has not been introduced centrally. At the beginning, that is, in the early 1970s, a range of schools and education authorities started offering courses in computer science and using computers in other subjects on their own initiative.

Not until 1984 was the subject 'informatics' introduced in the school. It was an elective subject and was a mixture of a 'computer science' and 'computer awareness' course. The subject was extremely popular - especially to pupils and their parents - and most of the schools included it in their list of offers to the pupils. Actually, substantial problems presented themselves to the schools and the local authorities in the procurement of vital preconditions in terms of getting computers and having teachers trained in instructing this subject. However, these problems were overcome in the course of some years without vast obstacles; in as much as only two or three teachers per school were needed to cope with computers and be in charge of the voluntary subject.

2.2 Top-down: Ministry guidelines

At the end of the 1980s, however, 'informatics' was made a compulsory subject, and a deliberate process of integrating themes from mformatics to all of the subjects of the school was started. The Ministry of Education published guidelines for most of the subjects regarding the integration of informatics and computer applications, and suddenly the teachers found themselves in the situation that they had to integrate informatics and use computers in all subjects. Furthermore, a report was published, describing the demand for computer equipment and in-service training at the schools. But how to solve the task was the problem of the individual schools and municipalities.

2.3 The task, in short

To put it short: The task is that

- the *whole* school, meaning <u>all</u> teachers in <u>all</u> subjects and in all grades are to integrate informatics and computer applications, and
- the preconditions necessary for this are to be established.

2.4 The preconditions

However, most schools did not have to start from scratch: On their own initiative many teachers had already started applying computers in their instruction and many places already were experienced in offering courses in informatics and computer application. Over the years, computer equipment had also been procured for the schools, usually to be used in the subject 'informatics', and it was generally believed that the basis of a swift and positive development in computer application in instruction was at hand.

The great majority of teachers had attended basic computer courses, learning how to operate the equipment, word processing, and how to use spreadsheet and database programmes. Besides, they had learned about examples of a wide range of educational software of various types and for various subjects.

The schools were in possession of computer equipment, typically 10 - 30 computers, often placed in the same room. They were high-quality machines, and programmes such as word processing, spreadsheet, graphic programmes etc. were available. Furthermore, there was quite a number of educational software.

Now that the guidelines were established, everyone expected the free, independent, and responsible teachers to introduce computers in their own instruction by themselves.

However, only very little happened!

3. The problems

Many factors of importance to the development of IT use in instruction had been underestimated. Most of them were related to the teachers - directly or Directly - meaning that the problems might very well be founded on concrete matters, but m reality, the teachers' attitudes and frequent absence of will to apply the computers were the main obstacles. Only very little trouble had to show up before many teachers would use this as an excuse for not applying computers in their instruction. Admittedly, actual problems did occur - and still do. Examples of these sets of problems include:

3.1 A (non) 'user-friendly' interface

Although the computer equipment in schools was of a high quality and was very suitable to informatics instruction, the new and Creased group of users brought about new types of problems. To trained users these problems would seem to be irrelevant trifles, however they often constituted the barrier which prevented the majority of teachers from getting on with their use of computers in their instruction.

> *One (true) example: A teacher had attended a word processing course and was convinced that it was a good idea to use this kind of software and have his class work with it in the computer room of the school. So he had booked the room and was instructed by the teacher in informatics about starting up the equipment. On the text-oriented equipment, however, starting up the word processing programme involved the writing of quite a number of commands, and, to be quite sure, the teacher had noted the whole procedure on a piece of paper.*
>
> *When the class appeared in the computer room and tried to start up the word processing programme - and the class was very attentive - it did not work. The computer only gave some unintelligible remarks such as SYNTAX ERROR and FILE DOES NOT EXIST. Desperately the teacher tried several times, with the same poor result - and the class started to find it amusing Then the teacher sent a pupil for the informatics teacher, who was engaged in teaching another class, to have his procedural note checked for errors, and the pupil returned with the confirmation that it was quite all right But it still didn't work*
>
> *.. The pupils were still more amused with the situation, and after another couple of attempts the teacher gave in, blamed the equipment for the failure, and ordered the laughing class back to the classroom.*

The cause of the problem turned out to be the teacher's use of O (the capital letter O) instead of the (the numeral character zero) on the keyboard. However, although this was clarified, no one could convince the teacher in question that computers should be integrated in his instruction. The failure m front of his pupils had had its price.

It could always be maintained that this problem could be avoided, but the point is that it was not! Even though the teacher had attended a word-processing course, and even though he had asked a colleague for advice, it went wrong.

3.2 'Lack of ideas'

The school as a system - and the teachers - are the originators in developing new ideas. However, at the same time they are also the main obstacle. Tradition, as well as teaching materials already procured, examination syllabi, and lack of time all impede development.

But another important problem is that the teachers still lack the foundation of ideas for the application of the new possibilities.

Innovation is always difficult. Therefore, the first railway wagons and automobiles looked like horse wagons -only the horses were missing. And therefore new possibilities with CIT are often applied to solve the tasks of 'the past' instead of leading the way to 'future'. In a somewhat coarse expression one might say that many applications of CIP actually correspond to using the car with the purpose of training the horses to run faster, as it happened in the early age of motoring.

3.3 The 'Camel' complex

Sometimes you hear that persons such as politicians wonder why introducing computers in various firms is so swift and painless, while it is so time-consuming and troublesome when it comes to the school.

There is often a variety of causes, and if comparisons are drawn between the user situation of a teacher and an employee of a company, factors as the ones listed below will often apply:

3.3.1 Purpose clarity

Company setting: Usually, it is evident to both direction and staff why computers have to be introduced and which tasks they are to solve.

The School: It is somewhat uncertain why computers should enter the school, and the tasks that they should solve are rather vague.

3.3.2 Efficient working situation

Company setting: Usually, the employee has a dedicated system at his disposal which is adequate for the task to be solved.

The School: The teacher has to work with many different programmes, and also often with more different models of equipment -at the same time.

3.3.3 Ease and relevancy of use

Company setting: The employee uses his system every day, and it is always available at his desk. Equipment and programmes are adapted to the task to be solved.

The School: There may often be long breaks in the teacher's computer use, and the equipment is rarely present in the classroom but has to be booked a long time in advance. Furthermore, the teacher's personal preparation may be impeded by difficult access to the equipment. The application of equipment and programmes are not always intended for children or teachers in instructional situations.

3.3.4 Support

Company setting: The company regards the introduction of computers and the staff training as an investment in the future. Therefore, the employee attends the courses necessary for operating equipment and programmes, and when equipment is replaced, his training is up-dated.

The School: The authorities are uncertain of the role of computers in the school. The teacher may attend general computer courses, but there is no guarantee that the training takes place with the same equipment and the same programmes as those available at his own school. If new equipment is procured at the school, he cannot always expect to attend an up-dating course.

3.3.5 Payoff clarity

Company setting: To the company the results of the investments in equipment and staff training are relatively visible.

The School: It is hard to measure and prove the effect of computer application in the instruction.

3.3.6 Practice and phasing-in

But you can go further in comparing the conditions of the corporate employees and those of the teacher:

When a teacher or a firm employee is presented with computer technology, they both have an amount of work before them. They have to learn a series of new concepts, new methods, and also have to obtain new skills in operating the equipment. Furthermore, they must get acquainted with the programmes to be applied.

But hereafter they separate!

Company setting: For after this first amount of work the firm employee can often start using the computer in the various concrete situations, and gradually he can spend some time learning the last details.

The school: To the teacher, another quite new and bitter amount of work appears: How can his newly acquired and unsecured knowledge be related to teaching the pupils at different grades and in different subjects? In fact, this task is far more complicated than learning the basic application of a computer, and furthermore, it is far more difficult to find appropriate assistance.

So, the teacher has **two** big bulges to deal with - hence the designation 'the camel complex'.

3.4 "Time"

3.4.1 Problems with time

Time has proved to be an important factor in different ways. First and foremost the necessary time for the computer activities in the classroom must be at hand. However far from always do the granting authorities let demands for expansions in instruction be followed by expansions in the time available. Thus the teachers find themselves in the situation that they will have to drop other parts of instructional situation if they include computer applications. And, as they will often feel insecure as to the results of introducing computers, they will choose 'safety' first and work only a very little with computers to continue their traditional instruction.

3.4.2 The teacher, over time as a dimension

To the teacher him/herself, the computer is also very time-consuming. It is something new to the teacher, where the involvement of computers demands more preparation than traditional instruction, in which he has many years of practice. In this connection you may say that a sort of "ripening period" goes on in He teacher, which may be illustrated with the following phases:

- Not using computers at all
- Interested - trying to understand and learn about possibilities

- Learning to use computers for one's own use (the first big 'Camel-bulge')
- Preparing and testing the use of computers in the classroom based on activities described by others
- Mechanical use of computers in classroom for specific and limited purposes
- Using computers in the classroom as a routine
- Starting to modify and improve the use of computers -getting one's own ideas for its use (the second big 'Camel-bulge')
- Integrating the use of computers in one's daily teaching
- Change and renewal of teaching

To undergo such a range of phases will take tome, of course, and experience has proved that in fact none of these phases can be ignored - even through intensive course attendance.

4. The Solutions

Universal solutions to the problems in connection with a general introduction of CIT in the school may hardly exist, as the entire complex of problems is too extensive and too much subject to the local circumstances, traditions, and other specific matters.

4.1 Simultaneous solutions

One clear experience is the fact that <u>a whole set of preconditions</u> will have to be satisfied <u>simultaneously</u>.

Here, the comparison with the unlocking a Yale lock is appropriate:

In order to turn the cylinder of a lock of this sort, it takes the right key to position a number of lock pins in exactly such a way that the point at which they are cut will match the surface of the cylinder.

If just one of the puns is not in the correct position, the cylinder cannot be turned and unlocked.

The similar requirements apply to introduction of computers in the school: If just one of the various necessary preconditions for the introduction is not fulfilled, you will see that practically nothing happens.

Consequently the variety of individual problems will have to be regarded as a whole, and a solution to them all should be sought simultaneously.

4.2 The Aalborg experience

Some of the most important experiences and observations made on Aalborg have been:

- To the highest possible degree, the teacher must be involved and thus must join in the responsibility for the decision processes as to procuring equipment and programmes.
- An adequate number of user-friendly computers must be available, and they must also be accessible in practice.
- The teachers' in-service training must be based upon didactic and subject-oriented/educational contents rather than on programmes, the computer, or its application.

- Each school should must have a computer advisor who - being a teacher himself can help his colleagues through all the little obstacles and inspire and support them in their computer use in instruction.

4.2.1 Teachers' involvement

As far as possible the teachers' points of view and wishes should be taken into account as to the choice of equipment and programmes. It is vital that the teachers do not feel that decisions in this area are made without their influence. If the teachers feel this to be the case, they will be given with a convenient excuse - to themselves as well as to their surroundings - for not undertaking the task of computer use. However, if the teachers are involved in the choices and the decisions, they will also feel more responsible for solving the tasks. Usually, teachers are not particularly sensitive or frightened by novelties, but in matters where they feel insecure themselves they will be particularly careful in choosing ways and methods which they feel that they can handle.

4.2.2 Rethinking user-friendliness

Here the key-words are 'user-friendly' and 'accessible'.

User-friendliness is a relative concept which is hard to define unambiguously. For instances which of the following two types is the more user-friendly? A Macintosh with the chance that the programmes 'disappear' into random files, or a text-based menu system in a network which enables you to start one of the five programmes which you normally use? Perhaps, user-friendliness is most adequately defined in that the user always feels in possession of some relevant possibilities of action in relation to the system - that he always knows how to get on. Then it is less relevant whether he does this by clicking a mouse or choosing a programme from a menu.

Accessibility to equipment is very important, too, both at the school when the equipment is to be used in instruction, but perhaps far more important is accessibility for the preparation of the instruction. Here it has been clearly experienced what an advantage it can be for teachers to be able to borrow equipment to take home and learn procedures in peace and quiet.

4.2.3 Relating to classroom applications

The first in-service training in informatics for teachers in Aalborg were traditional courses in the operation of the equipment and of various programmes. The examples used in the instruction were chosen in such a way, of course, that they illustrated the best sides of the capacity of the equipment and the programmes - rather than what possibilities might be added to instruction and the subjects. On closer reflection it is no wonder that so little subsequently happened in computer use out in the classrooms. The teachers could not handle 'the second bulge' alone, and they had neither time nor experience enough to develop innovative ideas for computer use in the instruction.

Today, we carefully try to base in-service training in CIT in the teachers' own subjects, as the teachers are most capable in seeing the factual and educational possibilities in applying CIT within their own subjects. We also take great care in connecting the courses as much as possible to daily instruction, e.g., in starting from cases which the teachers may use in their instruction simultaneously with - or immediately after - the in-service course.

4.2.4 Importance of a computer advisor teacher in the school

One of the most important conclusions which we come to is the necessity for someone fulfilling a computer-advisor function at all schools. He should be closely connected with, and be an important part of the teachers' in-service training.

The computer advisor is a teacher belonging to the school, whose task consists in helping his colleagues in a flexible way with their daily use of computers. In practice this can be done in many ways. The computer advisor may, for instance, join a colleague in his lessons for a period, when this colleague wants to work with computers in his class. Then the situation occurs that two teachers are at hand when a class is to start computer instruction, i.e., one teacher who knows the class well, and one who knows computer operation well. This has turned out to be a clear advantage, especially as there is always an immense demand for assistance to the pupils at the beginning of computer use

Another advantage of the computer-advisor arrangement is that little problems at the school are coped with without delay. The teachers rest assured that in case of an unpredictable problem they can draw from the computer advisor's experience on short notice. Hereby they feel more secure and consequently more ready to get on with using computers in their instruction.

Definitely, the introduction of computer advisors in the school system of Aalborg has been one of the factors to give a push forward in the development of CIT application at the schools.

UK Case Study: Communications and Information Technology in UK Teacher Education.

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Abstract

In order to limit the scope of this paper the phrase communication and information technologies is taken in the logical sense: the use of both communication and information technologies in teacher education. This paper briefly reviews the current state of Information Technology in education and in teacher education in the UK before describing the services of communication and information technology available to education. Six applications of communications with Information Technology are illustrated before the author draws out points which have been learned and the issues for the future. The paper concludes by applying these experiences to other countries, particularly those in transition in central and eastern Europe, suggesting several projects modelled on the illustrations.

1. Teacher education in the UK

The UK is in the throws of wide-ranging changes in education at almost every level, from nursery provision to higher education and research. However this change to one system, education, is not massive compared to that occurring in Eastern Europe. Within the UK changes there are differences between the four countries of England, Wales, Northern Ireland and Scotland, each of which has its own educational government. These changes are briefly outlined below:

1.1 Changes relating to the school sector

Compulsory education to 16 years of age has been affected by the Education Reform Act passed in 1989 which started a staged implementation of the National Curriculum for England and Wales, and was adjusted for Northern Ireland. This curriculum consists of 'attainments targets' in core and foundation subjects, levels of attainment and compulsory tests at four key stages. Results of the tests will be published in schools' league tables.

The implementation of the National Curriculum has put enormous pressure on teachers to conform with the new law. Although an Attainment Target for Information Technology is currently included within the subject of Technology (except in Northern Ireland), the use of telematics is not compulsory. The same law has started a process of devolving funding from local (regional) education authorities to schools. As a number of these regional bodies had adopted telematics for purposes of communication with schools and for the sharing of resources, the financial devolution has decreased the incidence and support of telematics in compulsory education.

1.2 Changes relating to higher education

Higher education and research are also in a state of flux due to increased student numbers without an equivalent increase in resources. Polytechnics and colleges of higher education have been encouraged to take university status with corresponding increase in research. They are also now eligible for connection to the Joint Academic Network and this will increase participation. However it is likely that universities will have to pay for this service some time in the future.

Thus telematics in higher education is increasing and a current national initiative to improve teaching in universities with new technology, The Teaching and Learning Technology Programme, is supporting a number of projects which involve telematics, as is European funding through programmes such as DELTA.

2. Information Technology in teacher education

2.1 Strategy

The UK has developed the application of IT in education starting with its application in schools. It was felt that classroom and curriculum practice was necessary before IT could be incorporated into pre-service teacher education. This has possibly slowed the adoption of IT. Existing practices of established teachers are hard to modify and require whole institutions to prepare to change. In contrast, new teachers are predisposed to major changes in teaching style frequently necessary for powerful use of IT to enhance teaching and learning.

The strategies to apply IT in education have included part-funding for equipment from the government, projects to develop software and curriculum materials, regional centres for resources and expertise. Most recently, advisory teachers for a range of subjects have been released to work alongside teachers in their own classroom. Recent research projects have described the impact of this new technology on teaching and learning. Valuable development has taken place but the enormous benefits envisaged have been limited by institutional and other constraints (Impact Report, 1993). Good practice using IT to enhance teaching and learning remains patchy in UK schools.

2.2 Factors affecting in-service teacher education

A recent evaluation of a staff development programme for IT in teacher education noted several factors which affect in-service teacher education and the development of schools to use IT to enhance teaching and learning (Brown, 1993). Teachers and institutions need to own the process of change, staff development needs to be increasingly diversified and the teachers themselves need to engage in the search for ways in which IT can enhance teaching and learning.

Two approaches were contrasted in the evaluation: a utilitarian- to a shallow-technical vision of improvements, a quick fix using worksheets and similar means to gain skills. The critical approach in contrast attempted to change both the teachers and their learners' knowledge structures and thus required a much broader curriculum approach. Thus the more successful but time-consuming approach to teacher education for information technologies requires the teacher to become more reflective and to encourage this in their learners, recognising that this changes the role of the teacher in order to promote learner autonomy. Such a change is difficult to make for a whole school and requires a new flexible approach to teaching and learning.

Recognition of the impact of IT on learning can be enhanced with some immediate applications commonly involving rapid production of graphical representation and data logging. However even potentially very powerful applications do not lead to spontaneous development, only when they are embedded in powerful teaching environments in which the time to reflect away from the computer may be just as important as time on the task.

Complimentary activities are also important for the transfer of learning. The powerful teaching environment has a range of activities from sequential learning to role play and the skill of the teacher is to use an appropriate strategy to suit the pupils needs and preferred learning styles at that time and in that context.

2.3 IT in teacher education: Relation to overall program

Pre-service teacher education is now required to prepare teachers to use Information Technology resources with confidence and competence. However communications are not mentioned, only IT resources. Student teachers must also be prepared to teach the National Curriculum, which, as noted above, includes IT as a cross-curricula theme and as an attainment target in England and Wales. This is currently under review. Davis (1992) reviews the development of IT in pre-service teacher education and gives examples of courses. In the early 1980s ITwas serviced as an optional isolated subject/skill. It is now seen as an integral part of teaching and learning. This has required considerable staff and institutional development for teacher education in universities and colleges. Project INTENT (Somekh, 1992) and the SPRITE project in Scotland (McDonald, 1993) have developed valuable approaches for this.

2.4 Pressures from an increase in school-based pre-service teacher education

However the recent demands by the government to increase the amount of school-based training is putting particular pressure on IT in pre-service teacher education. Few schools have strong practice in respect of IT as noted above, and their resources are under pressure due to the curriculum and the need for development of existing staff. Student teachers therefore have relatively little access to IT unless this is specifically planned and negotiated.

Several excellent approaches are being tried at present where the student teachers, with support from their university, assist practising teachers to implement curriculum and institutional development (see for example Tearle (1993) and Trushell (in press)). In addition there are several universities planning to use telecommunications to improve support for students in schools, including Exeter University.

3. Services available in the UK for communication and IT

3.1 Satellite and terrestrial telecommunications

The UK has access to satellite TV as does most of Europe. However the only region to have a high proportion of schools with satellite receiving dishes is Wales. There are a range of computerised services available through telephone lines throughout the UK. The services available to education in the UK have varied since their inception in the early 1980s. They are either networked services with one or more host computers or services used between two points. These systems are contrasted in Davis (1992b). We will consider networked systems first.

3.2 Network services

For compulsory education there is the Campus 2000 system available anywhere in the UK for the cost of a local phone call and paid for by annual subscription by institutions. The institution is allocated a single identity for all users in the institution. Campus 2000 provides central Telecom Gold electronic mail, some databases created and updated by volunteers or sponsors, and computer conferencing. Additional services may also be purchased. For example, gateways to services such as ECCTIS, which provides information on courses in UK further and higher education. There are also a few local systems available within a region, frequently run in association with the local education authority.

Services outside the UK such as Bitnet are now available through gateway services (TES, 1994), but do not have local-call access nationally. These are predominantly American and can appear culturally biased to UK users.

For higher education and research the Joint Academic Network (JANET), funded by the Department for Education, provides national electronic links between universities plus gateways to other services including networks in other countries. This service is currently free to universities, but they must manage the mail distribution and user support themselves. A wider-band network, SuperJANET, is now also being installed.

3.3 Point-to-point communication

Point-to-point electronic communication is also available. Any individual or institution could make their computer available to outside users by attaching a modem. A few do so to provide information to bulletin boards. A new form of digital telephone line called ISDN (Integrated Services Digital Network) is coming into service for point-to-point communication. These lines have at least twice the band width of ordinary phone lines and, as they are digital, the signal has no errors. They can carry both voice and computer information, including video, relatively easily for any sector of education. In future, these lines may also permit up to ten points to be connected together at one time.

4. Six illustrations of telematics for teacher education

The section describes a number of projects which have used communications and information technology for teacher education. Sometimes the Information Technology was a medium, in other cases it was part of the process of education, and most frequently the aim was to improve skill and knowledge of IT as well as aspects of teaching and learning. The illustrations are given in chronological order and thus reflect to a small extent the development of the technology over the last ten years.

4.1 *Illustration 1:* Database and notice boards for practising teachers (ResCue)

One of the earliest applications of electronic communication to teacher education was the creation of the UK national electronic network for pre-vocational education and training called ResCue which was hosted within the Campus 2000 computer system from 1985-1990 and thus freely accessible by any teacher with access to Campus 2000. The author created this network in response to the curriculum development required to improve vocational education in schools and colleges across the UK.

The change to resource-based learning to develop basic skills within a practical and vocational context created a demand for information about materials and assignments which could be used as models for teachers to adapt. ResCue provided a catalogue of materials with keywords including basic skills and a full-text database of assignments donated by teachers across the UK. In addition there were notice boards for each of the Regional Curriculum Bases and staff in schools and colleges were encouraged to use e-mail to enrol for courses and to share their concerns (Davis, 1989).

ResCue was successful in increasing access to resources, but the most frequent question by non-IT staff who came across it at an exhibition or conference was 'How can I use it?' Most frequently they were told to use their college's computer connected to Campus 2000, but difficulties of access frequently made this impossible (Davis, 1989 and Somekh, 1989). The lack of computer awareness and the unreliable nature of e-mail a few years ago accentuated the difficulty of sharing resources within one institution. Such barriers would not be as difficult now, but the needs have also changed.

4.2 *Illustration 2:* Open University courses

The Open University makes considerable use of telematics in several of its courses. In February 1988 the OU Home Computing Programme went live with 5,000 students on three courses DT200, M205 and M371. Among its objectives was:

> "to provide an interactive communications facility for students, staff and tutors." (Butcher et al, 1992)

Students were given access to E-mail and computer conferencing. There were many standards and access issues resulting in standardisation on a IBM-compatible PC running under DOS and a windows-like software called Gem. Modems and PCs were available with a subsidised lease arrangement. Berry and Burrows (1990) estimate that by 1990 a capital investment of six million pounds sterling had been made by students, UK Government, and the University for all OU home computing. Telematics was one aspect of this investment.

The Open University is offering a distance pre-service teacher education course beginning in 1994 and it will incorporate telecommunications, possibly modelling some aspects on the older DT200 course. The DT200 course concerned both technical and social issues of Information Technology and used computer conferencing within one assessment. It also had a database assignment with an on-line element. Considerable non-compulsory communication took place among a proportion of the students across the UK, so much so that the volume of messages was difficult to read. Local tutor groups also hold conferences and these act as a valuable entry point and distance 'seminar/tutorial'. The role of telematics for professional development is discussed in more detail in Davis (1988). However a percentage of students find this medium difficult and there are issues in developing good communication practices. Assessment through this medium has now been tried and is successful when the study of telematics is an assessed part of the course (Mason, 1993).

4.3 Illustrations 3: Initial teacher education: Student teachers' communication

When I moved into pre-service teacher education I was surprised to find little use of electronic communication (Davis, 1991). I soon uncovered some of the additional difficulties faced by pre-service teacher educators. In organising an international e-mail project across three countries there were major difficulties in time-tabling with so much time spent by pre-service teachers off the university site and radically differing term dates across counties. There are only two useful windows of opportunity: November and early May when most students will be in college.

In November 1989 I co-ordinated a multi-cultural project where students in a number of sites in three different countries briefly described how they would incorporate an aspect of multi-cultural education into their classes: ethnic food in science and poems from different countries complimented comparisons of geography and history. The students learned much from each other and finished off with a discussion of ways in which to handle an outburst of racial conflict in their classroom.

John Meadows of South Bank Polytechnic in London has also organised and refined a range of projects for student teachers. In Meadows (1992) he describes some general factors which affect successful international projects:

- their time-consuming nature;
- the need for careful pre-planning between teachers on the different sites;
- the cost of telecommunications, especially when exploring databases;
- the access to computers, software and telephones both in college and in schools; and the training and support required by new users;
- the timing of messages;
- the suitability of topics-social, cultural and environmental topics are obvious but alternative conceptions of science have also been used successfully;
- and the compatibility with educational philosophies.

Such projects are becoming increasingly difficult to organise due to the restrictions on pre-service teachers' time on the university site. Now the need is to support students in schools with access to library catalogues, tutor by e-mail, and peer group discussions. In Exeter and in other locations pilot projects using JANET and/or Campus 7000 are starting to emerge. However I expect we will find many of the issues faced in ResCue will emerge again relating to lack of access and lack of confidence.

4.4 *Illustration 4:* Students', student teachers' and teachers' curriculum development in a Modern Languages Newspaper Day.

Teacher education about communication technologies frequently takes the form of a project. Teachers can take this on spontaneously or with support from the local university or education authority. In this case the object was for each participating school (over 200) to produce a newspaper in a range of modern foreign languages. Some source material was provided by e-mail on the day by a group of-A level students who formed the national Newsday Newsdesk in Cleveland. This activity aimed to use languages for real purposes, working from authentic materials, and also to stretch students' IT skills and organisational ability.

In one Exeter school, two teachers and three student teachers took part with 30 school students who were chosen for language ability (aged about 15). E-mail was through Campus 2000 and preparatory materials came form this source as well as the university. Word processing and DTP software were also important. A scanner, Ion camera, and clip art and images drawn previously with software were also available to provide illustrations for the newspaper. The induction day included a talk by a representative of a local newspaper and materials provided by Campus 2000. Thus awareness of style, layout, and organisation was important. A student editor and two sub-editors were appointed to oversee and run the project. Much of the afternoon of the induction day was spent working out systems and lines of communication to enable effective control of newspaper production from receipt of e-mail to desk-top publishing. The student teachers acted as assistants advising on composition and helping with proof reading.

A steady stream of visitors and helpers visited throughout the day to observe the development of the newspaper. Several commented on the calm, organised, and hard-working environment. The pupils concerned demonstrated a high (and surprising) degree of sophistication and competence in such areas as scanning screens for newsworthy items, choosing items to work on directly in the foreign language and editing them down without passing through the medium of English. Communication technology is one of the few ways to make external sources of input really meaningful in the confines of a Languages classroom. Pupils begin to see that they can have access to the real world of languages used for real purposes, not merely chunks of discourse taken form a textbook. Both the student teachers and the teachers' levels of awareness of the possibilities offered by IT was raised. Both groups hope to be able to incorporate more IT into modern foreign languages.

4.5 *Illustration 5:* Professional development on-line with ISDN

DeskTop Conferencing (DTC) uses ISDN telephone lines to link participants at either end, sharing both voice and computer systems. Teacher and student can run the same software together, see the same screen, discuss it, and even key in changes. In addition, a flip-chart facility is available and file transfer is extremely quick. To establish a link one participant simply dials up the computer system and phone at the other end using the ISDN lines, which are part of the ordinary UK phone network. They then have a dedicated line for the duration of the call over which they can talk to each other and a second line which displays the graphics and text of one of the computer systems on the screens at both ends. The call charge is the same as that incurred for the telephone in the UK for each phone line in use. The audio and data phone lines may be used separately or together.

The Exeter University Computer Conferencing Project used DTC to tutor staff in the application of Aldus Pagemaker. Once the tutor (a university lecturer) was connected to the school via ISDN2 both he and the school staff were looking at the same screen and both had access to the same keyboard with the software running on the school's PC. In addition the voice line provided immediate and friendly contact, which minimised the mystery of the IT and gave the school staff control over their own progress. The support staff thus became able to produce higher-quality, better-designed materials for their schools. Senior staff received tutoring which enabled them to have an overview of the possibilities of Aldus Pagemaker, still video camera and other products in order to improve the management of resources and their production.

One school principal felt that the availability of in-service and technical support through ISDN would be 'magic':

> "Just say at the end of a working day you plan a 3.45 pm encounter (link) where the maths tutor in the university and my maths staff here engage in a very intensive piece of in-service. Absolutely top rate."

The schools feel that the quality and relevance of in-service courses would be easy to identify and could be adjusted to their needs with great flexibility.

The teachers also felt the in-service support was very valuable. A mathematics teacher explained the importance of multimedia when learning to use the still-video camera via DTC link. She felt that it was better than face to face tuition:

"I'm not very au fait with technology at all, but just having those pictures on the screen and Bruce's voice was marvellous. When someone is explaining how to use something standing beside you they often take it over from you. But using the link you have to cope with it. You have the verbal and the visual information and no one is taking it away from you. They try to explain to you instead. I did not find it a second best. I found it very useful."

ISDN will now also deliver video with videotelephones or on a PC screen (Mason and Bacsich, 1994), but this has had few applications as yet and none in teacher education.

4.6 *Illustration 6:* Satellite TV with partial mixed feedback

Brockley (1993) has been using satellite TV for provision of courses to schools in Wales from a regional centre. The courses are mainly designed for extension work for pupils but have also included teacher education. Recently Terry decided to improve the feedback to the presenters by linking some groups in the audience live. The subset linked to the studio broadcasting by satellite will act in the same fashion as a TV audience modelling behaviour expected of typical learners and asking questions of interest to them. Currently the links planned are by phone and e-mail and they may extend to ISDN2 applications as well.

5. Points learned and issues

5.1 New learning practices needed

Communications and information technology do not easily fit into existing approaches to education, including teacher education. The application of Information Technology takes the focus of attention away from the teacher to the information and the learner. The use of communications with IT is an extreme example of this and can involve the teacher in a time-consuming support role unless learners are encouraged to become autonomous. Such a change has been called for, so rather than being subversive, communication and information technologies can be seen as a means to promote new educational practices through which learners learn to manage their own learning with support and encouragement from teachers and other staff.

However, institutional structures in universities and schools do not easily adapt to flexible learning strategies, especially in terms of time and place. Frequently the pressure to cover an increasing range of knowledge within time-table constraints has meant that new approaches are dropped in favour of expedient practice. The sharing of resources across subject areas and courses requires careful management, including support from the senior management team, co-operative technicians, and a co-ordinator. Learners must be encouraged to take the lead and to use scarce resources when they are available. The increasing portability of communication and information technologies is opening up new opportunities for this.

5.2 Time, access and flexibility issues

In-service teacher educations in contrast, means releasing staff from school commitments to attend courses. Here the new multimedia communications can offer the flexible solution required. However senior managers and policy makers will still need to free staff time in order to promote the quality of interaction and reflection required for curriculum change. Similarly teachers who are learning to adopt new technology need easy access to it outside course time in order to practice and consolidate their knowledge.

5.3 Reflection on theory and practice

The use of communication and information technology with pre-service and in-service teachers (in schools and universities) frequently encourages them to revisit educational theory and renew their practice with considerable vigour. Most studies evaluating Information Technology in education conclude that the quality of learners' use of IT is dependent on the teacher, and that a range of strategies are important. Simply exploring information through new technology is not successful. Teaching strategies will include non-computer activities such as role play and direct fact giving. The important factor is that the teacher learns when to intervene and how to organise a varied learning environment.

5.4 Phasing

The considerable teacher education required will probably occur in phases. Cory (1991) has described the phases of IT adoption for schools; Maddux (1993) has described it for this field of research; and Davis (1992 a, b) has described it for staff in universities. Staff and institutions seem to go though a phase of enthusiasm for a particular application, a consolidation of this before adopting the next application. Care must therefore be taken to introduce applications which meet a teacher's need and then to provide time for consolidation before moving on. The first need may well be personal and is frequently word processing. Electronic communications have required this basic skill until the advent of multi-media communications and so have had to be left until a later stage of computer familiarity.

A second plateau occurs when teachers start to use the technology to teach, and at first they may find it impossible to hand control to learners. However, with time and the clarification of appropriate classroom management this skill can be developed.

The final stage of developing a wide range of teaching strategies is probably the most difficult and yet important. In this teachers must encourage their learners to take control and also to develop their own thinking and learning skills (metacognition). In the UK and other countries we have some distance to cover in order to achieve this. The current rate of educational change with a national curriculum and school-based teacher education is not helping. Teachers are facing an innovation overload which will slow the rate of change.

6. Applications of the UK experience to other countries (especially Central and Eastern Europe)

6.1 Suggestions for transfer of experience

Communications and information technology can provide a valuable support. The model of ResCue or the Open University (Illustrations I and 2) could be modified to address pressing needs, providing there are appropriate resources.

Where suitable expertise is developed, networks of teacher educators and teachers could provide mutual support for course and curriculum development. Collaborative projects within and across countries would provide a valuable stimulus to the development of a new curriculum and the use of target languages, as in those described for pre-service teacher education and the modern foreign language Newsday (Illustrations 3 and 4).

Multi-media communications could also be used in various university centres using wider-band communications, such as ISDN and SuperJANET (see Illustrations 5 and 6). The Exeter University Computer Conferencing Project is now developing approaches to use ISDN and SuperJANETfor professional development between universities and other places such as schools and training centres. There is little reason (apart from cost) to limit these wider-band communications to the UK.

6.2 Notes on technical concerns

Some technical issues should also be tackled. An appropriate communications infrastructure in the form of reliable phone lines and accessible IT resources is essential with appropriate management and support. Some target languages will require software development to display and transmit all the characters and accents. The lack of friendly and consistent interfaces has been a difficulty across the world. Similar difficulties with consistent interfaces affect multimedia communications in addition to increased cost. There should be educational rates for telecommunications as there are for other materials used in education, as called for by the 1993 World Conference on Children's Rights (Davis, 1993).

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TELETEACHING '93: Norwegian Contributions

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Abstract

Teleteaching 93 (TT93) was arranged in Trondheim, Norway August 20 25, 1993. The Norwegian Computer Society was technical operator on behalf of lFIP's Technical Committee on Education (TC3). In this paper, I will pre - sent the Norwegian contributions all relating to applications of communi - cation and information technology in distance education. 23 full papers and 6 short contributions will be examined Abstracts of all of them are prin - ted in Appendixes 1 and 2.
I will examine the content of the Norwegian papers by looking into:
- *which institutions are involved*
- *what types of technology have been used*
- *what areas of work are involved.*

In the concluding chapter, I will discuss the relations between institutions, technologies and areas of work and end up with some remarks on the futu - re use of technologies in Norway.

1. TELETEACHING 93

Teleteaching 93 (TT93) was arranged in Trondheim, Norway August 20 - 2S, 1993. The Norwegian Computer Society was technical operator on behalf of IFIP's Technical Committee on Education (TC3).

1.1 Objective

The objective of the conference was to demonstrate how telecommunication and information technology are used in education, distance education and distance working, and to highlight the social consequences this has on society.

1.2 Participation

The conference Programme consisted of nearly 200 contributions with keynote and invited speakers, paper and poster sessions, workshops, projects and demonstrations. The wide variety of contributions gave a very good presentation of the use of technology on a world-wide scale. Seldom or never have so many experts in different fields been together to discuss future trends in the use of technology. TT93 was not a conference for experts on technology. Originally we had planned a stream for experts on communication, but most presentations and participants came from the user side.

500 participants came from 42 different countries. A total of 94 papers were presented in paper sessions and published in the Proceedings (Davics, Samways, 1993). In addition, 32 papers were presented as short contributions in special sessions. They are not printed in the Proceedings, but their abstracts together with abstracts of the full papers were printed in a special book of abstracts. They are available on a listserver in Trondheim (Appendix 4)

In this paper, I will present the Norwegian contributions. 23 full papers and 6 short contributions will be examined. Abstracts of all of them are given in Appendices l and 2.

2. Appendices and tables

The facts and discussions in this paper are based upon the following Appendices and Tables:

2.1 Overview of appendices:

Appendix 1: Abstracts of Papers
Appendix 2: Abstracts of "Short Contributions"
Appendix 3: Institutions
Appendix 4: Electronic Information
Appendix 5: SOFF: Norwegian Execution Board for Distance Education
Appendix 6: NKI
Appendix 7: NKS

Appendixes 5, 6 and 7 have been downloaded from ICDL: The International Centre for Distance Learning, Open University, United Kingdom

2.2 Overview of tables relating to participation in the conference

Table 1: Institutions
Table 2: Technology
Table 3: Areas of Work

Table 4: Areas of Work Distribution by Technology and by Institutions

2.3 Proceedings:

The most valuable source of information for this summary has been the Proceedings from Teleteaching93:

TELETEACHING
Editors: Gordon Davies and Brian Samways
IFIP Transactions A-29
North Holland
ISBN: 0 444 81585 6
ISSN: 0926-5473

3. Introduction: Distance education in Norway

Norway has a long tradition for Distance Education (DE) with correspondence courses. One of the main reasons for this is the scattered population in geographically remote areas with little access to education. The education has traditionally been given by private institutions, but lately universities and schools have seen a new market in this area.

In the later years, there have been many projects in DE using telecommunication services such as datacommunication, satellite TV and Inter-active TV. The projects have not only been in DE, which is well documented in this paper.

3.1 Sources of support

Different sources of funding have been an important factor in establishing the projects and activities on a broader scale than documented in this paper. I will especially mention the following contributions.

3.1.1 Ministry

The Norwegian Ministry of Education, Research and Church Affairs has since 1984 run a very large project related to introducing computers in education. Pedagogical software has been developed and tried out in special project schools. In 1986, a project started about using data communication in education. An advanced software product called Winix (LAN, Unix on server and Windows 3.1 on workstations), has been developed and used both in education and DE. Its main applications in connection with this paper are e-mail and electronic conferences.

Many of the Norwegian papers in Teleteaching 93 are based upon the use of Winix.

3.1.2 Soap

The Norwegian Executive Board for Distance Education at University and College Level, with the acronym SOFF, was appointed by the Royal Norwegian Ministry of Education, Research and Church Affairs in 1990 as a three-and-a-half-year project. SOFF is a national advisory body in the field of distance education (DE).

SOFF has funded many of the projects described in the Teleteaching 93 papers.
For more information about SOFF, see Appendix 5.

3.1.3 Norwegian Telecom

Norwegian Telecom has worked actively to create a market for new services and products by funding projects, mostly in DE. Norwegian Telecom Research has the responsibility to set up the projects.

3.1.4 Private agencies

I would also like to mention the contributions from two private institutions, NKI and NKS. Detailed information about these are given in Appendix 6 (NKI) and Appendix 7 (NKS).

3.2 Organisation of rest of the paper

In the following, I will examine the content of the Norwegian papers by looking into:

- which institutions are involved
- what types of technology has been used
- what are the areas of work.

In the end I will draw some conclusions based upon the findings.

References to the papers will be made by the numbers used for the reports in Appendix 1 and 2.

4. Institutions in Norway involved with Distance Education and reporting at Teleteaching 93

Appendix 3: the institutions involved in the Norwegian projects in alphabetical order. The total number of institutions are 21.

Table 1 shows the institutions divided into the following categories:

A. Upper Secondary Schools
B. Universities
C. Private schools or institutions
D. Norwegian Telecom

A. Upper Secondary Schools
B. Universities
C. Private schools or institutions
D. Norwegian Telecom

Table 1 also shows the category to which each paper belongs and the number of papers in each category.

Comments to each category:

Table 1: INSTITUTIONS

Codes:	Technology	Sum
USC	Upper Secondary Schools	7
UNI	Universities	7
PRI	Private schools or institutions	6
NTC	Norwegian Telecom	4
COL	Colleges of Education	4
CEA	County Educational Authorities	1
MIN	Ministry of Education	1
NAF	Norwegian Armed Forces	1

Nr:	USC	UNI	PRI	NTC	COL	CEA	MIN	NAF
1		1		1				
2							1	
3		1						
4		1						
5								
6			1					
7	1							
8	1							
9					1			
10		1						
11	1							
12		1		1				
13	1							
14		1						
15					1			
16	1							
17			1					
18	1							
19			1					
20		1			1			
21	1							
22								1
23			1					
24			1					
25					1			
26			1					
27				1				
28						1		
29				1				
Sum:	**7**	**7**	**6**	**4**	**4**	**1**	**1**	**1**

4.1 Upper Secondary Schools

The age range of students is normally 16 - 19 years. Upper secondary education in Norway comprises general academic education and all sorts of vocational education.

Most of the schools give courses in a wide variety of subjects, but the papers deal mostly with general education.

List of the schools in alphabetical order with reference to paper number:

- Eikeli Upper Secondary School (13)
- Firda Upper Secondary School (21)
- Hamaroey Upper Secondary School (7 and 8)
- Honningsvaag Upper Secondary School (16)
- Maaloey Upper Secondary School (2 1)
- Nordreisa Upper Secondary School (11 and 18)

There are seven papers from these 6 schools. Two of the schools gave a paper together (13). Projects from three of the schools were funded by the Ministry of Education (7, 8, 11, 16 and 18). One of the schools (13) was funded by money from the Ministry of Education and from Norwegian Telecom. The last two (13) were funded by money from local county educational authorities.

It is interesting to notice that no papers were given by secondary or elementary schools. This does not mean that it is no activity m these schools. The main reason why is that teachers on this level have no tradition for writing papers.

4.2 Universities

Three out of Norway's four universities were represented with papers.

List of the universities in alphabetical order with reference to paper number:

- University of Oslo (3, 12 and 14)
- University of Tromsoe (1)
- University of Trondheim (4, 10 and 20)

The total number of papers were 7.

Two of the papers (1 and 12) were given together with Norwegian Telecom.

One paper (20) was a co-operation with Trondheim College of Education.

4.3 Private schools or institutions

List of the institutions in alphabetical order with reference to paper number:

- BI - Norwegian School of Management, Oslo (26)
- NKI (17, 19 and 23)
- NKS (6)

The total number of papers were 5.

Short comments about the institutions:

BI - Norwegian School of Management, Oslo, is the biggest and most recognised private Norwegian school in business education on the university level.

Information about NKI and NKS is given in Appendix 6 (NKI) and Appendix 7 (NKS).

4.4 Norwegian Telecom

Four papers (I, 12, 27 and 29) were from a special department of Norwegian Telecom, Norwegian Telecom Research.

Paper 1 together with University of Tromsoe.

Paper 12 together with University of Oslo.

4.5 Colleges of Education

The Norwegian colleges of education educate teachers for elementary and lower secondary education. (age range 7 to 16). Universities educate teachers for lower secondary (13 - 16) and upper secondary (16 - 19).

List of the colleges in alphabetical order with reference to paper number:

- Alta College of Education (25)
- Bergen College of Education (15)
- Sogndal College of Education (25)
- Trondheim College of Education (20)

The total number of papers was 4.

One paper (25) was given together by two colleges.

One paper (20) was given together with the University of Trondheim.

4.6 Other institutions

County Educational Authorities

Paper 28 is from the Soer-Troendelag County Authorities, Trondheim

This project is financed by the Ministry of Education.

Ministry of Education

Paper 2 is from Ministry of Education, Research and Church Affairs

Norwegian Armed Forces

Paper 22 is from Naval District Oestlandet, Horten

5. Technology used for Distance education in Norway

Table 2 shows a survey of the technology used and the technology used for each paper. We have the following categories with number of papers for each listed:

Computer-mediated communication: 20
Interactive TV: 6
Telephone and telefax: 2
TV: 2
Software: 2
Radio: 1
Multimedia network: 1
Video: 1

In the following we will go into some detail for each category.

5.1 CMC: Computer-mediated communication

There was total of 20 papers involved with CMC. CMC was by far the most used.

CMC (Computer-mediated communication) covers a wide area of services such as e-mail, electronic conferences, LAN (Local Area Networks) and BBSs (Bulletin Board Systems). A closer survey of the papers shows that the following services were used, (with total number of papers for each category, as well as individual paper-numbers).

5.1. 1 LAN (Local Area Networks): 9

It is interesting here to note that only one system is involved. The system used is called Winix and has been developed in Norway by the Ministry of Education. It is based on Unix on server and Windows 3.1 on workstations. Internet-addresses.

Papers: 7, 8, 9, 11, 16, 18, 20, 22, 28

5.1.2 BBS (Bulletin Board System): 4

Papers: 2, 21, 23, 26

5.1.3 UNINETT (The University Network as part of Internet): 3

Papers: 12, 14, 15

5.1.4 Minitel: 1

Paper: 13

5.1.5 Research overview

Three of the papers (6, 17 and 19) were of "research character" while the others presented the results of projects.

The headings of the research papers illuminates what was examined:

- The Pedagogical and Technological Challenges in Computer-Mediated Communication in Distance Education (6)
- Pedagogical Techniques for Computer-Mediated Communication (17)
- Experiences with Computer Conferencing and Teleteaching at NKI, Norway (19)

It is also interesting to note that these three papers were given by private institutions (NKI and NKS).

5.2 ITV: Interactive TV

A total of six papers were involved interactive TV, after CMC the next-highest category on the list of technologies used for distance education in Norway.

By ITV we will understand a two-way TV connection. Video-conferences are also a commonly used word for this technology.

There are different standards for ITV which is reflected by one paper using 2MB-connection and four papers using ISDN Videophone (64KB). In recent years there have been many projects in Norway using both these standards. We are now entering a more stabled phase with common use of these services in many different educational areas. This also illustrates very well the heavy involvement of Norwegian Telecom in this area.

5.2.1 2MB-connection

Paper: 1

5.2.2 ISDN Videophone

Papers: 4, 12, 25, 29

5.2.3 Research

One of the papers is of a research character : Videoconferences and Videotelephony: A Pedagogical Challenge in Distance Education (27).

5.3 TEL: Telephone and telefax

There were two papers involved: 11 and 26.
We have put telephone and fax together as both papers involved used the services in combination. It is also interesting to note that TEL services were used in combination with:

- CMC and software packages (11)
- CMC and Video (26).

5.4 SW: Software

There were two papers involved: 11 and 18

I assume that SW was used in many other projects, but these were the only presentations that explicitly said they were using a certain SW product as an integrated part of the project SW were used in combination with CMC and TEL.

5.5 RAD: Radio

There was one project involved using radio: 10. Radio is used in combination with TV.

5.6 MNW: Multimedia network

There was one project which involves a trial 34Mbit/s switched network interconnecting the four universities in the country: 3

5.7 VID: Video

One project: 26. ideo is used in combination with CMC and TEL.

Table 2: TECHNOLOGY

Codes:	Technology	Sum
CMC	Computer mediated communication	20
ITV	Interactive TV	6
TEL	Telephone and fax	2
TV	TV	2
SW	Software	2
RAD	Radio	1
MNW	Multimedia network	1
VID	Video	1

Nr:	CMC	ITV	TEL	TV	SW	RAD	MNW	VID
1		1						
2	1							
3							1	
4		1						
5								
6	1							
7	1							
8	1							
9	1							
10				1		1		
11	1		1		1			
12	1	1						
13	1							
14	1							
15	1							
16	1							
17	1							
18	1				1			
19	1							
20	1							
21	1							
22	1							
23	1							
24				1				
25		1						
26	1		1					1
27		1						
28	1							
29		1						
Sum:	**20**	**6**	**2**	**2**	**2**	**1**	**1**	**1**

6. Areas of application

Table 3 shows a survey of the areas of application of distance learning and the area(s) for each paper.
We have defined the following categories with number of papers for each listed:

Distance education: 15
Distance working: 6
Education m the classroom: 5
Research: 5

In the following we will go into some detail for each category.

6.1 DE: Distance education

A total of 15 papers were listed under DE. This was by far the most used area of applications.
We may distinguish between the following sub-areas, with the number of papers for each area :

1. Medical field: 1
2. University level: 8
   This comprises universities, teacher colleges etc.
3. Upper secondary level: 5
4. Business education: 1

It is worthwhile to go into some more detail under this heading to analyse the type of DE which is being given. The headings given are the titles of the papers. The number of the paper is also given for each paper.

6.1.1 Medical field: 1

Teaching and Learning Aspects of Remote Medical Consultations (1)

6.1.2 University level: 8

- Distributed Electronic Classrooms with Large Electronic White Boards (3)
- JITOL: Just In Time Open Learning (9)

Table 3: Areas of work

Codes	Areas	Sum
DE	Distance education	15
DW	Distance working	6
EDU	Education: In the classroom	5
RES	Research	5

Nr:	DE	DW	EDU	RES
1	1	1		
2		1		
3	1			
4		1		
5				
6				1
7		1		
8		1	1	
9	1			
10	1			
11	1			
12	1			
13			1	
14	1			
15		1	1	
16	1			
17				1
18			1	
19				1
20	1			
21	1			
22	1			
23			1	
24				1
25	1			
26	1			
27				1
28	1			
29	1			
Sum:	15	6	5	5

- Distance-Teaching: Technological Possibilities and Resource Constraints (10)
- Teleteaching in a Graduate Seminar: Practical Experiences and a Look Ahead (12)
- Learning Computer Network Services by Using Them in Familiar Surroundings (14)
- Conference-Based Teaching of a First-Year University Course in Mathematics (20)
- To be Seen on the Screen -Is That the Question? (25)
- The Videtelephone Experience in Higher Education in Norway (29)
- Videophony is the answer, but what is the question?

6.1.3 Upper secondary level: 5

- Distance Education that is Human, Low-cost, and High-tech (11)
- Distance Education in Finnmark, North-Norway. A SPINN Project. (16)
- The FILAM Project, a Low Profile Approach to Computerized Distance Teaching (21)
- The Winix Project in the Oslofjord Area (22)
- Technology against Centralization. Distributed Classes (28)

6.1.4 Business education: 1

- Computer Conferencing within a Distance Education System Based upon the Students
- Freedom of Choice (26)

6.2 DW: Distance working

There were total of 6 papers listed under this heading.

The papers addressed the following types of distance working, as indicated by the titles of the papers. The titles are given with the number of the paper and a short description.

1. Teaching and Learning Aspects of Remote Medical Consultations (1) A doctor without specialist education, is educated by a professor in TromsO. They are working together on heath diagnoses of patients.
2. Teachers in Network (2)
   A national network has been established for teachers using CMC for communication. The network is used mainly for discussion on subject and other matters.
3. Video telephones and Norwegian Sign Language: Systemic Constraints on Communication in a Visual-Spatial Channel (4)
   Sign language communication between eight deaf adults fluent in Norwegian Sign Language
4. Data communication - A Tool in Planning and Bringing Through the SPINN Project (7)
   The SPINN-project has established a project group with members from three different schools and a central project manager. The paper gives experiences from the work in the group.
5. LUPEN, a Project in the Teaching of Literature at Elementary Levels in Secondary Schools. (8)
   The students answer questions from the teacher and work together on specific tasks using electronic conferences. Teachers from different schools work together to establish the project in co-operation.
6. A Pedagogical Network of Schools in the Bergen Region (15)
   The project is established and run by Bergen College of Education. The network is used to exchange meteorological data between the schools.

6.3 EDU: Distance Education: In the classroom

A total of five papers were presented. All the projects involved use data communication as part of the classroom activities in different school subjects. Titles of the papers are given with the number of each paper.

1. LUPEN, a Project in the Teaching of Literature at Elementary Levels in Secondary School. (8)
2. Sans Passeport: Learning French in Norwegian Schools (13)
3. A Pedagogical Network of Schools in the Bergen Region (15)
4. International E-mail in Language Instruction (18)

5. Using E-mail in an English Class at NKI (23)

It is interesting to note that three of the papers (13, 18 and 23) are about learning foreign languages, one (1) about Norwegian literature and the last one (15) about environmental studies

6.4 RES: Research

A total of five papers were in the category.

Titles of the papers are given with number of each paper.

1. The Pedagogical and Technological Challenges in Computer-Mediated Communication in Distance Education (6)
2. Pedagogical Techniques for Computer-Mediated Communication (17)
3. Experiences with Computer Conferencing and Teleteaching at NKI, Norway (19)
4. Satellites and Distance Education (24)
5. Videoconferences and Videotelephony: A Pedagogical Challenge in Distance Education (27)

Three of the papers (6, 17 and 19) were research about the use of CMC. The other two concern the use of TV (24) and Inter-active TV (27).

7. Conclusions

In the preceding sections we have looked into descriptive statistics about institutions, technology and areas of work, in separate discussions. Conclusions have been based upon statistics for each category and, to a certain extent, between the categories.

In this chapter I want to look more into relations between the categories and the future use of technologies in Norway distance education.

7.1 Relations between the categories.

Table 4 shows the areas of work distributed on technology and institutions.

Comments will be based upon the institutions:

(The conclusions drawn are also based upon my general knowledge of the situation in Norway. The papers alone may give a false picture of what is going on.)

Table 4: Areas of Work Distributed on Technology and Institutions

Technology Codes:	Sum			Institutions Codes:	Sum
CMC	22			USC	10
ITV	8			UNI	9
TEL	2			PRI	8
TV	2			NTC	5
SW	2			COL	4
RAD	1			CEA	1
MNW	1			MIN	1
VID	1			NAF	1

Nr:	CMC	ITV	TEL	TV	SW	RAD	MNW	VID	Sum:
USC	7		1		2				10
UNI	3	3		1		1	1		9
PRI	5		1	1				1	8
NTC	1	4							5
COL	3	1							4
CEA	1								1
MIN	1								1
NAF	1								1
Sum:	**22**	**8**	**2**	**2**	**2**	**1**	**1**	**1**	**39**

7.1.1 Upper secondary schools.

All seven papers involve CMC as technology. No use of ITV, is the most significant observation. One obvious reason is that ITV is too expensive for education in schools.

7. 1.2 Universities

The papers involve nearly all technologies listed, with three papers relating to CMC and ITV and one on MNW. The last one (MNW) is very interesting because it concerns the future network between the universities and the potential for DE and DW.

The universities have the necessary funding for experimenting with new communication technologies. The problem is on the student side in DE. Do they have economy to afford, for example, ITV?

7.1.3 Private schools or institutions

Five papers concern CMC and one TV. They were all research papers. The reason why ITVis not represented with many papers is economy. ITVis still too expensive to be used commercially in Norway on a regular basis.

7.1.4 Norwegian Telecom (NTC)

NTC is mostly involved with projects using ITV. This was already mentioned in the Introduction-section:

"Norwegian Telecom has worked actively to create a market for new services and products by funding projects, mostly in DE. Norwegian Telecom Research has the responsibility to set up the projects."

7.1.5 Colleges

Three papers concern CMC and one ITV. The project with ITV(Paper 25) was very interesting, but I doubt that colleges can afford to use ITV on a regular basis in the near future.

7.1.6 Other institutions

County Educational Authorities

There was only one project using CMC but a very interesting one with distributed classes. This may be the future for small schools with a very limited amount of subjects to offer the students.

Ministry of Education, Research and Church Affairs

There was only one project (Paper 2) using CMC, a very interesting project about setting up and running an infrastructure for teacher co-operation.

In addition we should also mention all the other projects financed by the Ministry. They are represented under 7.1.1.

Norwegian Armed Forces

There was one project (Paper 22) from the Naval Forces, using CMC. This project shows a great potential for the future. All the Navy's landbased installations will be equipped with LANs and can communicate with each other and with schools, universities and other institutions. DE can be given to all personal by any institution.

7.2 The future use of technologies for Distance Learning in Norway.

Many conclusions on this have already been given in section 7.1. In addition I would only like to mention the following trends. The discussion is based upon the remarks in the Introduction section.

7.2.1 Factors related to Norwegian geography

One of the main reasons for the many projects with DE in Norway are the scattered population in geographically remote areas with little access to education. With new and cheaper opportunities for communication, I expect DE to be growing in the future.

7.2.2 The role of the Norwegian Ministry of Education, Research and Church Affairs.

The Ministry has been a very active partner up to now funding projects. A new policy has however now been introduced where the Ministry will not any longer fund projects in schools. Instead they will take care of the national infrastructure for data communication. The consequences of this new policy are yet to be seen. Local school authorities are very short on economy for the moment and thus we can't expect as many projects as in the previous years.

7.2.3 The role of SOFF (The Norwegian Executive Board for Distance Education at University and College Level, see Appendix 5)

SOFF has funded many projects on the university level during their first four-year plan. They have just started on a new four-year plan. This gives expectations for the future development of DE on the university level. SOFF is not involved below university level, but teachers in schools may benefit from the SOFF projects because they are one of the main target groups for the education given by SOFF institutions.

7.2.4 The role of Norwegian Telecom (NTC)

As stated many times, NTC has done a lot, especially on the ITV-sector for distance education in Norway. New products are being developed for ISDN applications and I expect that Norwegian Telecom Research will still be active in this sector with projects in the future. Time will show if there is a market for these products in education.

With great hopes for the future use of telecommunication technologies in Norwegian education, I conclude this paper.

APPENDIX 1:

ABSTRACTS OF PAPERS

Full versions of the papers are printed in Proceedings:
TELETEACHING
Editors: Gordon Davies and Brian Samways
IFIP Transactions A-29
North Holland
ISSUE: 0 444 81585 6
ISSN: 0926-5473

1:
Teaching and Learning Aspects of Remote Medical Consultations
Sigmund Akselsen,
Norwegian Telecom Research,
P. O. Box 1 156,
N-9001 Tromsoe,
Norway
Svein-Ivar Lillehaug,
Institute of Community Medicine,
University of Tromsoe,
N-9037 Tromsoe,
Norway

Abstract
This paper discusses educational effects of remote medical consultations. First, a definition of telemedicine and a brief overview of some of Norwegian Telecom Research's remote consultation applications is given from an educational perspective. Some state of the art theories of teaching and learning are presented and discussed. Then, the focus is put on functionalities that can increase the educational outcome from remote consultations. Finally, possible impacts on society from life-long learning through remote consultations are discussed and thoughts on future work are given.

Keywords: Computer Applications, Life and Medical Sciences; Information Systems Information Systems Applications, Communications Applications; Computing Milieux, Computers and Education, Computer Uses in Education.

2:
Teachers in Network
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Abstract
The paper describes the development of, and experiences from an electronic network for teachers in Norwegian upper secondary schools. About 800 users have been registered up

to now. The work is concentrated on the "user-operated network", involving moderators, advisers, editors etc.
In total about 15 moderators are involved in 40 topics. International links are becoming an increasing part of the activity.
The main objective has been to increase competence on how to make use of electronic conferences and electronic mail for educational and administrative purposes.

Keywords: Communication Application; Group and Organization Interfaces; Computer Uses in Education.

3:
The MUNIN* Project - Distributed Electronic Class Rooms with Large Electronic White Boards
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Abstract
The Norwegian PTT and UNINETT has established a trial 34Mbit/s switched network interconnecting the four universities in the country. The main usage of the network will be for distributed Multi Media applications. One application on the "Supernet" is what we understand by distributed electronic class rooms being located at the different universities. Via "electronic white boards", students can follow the same lecture simultaneously from class rooms distributed at several universities. The teacher will reside in one of the class rooms together with the local students. In addition to the teacher, the students in ALLthe class rooms can write (and erase) on the "same" distributed board in real time during a lecture, e.g. if the lecture is more like a seminar. Another advantage is that the teacher on the electronic board has to his/her disposal all the presentation possibilities provided by modern multimedia work stations such as video, still pictures, animation and sound . Appart from the possibility to achieve advanced education at a distance, we believe that this will also make it possible to provide qualitatively better lectures.

*According to Norse mythology "Hugin and Munin" were the messengers of Odin.

4:
Video telephones and Norwegian Sign Language: Systemic Constraints on Communication in a Visual-Spatial Channel
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Abstract
Video telephones present a new and interesting medium for long distance communication, especially for Deaf and hearing-impaired people.
This article presents a discussion of some findings of an evaluative study of a prototype video telephone system developed by Tandberg Telecom A/S and the Norwegian Telecom Research Department (NTRD). The study was carried out at the request of NTRD by a research team with members from the University of Trondheim and the Norwegian Institute of Sign Language (IT). Sign language communication between eight Deaf adults fluent in Norwegian Sign Language was used as a test of the efficacy of the video telephone system.

The equipment we tested seems still to have many critical limitations as regards maintainance of the very high level of image quality and transmission rate that normal sign language communication demands.

Keywords: Input/output and data communications, Data communication devices; Performance analysis and design aids; Compression (Codi ng) (E.4)

5:
Technology is Key to Supporting Andersen Consulting and Arthur Andersen Education Strategies

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Abstract
Skilled people are our firm's most important resource. We make major investments in training, and faced with rapid growth, technology is fundamental to our new learning strategies. The time has come for classical training to make way for new approaches. The purpose of this paper is to describe how technology is helping to meet the personnel development challenges facing the Arthur Andersen Worldwide Organisation. After describing the challenges, the evolution of education strategies is presented to give context to the use of technology in a challenging environment. Specific training solutions are described to understand the extent that the firm has invested and broken new ground in the use of technology as a part of its personnel development strategies.

6:
The Pedagogical and Technological Challenges in Computer-mediated Communication in Distance Education

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Abstract
Computer-mediated communication (CMC) is a relatively new phenomena in education and learning, and our knowledge about this new educational form is limited. The CMC technology has to be considered as a single element in a total educational system, and the other basic elements in this system should influence and determine the choice of the technology. The technology shall not separately determine the pedagogical model.

Educational computer-mediated communication is a complicated field, which affects organisational, sociological, pedagogical, technological and economical areas of research. This paper is restricted to mainly examining some issues and problems connected to text-based CMC-technology, and focuses on the following approaches connected to educational CMC:
1. Does CMC support collaboration in distance education?
2. How important are interface features and specific software and system design in determining the success of educational CMC?

Keywords: Models and Principles, System and Information Theory; User/Machine Systems; Information Interfaces and Presentation, User Interfaces; Group and Organisation Interfaces; Computers and Education, Computer Uses in Education.

7:
Datacommunication - a Tool in Planning and Bringing Through the SPINN-project
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Abstract
SPINN is the name of a project involving three secondary schools situated in the northern part of Norway: Honningsvaag secondary school, Nordreisa secondary school, and Hamaroey secondary school.
The project is financed and run by the Norwegian Ministry of Education, which also has developed Winix, the software used in local area networks (LAN) and in communication between the participating schools (WAN) and in distance education. Winix is based upon Windows, and Unix as the operating system on the servers. The project was established in the autumn of 1989.
Since 1987 the members of the "Ideagroup" (a group established by the Norwegian Ministry of Education to help work out projects in
telecommunication), and later followed by the project-managers of SPINN, have co-operated. Electronic communication has been a useful tool in our work. The members are scattered and there are large costs involved in arranging meetings.
This article describes the background of this co-operation, the tools we have used for datacommunication and the experiences we have achieved. It concludes with an evaluation of this kind of collaboration.
Keywords: Datacommunication, Distance working, Education

8:
LUPEN, a Project in the Teaching of Literature at Elementary Levels in Secondary School.
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Abstract
This is a description of a project which took place in 1991/92 in the three SPINN schools Hamaroey, Honningsvaag and Nordreisa secondary school (SPINN, the School Project In Northern Norway).
There were two main goals in this project: a) The teaching of literature b) Using electronic mail and conferences (WINIX).
There were two conferences, one for the students and one for the teachers. What we intended to do, was to let our students ask good questions and then make them public in the conference, so that other students could try to answer them. First, the students were more interested in talking to the other students than talking about literature. We also think it was very difficult to follow things up at the times when we had agreed. We think it is very important that there is a strong leader who can see to it that everybody does what is wanted at the time which has been agreed upon.
Our students seemed to like working in this way, they could see that a computer is a very useful tool, not only when using a word procesor, but also as a tool for electronic communication. We think that our students thought this was a better way of "talking" and learning about literature than "ordinary" classroom teaching. In the final section of my paper, some of the contributions in the student's conference have been translated into English.

Keywords: Computer Uses in Education

9:
Just In Time Open Learning - a European Project from a Norwegian Point of view

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Abstract
The European DELTA programme has as its main objective not to provide education or training, but to facilitate and prepare systems to make access and distribution of learning simpler. Among new projects starting in January 1992, JITOL - Just In Time Open Learning - involves 12 partners, among them The Norwegian Ministry of Education. The core objective of the JITOL project is to gain experience through user trials - or pilot testing - of open learning in different settings. While the initial proposal had several categories of learners involved, the final project ended up with three groups:
advanced learning technology professionals (ALTP), diabetic self-help therapy (DSHT) and corporate staff (CS).

Activities are organised through seven work packages:
WPI JITOL System Development Work,
WP2 Evaluation, Testing and Validation,
WP3 Advance Learning Technology Professionals (ALTP), pilot testing of open learning,
WP4 Diabetic Self-Help Therapy (DSHT), pilot testing
WP5 Corporate Staff (CS), pilot testing,
WP6 JITOL Implementation and Marketability,
WP7 Project Management

Norwegian participation was initiated by expressed interest in the Norwegian WINIX concept, an integrated system with network and communication software as the most central features. In addition the MA& Ph.D. studies in Educational Information Science, based on a distributed learning model, would fit nicely into the ALTP user trials of WP3. These two assets made Norway an interesting partner for WPI and WP3. A Norwegian desire to build up national competence and experience in project evaluation related to new information technology projects, naturally lead to participation also in WP2.

Norwegian activities are concentrated on these 3 work packages. Winix software is being adjusted to JITOL requirements, first user trials are presently under way, evaluation follows, and part of this will soon be available.

Keywords: Communications Applications; Computer Uses in Education

10:
Distance-Teaching : Technological Possibilities and Resource Constraints

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Abstract
Distance-teaching projects place new resource demands on educational planning. The use of the new technology is expensive, and cannot be introduced within existing educational budgets. The demand made on human resources is also high, and developing distance taught courses involving use of new technologies at a time when human resources are scarce is difficult or impossible. New administrative and financing routines will need to be initiated if major, high-cost distance-learning projects are to succeed. The same is true of the political planning of educational developments. These issues are explored in the context of a national project involving the University of Trondheim and national Norwegian radio and television, which offers half of a first-year university English course to distance students over the whole of Norway.

11:
Distance Education that is Human, Low-cost, and High-tech

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Abstract
Cooperating with county educational authorities and neighbouring municipalities, Nordreisa Upper Secondary School in 1988 set out to make GCE-courses available to adults in a part of Northern Norway characterised by economic crisis and lack of education.
Eventually, teleteaching turned out to be the only means by which we might accomplish our original objective, which was to establish educational facilities that would make it possible for adults in the entire area to improve their qualifications - also after the threes year project period was over. Furthermore, we wanted to make it possible for students to join a course at any time, and study in a tempo adjustable to other demands on their time.
To accomplish this, we developed teaching strategies, extensive subject kits and advanced software packages. Groups at different locations are taught simultaneously in a seminar-

like manner over two-way speaker phones, and we make extensive use of computers with communication software and of faxes, where computers are not available.

Keywords: Arts and Humanities; Computer Uses in Education

12:
Teleteaching in a Graduate Seminar: Practical Experiences and a Look Ahead

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Abstract
We describe the implementation of distance education in a graduate seminar at the University of Oslo, where two groups of students followed a seminar from different locations. Avideo conferencing system was used to communicate between the two sites. The use of video conferencing in distance education has mostly been limited to controlled experimental studies by researchers in the field. Our starting point was different - we had a need for communication and took advantage of existing infrastructure and current technological equipment. We describe the videoconferencing facilities used, and summarize factors that made this form of distance education feasible.

Reactions from students and guest lecturers are summarized. Several participants at both locations thought the use of video transmissions had a positive impact on the seminar. Some enjoyed gaining experience in using the new medium. Others thought the added number of participants improved the discussions. Students located with the lecturer were much less distracted by the video transmission. Several regretted the lack of informal social interaction in breaks and after lectures.

Our experiences show that it is possible to use current videoconferencing systems for graduate level educational purposes. We found a number of factors to be requirements, including existing infrastructure, no initial investments, minor running costs, supportive attitudes from the involved organizations, available technical assistance, and an excess of enthusiasm on the part of all participants.

Electronic communication can be divided in two isochronous communication operates in real time and allows interaction, while asynchronous media do not have rigid time constraints and can be accessed whenever convenient. The video link attempts to substitute the "isochronous" lecture, but has no support for "asynchronous" data such as announcements and handouts which is better handled by electronic mail. Since participants had access to electronic mail, the mailing lists became an important channel of communication that complemented the video link. Adding more channels of communication could further increase the quality of teleteaching, and at the end we relate our experiences to the ongoing development in groupware and electronic classrooms.

By basing future teleteaching system on general computers with network conllections, and tailor tools for teleteaching, one might increase the chances of offering distance education as an extension to already established courses. Tomorrow's electronic classroom should be set up so that following lectures from a distance involves no extra work for students or lecturers.

13:
Sans Passeport: Learning French in Norwegian Schools

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1347 Hosle, Norway

Abstract
1. PRESENTATION OF THE PROJECT. The Ministry of Education, the Telecommunication Administration, and French authorities supported the project in 89/90.
2. POLITICAL ASPECTS OF THE PROJECT. The project was created as a means to strengthen French in Norwegian schools.
3. TECHNOLOGY. At length the French MINITEL proved uneconomical and unpedagogical. Professor dr. es sc. Christian Athenour, University of Nice, developed a communication software, EDE, for the project.
4. A SHORT OVERVIEW OF THE PROJECT IN THE ORIGINAL 11 NORWEGIAN SCHOOLS.
5. CONDITIONS FOR RUNNING THE PROJECT AT EACH SCHOOL.
The teachers' competence in the use of newtec varies greatly. The schools are equipped differently.
6. TELETEACHING AND DATABASES - A NEW WAY OF TEACHING AND LEARNING FRENCH.
French with telecom as optional subject.
Thematic telecommunication as integrated work.
Teleteaching with French databases as optional hours.
Preparatory work on database teaching takes place at the teleregions before the bases are downloaded in the classroom. Exercises and tasks for the databases are authored.
7. METHODOLOGY IN TELETEACHING WITH DATABASES IN FRENCH. Teleteaching can be structured as written and oral work, as well as it can exploit the possibilities in word processing. It is also used in combination with other software and in the language laboratory.
8. STRATEGY FOR THE SCHOOL YEAR 92/93.
Essay-writing based on databases. Syntactic and lexical maturity and progress will be measured with other software. French and Norwegian schools cooperate on the production of questionnaires. The result will be analysed on NSD Stat. Each Norwegian school produces one item of information on Norway's speciphicity. These three activities will be sent via E-mail to a central teacher. The activities also aim at pointing out social, cultural and linguistic differences.

14:
Learning Computer Network Services by Using Them in Familiar Surroundings

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Abstract
Linked to UNINETT (the Norwegian academic network which is part of Internet), users have access to an international communication infrastructure through interconnected computers. The network provides computer-mediated communication (CMC) and resource sharing services. The present project FIK (Distance Education through Communication Services) is aimed at increasing the number of users of the network services. The target group is users and potential users of UNINETT's services within the college- and university community.
Through a distance education course the participants learn to use the services from their own computers in familiar surroundings. The course curriculum includes text-based services, and these are also used for interaction and educational purposes. The project deals with several challenges; developing an educational model, developing the course content and material, educational purposes, administrative tasks and use of different CMC media in distance education.
This paper gives a presentation of the FIK-project, focusing on some of the challenges, and presents some views on how the course can be applied over wide areas and form a basis which makes other courses available by use of the same services.

15:
A Pedagogical Network of Schools in the Bergen Region
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Abstract
A model for open systems is presented. The model is used to establish-a computer network of schools in the Bergen region. The network is used to exchange meteorological data between the schools. A database program in Prolog is developed to manipulate the meteorological measurements. The pedagogical network is also used in English education. A cooperation with the Norwegian Telecom in building a ISDN-network for schools is also presented.

Keywords: Open Systems, Network of Schools, Meteorological Database in Prolog, ISDN.

16:
Distance Education in Finnmark, North-Norway. A SPINN Project.
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Abstract
This paper describes aims, methods for and experiences from a project for Distance education. The participants have been several groups of fishfarmers in Finnmark, the northernmost county in Norway. The incentives for the project were both to raise the professional skills in a specific industry and trying CMC as a pedagogical tool for distance education on the outskirts of the county. The project has been financed by the

authorities in Finnmark as part of a programme to increase the professional skills in the fishing industry.

All of the fish-farming units are mainly situated in sparsely populated areas with no offers in Fishfarming subjects at local schools. The long distances and rough weather conditions in Finnmark, especially during winter, made it a great challenge to run an educational program. Data communication was expected to be a perfect tool for communication between the participants and the teachers.
This paper will give a short description of the planning process, the methods we were using and our experiences during the project.

Keywords: Computer Uses in Education

17:
Pedagogical Techniques for Computer-mediated Communication
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Abstract
This paper presents a literature review of pedagogical techniques that have been used in courses taught via computer-mediated communication. The review intends be of value for program planners, course designers, and teachers who are involved with CMC courses. The paper presents examples from CMC implementations of learning contract, mentorship, apprenticeship, lecture, debate, simulation, role play, discussion, transcript assignment, brainstorming, delphi, and project.

18:
International E-mail in Language Instruction
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Abstract
Nordreisa videregaaende skole in Northern Norway has used E-mail for a number of years, for general communications purposes as well as in instruction.
E-mail is but one of the tools in our experiment with Computer Assisted Learning. Other tools are a grammatical adviser, an electronic dictionary, a dictionary of English prepositional phrases to name some.
So far, we have found these tools of particular value to language instruction. We have participated in a UNESCO-sponsored project on the global environment last year, where students from some ten countries have
examined their local environment, as well as discussed global implications. Schools need to build up a local system for the distribution of international E-mail in order to make the concept catch on. Such projects have to be well planned in order to be fruitful.
A UNIX-like E-mail system would take much of the hassle out of local organisation of international E-mail. This makes direct student - to - student links available.

About the author: I have been head of project for the local branch of the SPINN project and member of the central project group since its origin in 1987. I teach English and German.

19:
Experiences with Computer Conferencing and Teleteaching at NKI, Norway *Tor - stein Rekkedal,*
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Abstract
The paper discusses problems and challenges facing distance learning institutions which are in the process of introducing new media and communication technology into existing teaching/learning systems relative to those facing institutions entering the field of distance education via the new developing technologies. On this basis the paper describes research and experiments on new media applications at NKI, a Norwegian "multiform" teaching institutions operating a "large scale" distance teaching istitution as one main unit.
The paper focuses on the development of the EKKO computer conferencing system for distance education and experimentation with different educational applications during the last 5 years.
It is the authors view that NKI and others have collected a lot of practical experience on the administration of distance education based on computer conferencing as an optional or the main communication medium. However, the practical experiences have till now not lived up to the visions of a possible breakthrough or paradigm shift in distance education pedagogical practice.
The author points to some few conclusions from the experiments, but stresses the need for further research to develop a practical and pedagogical framework for computer conferencing in distance education.

Programme topic: Educational aspects

20:
Conference Based Teaching of a First Year University Course in Mathematics
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Abstract
This is a presentation of a project from Trondheim where mathematics has been taught by means of the electronic conference and mail system WINIX. The project has been a cooperation between the Department of Mathematics and Statistics at the University of Trondheim and Trondheim College of Education. The students were teachers in high schools (videregaaende skoler) in northern Norway taking the course as continuing education.
The talk will present the major features of the WINIX system and outline the way it has been used, in combination with educational software. The talk will also present the experiences made during the period the project has been going on.

21:
The FILAM Project, a Low Profile Approach to Computerized Distance Teaching.
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Norway
Jan Eide, Maaloey vidaregaaande skole,
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Abstract
Although computers are plentiful in Norwegian schools, they vary much in age and quality. Advanced methods of computerized teaching generally require costly software development and upgrade of hardware. The authors instead advocate a low-profile approach in order to make budget distance teaching available to all schools. They presently run a one year course in biology for 3rd year students in the Norwegian upper secondary school. Among the challenges are how to fit in compulsory laboratory exercises and field work. Emphasis is laid on methods that inspire the students to take active part in the teaching process. The course will be finished by the end of June 1993.

22:
The Winix Project in the Oslofjord Area
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Abstract
This project has been conducted by the Ministry of Education, Research and Church affairs in cooperation with Naval District Oestlandet/Continuing Education. The Directorate of Labour has also participated. Crew and serving personnel at Karljohansvern Naval Base (KNB) in Horten, in addition to the islands Bolaerne Fort outside Toensberg, Oscarsborg

Fortress by Droebak and Rauoey Fort outside Engalsvik in Oestfold, have participated in the project too.
The main objective of the project has been to enhance the possibilities of better communication and the use of distance education at Naval District Oestlandet by using Winix (Winix Network is a Local Area Network (LAN) with UNIX on a server and Windows interface on workstations. The main services used in the project is Winix Mail and Winix Conference. Datacommunication is based upon Internet). There was also a need for quick access to current information on vacant jobs from the Directorate of Labour's database SOFAKS. Until the Winix project was initiated, we received current data on a diskette every four days. This was copied and sent to the islands. Another objective has been establishing cooperation with other educational institutions, both within the Armed Forces, and civil institutions.
During the project one has also found a reliable way of transferring SOFAKS from the headquarter and the server in Horten to the remote PCs on the islands by using Winix Emulator. SOFAKS has been transferred from the Directorate of Labour to KNB in Horten the same way since February 1992.
In the autumn 1991 the first distance education courses started with students from all Naval District Oestlandet. At the same time we had a limited number of students accepted to the University of Trondheim. From the autumn 1992 one has also been cooperating with Agder College of Engineering. Cooperation with the schools in SPINN (the School Project In Northern Norway) has been established, and students from Naval District Oestlandet are now studying English and Social Studies at Nordreisa Junior College through a distance education programme. Cooperation with SIRNETT (Schools In Regional NETwork) in Troendelag about education at the Junior College level is now being established.
During the Winix project at Naval District Oestlandet there has been established a local study centre at KNB, as part of the educational support for distance education students and external candidates.
In July 1992 a Winix network was established in the Headquarters Defence Command/Naval Staff (Director of Continuing Education) in Oslo, and during the autumn 6 naval bases throughout the country established similar networks. All the local networks are connected to the server in the Naval Staff. All the naval bases will have Winix networks in 1993. The update of data for SOFAKS will later on be transferred over the Winix networks in the Navy to all the bases, instead of sending diskettes.
Cooperation within Department of Continuing Education, and with civil schools through Winix, will enable us to offer a varied curriculum to all servicemen and other personnel with a need for further education, no matter where in Norway they are serving.

Keywords: Computers And Education, General; Computer Uses In Education.

23:
Using E-mail in an English Class at NKI

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Abstract
We tried using international E-mail as the basis for an English class at NKI College of Engineering. Although using E-mail this way is not a new idea, this kind of class had not been tried at NKI or, as far as we know, in Norway.
We planned for the students to have a penpal at a college in the United States for exchange of letters and writing assignments. Our hope was that the exchange would provide both motivation and practice in learning English.
The students were enthusiastic about the E-mail plans, but unfortunately the other class did not follow through very well. Despite the lack of response, our students remained enthusiastic about the idea of using E-mail. Using the computer for writing and revising did provide a good learning experience for the students.

Keywords: Computers and Education, Computer Uses in Education

APPENDIX 2:

ABSTRACTS OF "SHORT CONTRIBUTIONS"
(Full versions of these papers are not available).

24:
Satellites and Distance Education
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NKS Distance Educacion

Abstract
NKS Distance Education has been involved in several projects using satellite in their distance teaching. In spring 93 more than thirty sites in western and nothern Norway received lectures via satellite from a studio in Oslo. Two-way interaction was handled by telephone and fax. The lectures were a means to support both group work at the local sites and individual work at home between the lectures. A receiver site network is being built up presently all over Norway, and use of satellite in distance education may explode over the next few years.
Some results and conclutions from the evaluation material will be presented and discussed

25:
To be Seen on the Screen -is That the Question?
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Abstract
On the potentials of video conferences in drama education. Background
The Drama departments at Sogndal and Alta Teacher Training College in Norway, have during the last two years been working with the use of video conferences in drama education.
One objective of the project was to test out the potentiality of video conferences in enhancing the professional environment. The Drama departments had only one person engaged, and both colleges are located in peripheries, both geographically as well as professionally.
Another important question for us, was to test out whether video conferences could add something to drama, in other words, are we speaking of a new method that will add new dimensions to the drama education? Moreover, could on the other hand drama contribute to the technology of video conferences? In drama, there are methods developed specifically to stimulate communication in and between groups. How would these methods work in video conferences? Especially since one basic prerequisite in drama work, is the presence of the participants in the same room at the same time, this is a fruitful and interesting challenge.
Research design.
We established two main tests where we wanted to explore the above mentioned questions.
* Would it be possible to transmit performances made by students from one video conference studio to another, where professional educators comment and instruct the groups after their performances? Would the technique be good enough to catch the whole performance, i.e. fast movements over a large area, special lightning with theatre lamps, use of siluette screen, speech, song, acoustic music, recorded music, and different sound effects?
* Would it be possible to have two different groups in two different studios acting in the same play? Would the screen increase feeling of distance, or could it reinforce the participants experience of "attending the same room"?
Conclusion.
Our pilot tests so far, have given very interesting results. The use of video conferences have established a contact between the Drama departments in Alta and Sogndal and have lead to a cooperation extending far beyond the mere work with the video conferences.
The video conferences seem to work best in settings where participants in both studioes are active at the same time. The students experienced beeing part of one and the same play despite the distance. This means that the tests have succeded in taking care of essential drama elements like the feeling of attending the same room at the same time. The technique has thus given drama education new tools and possibilities, but fundamental drama premises have all the time been the most important aspect.
Views.
We assume that the specific qualities of drama work will be useful in etablishing communication at many levels in the world of communication technology. We assume furthermore that video conferences will open for the possibilities of connecting the whole professional drama milieu in Norway, as well as internationally.

26:
Computer Conferencing within a Distance Education System Based upon the Students Freedom of Choice

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Abstract
Handelshoeyskolen BI - The Norwegian School of Management (NSM) - has since 1990 offered the Business Candidate Programme as a two year part time distance study. The programme is traditionally taught in a one year full time study and a two year study based on evening classes twice a week. In the distance education programme students are supplied with a package of study materials containing: standard textbooks, extensive study guides, video-taped lectures, counselling material, communication software and a computer conferencing system handbook. The students are free to choose from the following services: weekend face to face tuition sessions twice every semester; ordinary lectures at any of NSM's 13 regional colleges; computer conferences on each subject; assignments for submission; telephone counselling and counselling via telefax. The students are allowed to take the nine exams in the programme any semester. They have to complete the programme within 4 years. The curriculum is fixed, but the students have all the other essential freedoms of distance education: time, place, pace, medium and access.
The computer conference system is run on a computer at NSM headquarters in Sandvika near Oslo. The system software is called Bergen By Byte and is run on a QNX platform. It has currently some 700 users - out of which approximately 500 are active students. The conference system offers the following facilities: notices, conferences, mail, file transmission and chat function.
In an ongoing study preliminary results suggest that more than 80% of the Business Candidate students have chosen to use the conference system. Frequency of use varies. Some 20% of the users seem to drop in approx. once a month to search for relevant information. 20 % join the system I - 2 times per two weeks. 20 % log on 2 - 4 times per week and 40 % are addicts who log on 5 times or more per week. Approximately 15 % of the logon events result in a written message in a conference.
Subject spescialists use the following pedagogical techniques in their conferences: Present topic of the week according to recommended progression; present topics for debate; answer any student questions; give summaries and supplementary material. The main task is to motivate students, help them organize their work and to solve their immediate subject related problems within no more than 36 hours.
The study suggests that 73% of the users find the system useful or very useful. 17 % say the system is of some use. 10 % of the users do not find it useful.

27:
Videoconferences and Videotelephony: A Pedagogical Callenge in Distance Education

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Abstract
In Norway, videoconferences and videotelephones have been used on an experimental basis in distance education for several years. The experiences show that these media have great potential in distance education. Both videoconferences and videotelephones may be successfully used for transmission of lectures. The pedagogical challenge of these media, however, lies in exploring their possibility for direct interaction. Through these media it

is possible for the teacher to make his/her presentations much in the same way as in a classroom. It is also possible to establish a dialogue between the teacher and the students that is in many aspects similar to what can be achieved in a classroom.
Nevertheless, teaching and communicating through these media is not the same as teaching and communicating face-to-face. The geographical distance and the technology involved make distance education via videoconferences and videotelephones something unique compared to both classroom teaching and distance education via other media.
This paper discusses the pedagogical potential of these media in distance education, based on experiences made in Norwegian experiments.

28:
Technology against Centralization

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Abstract
Our upper secondary school system was expanded and de-centralized in the 1970's. The number of young people will be noticeably smaller in the 1990's. In the planning of secondary education in Soer-Troendelag, the authorities have divided the county into four main regions. One of these, the Orkdal region, includes five schools, where at least three have clearly defined recruitment areas with declining birth rates, which will soon produce as few as 60 pupils per year. That means a lower demand for secondary education. Given today's methods of instruction, it also means a restriction of the pupil's freedom of choice. It goes without saying that, unless new approaches are tried, many schools will neither individually nor together be able to offer a reasonably broad range of subjects.
The schools have seen the need for co-operation and communication network between schools in a region. Electronic communication is the main medium in project, and gives the schools opportunity to organize electronic mail, electronic conferances and varied group communications. Distributed Classes might serve as a counteract to the fall in birth rates.
It is becoming Increasingly common these days to regard secondary schools as a resource for local cultural activities and for local trade and industry, beyond their primary role of giving an education to young people. At the same time there is an increasing understanding of the fact that giving further education courses, adapted to the needs of economic life, will have a positive feedback on the competence of the schools, and thereby also on the quality of basic education. The schools have now establish Resource Centres to meet the demands.
For smaller schools to be able to continue as adequate schools and to offer proper further education, adapted to local needs, we have adapted new methods and means of instruction. Groups of students substantially smaller than a regular class is able to study as speciality subject at a local school, while incorporating expertise from other schools. We have found solutions which meet these requirements.
The distributed activities are:
* Distributed classes: Health & environment subjects
* Distributed subjects: Arts & crafts, Commercial & clerical subjects

* Distributed subject parts: Commercial & clerical subjects, Maths
* Distributed indiduall apprentice training: Fishing trade & maritime subjects, Vocational education/subject related courses.

100 students attend the coures. We believe that we so far have gained interesting experiences on different levels, organisational development, designing distributed courses, pedagogical techniques, organisational development, improvement of the learning situation for the users and strengthening the local society. We are half way through the main project. But it is important to notice that it will probably take many years before results can counteract centralisation.

29:
The Videtelephone Experience in Higher Education in Norway
Videophony is the answer, but what is the question?

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Abstract
During the last years, the ISDN videotelephone has been tested for educational purposes in higher education in Norway. The experiences so far have been promising regarding the educational potential of this medium. This paper will present some of the experiences that have been made in the ChalNOR - project, which is an educational exchange project between two technical universities in Norway and Sweden. Focus will be on the following three aspects:

* The organisational aspects of making use of this medium in two large institutions. It is not sufficient just to have the technology available. The assumption is that organisational factors and personal attitudes towards distance education is crucial in the diffusion process.
*The experience of the students, and the quality of the education. A central issue here will be an analysis of how the students interact with the teacher and/or other students through this media in a communicative theoretical perspective. To what degree is the medium used for two way-communication.
*The value of the videotelephone and other new communication media in supporting informal academic network and competence development
in an information society. Are today's students and teachers oriented toward building informal networks, or are they more oriented towards their own institution?

APPENDIX 3:

INSTITUTIONS:

(Listed in alphabetical order).

1. Alta College of Education
2. Bergen College of Education
3. BI - Norwegian School of Management, Oslo
4. Eikeli Upper Secondary School
5. Firda upper secondary school,
6. Hamaroey upper secondary school,
7. Honningsvaag upper secondary school
8. Ministry of Education, Research and Church Affairs
9. Maaloey upper secondary school.
10. NKI - Distance Education
11. NKS - Distance Education
12. Naval District Oestlandet, Horten
13. Nordreisa Upper Secondary School
14. Norwegian Telecom Research,
15. Soer-Troendelag County Authorities, Trondheim
16. Sogndal College of Education.
17. Stord College of Education
18. Trondheim College of Education,
19. University of Oslo,
20. University of Tromsoe,
21. University of Trondheim,

APPENDIX 4:
ELECTRONIC INFORMATION

Welcome to the IFIP/TC3 information database.

28. December 1993

In this database you should be able to access updated information about the IFIP/TC3 activities. It will contain monthly newsletters as well as information about past and future IFIP events.

The database will be updated as soon as new information is available. You have access at any time. If you would like to be put on a mailing list for the latest information please send a message to infoadm@tt93.tih.no with the subject MAILINGLIST.

In order to access the information in the database, you will have to make a call to info@tt93.tih.no, similar to the call you just made to get this information. There are 4 different calls:

HELP
INDEX
NEWSLETTER
GET

The HELP call:
By entering HELP in the subject field you will receive this text.

The INDEX call:
By entering INDEX in the subject field of the call you should receive a short list of all the information in the database. The text field of the message will be disregarded.

The list may look like:

index-name	- #bytes	Description
newsletter	1525	The latest newsletter
nl940101	1525	TC3 newsletter dated 940101
tt93-paperl	12345	TeleTeaching'93 papers presented in session 1
tt93-paper2	23456	TeleTeaching'93 papers presented in session 2

The first column denotes the index-name you will have to use to get the information you like to have. The second column denotes the number of bytes in the file. The third column is a short description of the contents of the item.

The NEWSLETTER call:
By entering NEWSLETTER in the subject field of the call you should receive the latest newsletter entered into the database. The text field of the message will be disregarded. You may also access this information by using
the GET call (eg: GET newsletter or GET nl940101)

The GET call:
By entering GET in the subject field of the message and entering the index-name in the text field you should receive the information you requested. The GET call will accept requests for multiple entries in the text field.
The entries should be put on separate lines.

Eg:

mail info@tt93.tih.no
Subject: GET
Text:
GET nl940101
GET tt93-paperl

This should return the IFIP/TC3 newsletter dated January 1 1994 and the abstracts of the papers in session number 1 of the TeleTeaching'93 conference.

If you enter something which the information database will not understand then it will trie to return your message. The database will not make a distinction between capital and small letters. The database will also record your call and we may later mail you directly if there is something we think you should know about.

If you need any help or need you want additional information, please send a message to infoadm@tt93.tih.no

The texts are all in 7-bits ASCII and with no special formatting information. There is a maximum of 80 characters pr line.

INDEX:
TC3 921 An introduction to this information server
NEWSLETTER 1293 The latest newsletter from IFIP/TC3
NL940101 1293 The IFIP/TC3 newsletter dated 940101

CALENDAR	105	Calendar of IFIP events
TT93-PAPER1	17622	TeleTeaching'93 Abstracts from paper session #l
TT93-PAPER2	18178	TeleTeaching'93 Abstracts from paper session #2
TT93-PAPER3	20805	TeleTeaching'93 Abstracts from paper session #3
TT93-PAPER4	19357	TeleTeaching'93 Abstracts from paper session #4
TT93-PAPER5	20128	TeleTeaching'93 Abstracts from paper session #5
TT93-PAPER6	18309	TeleTeaching'93 Abstracts from paper session #6
TT93-PAPER7	21148	TeleTeaching'93 Abstracts from paper session #7
TT93-PAPER8	20359	TeleTeaching'93 Abstracts from paper session #8
TT93-SHORTI	19845	TeleTeaching'93 Abstracts from short contrib. #1
TT93-SHORT2	26259	TeleTeaching'93 Abstracts from short contrib. #2
TT93-SHORT3	20373	TeleTeaching'93 Abstracts from short contrib. #3
TT93-SHORT4	22891	TeleTeaching'93 Abstracts from short contrib. #4
TT93-SHORT5	11618	TeleTeaching'93 Abstracts from short contrib. #5
TT93-PROGRAM	48385	An intro. to the TT93 conference incl. program

***

This information server is running in the Computer science department at Trondheim College of Engineering. The college has more than 1400 students and a staff of nearly 200 in 6 different departrnents.

APPENDIX 5: SOFF

SOFF

(The Norwegian Executive Board for Distance Education at University and College Level)

DESCRIPTION

The Norwegian Executive Board for Distance Education at University and College Level, with the acronym SOFF, was appointed by the Royal Norwegian Ministry of Education, Research and Church Affairs in 1990 as a three and a half year project. SOFF is a national advisory body in the field of distance education (DE).

During SOFF's project period it is to survey the situation for distance education at University and College level, and propose a permanent organisation for the future. As part of SOFF's work, institutions have been able to apply for grants for the development of distance education courses. At the present moment, 62 courses have been supported and are either already operating or are still at the planning stage. Courses are in Norwegian, although some institutions plan to translate them into English. SOFF has a list of titles and a short description of these courses in English.

SOFF has produced reports covering the following areas:
An Evaluation Guide that all projects must use to evaluate their project (in English), Copyright and Distance Education, Conditions for Studying as a DE student, Instructional visual media, data/telecommunication
(including computer supported learning), and a structure and strategy group that has presented suggestions for the future of DE in Norway entitled, The National Knowledge Network Flexible learning in a Norwegian Network (a summary in English).

There are no course descriptions in the database for this institution.
Enquiries should be addressed to:

SOFF
NORUT-GRUPPEN A/S
9005 Tromso
NORWAY
Telephone: (+47 83)80300
Fax: (+47 83)12520

SERVICES

Courses vary according to needs of students and course contents. All courses have printed material, and usually a tutor that can be contacted by phone. Some use video (some sent over the Norwegian Broadcasting Network), some have computer programmes, or computer conferencing, some have video conferences. The majority have a certain amount of face-to-face tuition/lectures/group work etc.

STATISTICAL SUMMARY

SOFF's secretariat consists of three executive officers:
Gunnar Grepperud (Executive Officer) and two assistant Executive Officers:
Josephine Stenersen and Jan Alexandersen. There is also an executive board with seven representatives of higher education in Norway.

SOFF does not have a definite total picture for Norway at the moment, but believe the total numbers studying DE at University and College level to be about 7,000, probably increasing up to 10,000 in 1994.

APPENDIX 6: NKI

DESCRIPTION

NKI was established in 1959. Since 1974 it has been organised as a non-profit organisation. NKI runs a distance teaching institute, a full-time college of computer science, an engineering college, and a publishing house. In distance education, NKI offers approximately 60 study programmes at secondary and tertiary levels, comprising more than 250 single course modules. Courses are offered to individuals as well as to companies and public organisations. NKI also offers tailor-made courses, often developed in cooperation with business and
industry.

The NKI distance teaching institute offers both pure distance education and combined distance and face-to-face education. NKI has for more than 20 years been active in distance education research.
During the last couple of years, research has been concentrated on new technology and student support systems. NKI has developed a specific system for computer-mediated communication and has been in the forefront of testing out computer conferencing in distance education.
Distance-taught courses are offered mainly in the areas of General Education, Technical Education, Vocational Education, Business and Economics, and Administration. All courses lead to examinations, either state-organised or NKI-organised. NKI diplomas are readily accepted in Norway. All courses are accredited by the Government and/or by other state bodies. All courses are accepted as part of the Norwegian university and college system.

Enquiries regarding NKI courses, entries for some of which are in the database, should be addressed to:
Torstein Rekkedal NKI
POBox 111
1341 Bekkestua NORWAY
Telephone: (+47 22) 122950
Fax: (+47 22) 530500

SERVICES

All courses have a modular structure. The main medium is printed material, either self-contained correspondence courses or commentary courses (textbooks and study guides). NKI also uses fax, computer conferencing, telephone, video, and video conferencing.

STATISTICAL SUMMARY

NKI enrols approximately 15,000 distance students annually. It employs 180 full-time staff and 250 part-time tutors in distance education.

APPENDIX 7: NKS

NKS - The Ernst G Mortensens Foundation

DESCRIPTION

NKS was established as the first correspondence school in Norway by Ernst G. Mortensen in 1914. In 1976, the family of the founder established the Ernst G. Mortensen Foundation as a charitable foundation. NKS was donated to the Foundation and has been since 1926 an independent, non-profit institution.

NKS Fjernundervisning (NKS Distance Education) is the name of the original correspondence school, now transformed into a modern distance teaching institution. In 1976 the NKS Hogskole (NKS College)
enrolled its first students, and in 1987 it was recognised by the Ministry of Higher Education as a degree-granting private college with programmes in the area of business management and administration.

Study programmes are all offered by distance education methods. NKS Forget (NKS Publishing) was established in 1971 to publish textbooks for the educational markets form primary to university levels, and reference and non-fictional books for the trade.

Enquiries regarding courses offered by NKS, a few of which are described in the database, should be addressed to:
Erling Ljosa
Senior Adviser NKS
PO Box 5853 Majorstua
N-0308 Oslo
NORWAY
Telephone: (+47 22) 56 85 00
Fax: (+47 22) 56 85 37

SERVICES

The principal media used in most programmes are printed texts and correspondence tuition. Many students also follow face-to-face tuition in local classes all over the country, usually once per week.
Supplementary media in frequent use are audio cassettes (for presentation, exercises and communication), television and radio programmes (usually in joint projects with NRK, the State Broadcasting Corporation), and computer conferencing. Other media are used only to a smaller extent or in experimental projects.

STATISTICAL SUMMARY

In 1993, NKS has about 70,000 enrolled students; 30,000 students enrol annually producing a total of 60,000 courses enrolments. The institution offers a total of 200 courses. 120 full-time staff and 400 part-time distance tutors are employed. NKS's annual turnover is 130 million Norwegian kroner.

Case Study: A European Multimedia Training Network for International Distance Learning

Leopold Reif and Stefanie Fischer

Berlitz European Projects, Frankfurt am Main, Germany

Abstract

The "Multimedia Teleschool for European Personnel Development" is a major application project of the research and development programme DELTA of the European Commission. The project focuses on distance lear - ning with cross-border learner groups based on European computer confe - rencing systems and interactive TV programmes. Six courses are currently offered by the MTS for around 1,600 students in nine European countries. Datex-P, PSDN, and satellite technology open up the possibility of reaching students in Eastern Europe, even in places as far away as the Baltic States and Russia

1. Current situation

The need for advanced training is growing, a trend which is being brought about not only by even stiffer internal requirements for qualifications at the workplace (i.e. job-enrichment, tendencies to rationalize systems and communications, sup-national networking of companies and institutions), but also external changes in the economy, as, for example, the European Common Market and opening markets in Central and Eastern Europe.

Even now, the European market for staff development and advanced training within companies is estimated to be worth some 27 billion marks (Capital, 2/92). It is in this context that the "Multimedia Teleschool" (MTS) in the framework of the

European Research Programme DELTA[1] is providing a distance-learning concept which involves the use of up-to-date teaching aids at the workplace. This article documents the didactic concept, the necessary technical infrastructure, and gives particular attention to the innovation in European learning - interactive television.

2. The Multimedia-Teleschool concept

MTS uses telecommunications technologies in an attempt to create "virtual study centres" for students from European companies, and in this way to meet the need for real and effective advanced training. The main intention behind this approach is to overcome two problems associated with conventional distance learning, namely interactivity and integration.

2.1 Interactivity

Interactivity allows for the use of various feedback technologies at the workplace, such as telephones, faxes, computer-conferencing and even video-conferencing. Students and tutors have the option of communicating synchronously or asynchronously.

2.2 Integration

An interactive approach of this type, coupled with the assignments which are distributed to students on the courses, is designed to ensure student integration within study groups at both a national and international corporate level. The students are drawn from companies in many different sectors.

2.3 Instructional scenarios

From the teaching point of view, the MTS attempts to bring about four different educational scenarios:

- individual learning (Learner - Tutor),
- team tuition (Learners A, B. C - Tutor),
- sup-corporate tuition (branch A: Learners l-n; Tutor; Branch B: Learners l-n), and
- sup-national tuition (country X: Learners l-n; Tutor; country Y: Learners l-n).

The fourth scenario merits the EC's particular attention, despite all the problems surrounding it, as the EC is committed to the idea of European integration.

2.4 Examples of international courses

The current course "Business on Line" brings together students from Germany (Deutsche Telekom, DeTe Mobil), Spain (Polytechnic University Madrid), France (France Telecom, SNVB-Bank), Sweden (Ovemi), Finland (Ammatti-Instituuti), Russia (Russian Academy for Administration, Baumann Post Graduate), Italy (University Catania), Czech Republic (SPT Telecom), and Belgium (European Commission).

1 Developing European Learning Through Technological Advance, a Research Programme of the Commission of the European Communities, DG XIII.

Six courses are currently offered by the MTS for around 1,600 students in eight European countries. Any company wishing to participate is now able to enrol learners in these courses. In Western Europe, there are no technical barriers. In principle, Datex-P, PSDN[2] and satellite technology also open up the possibility of reaching students in Eastern Europe, even in places as far away as the Baltic States and Russia. Initial attempts at meeting the needs which exist in that part of the world are being made using the EC's Tempus and Comett programs.

3. Interactive television for distance learning

3.1 Examples

The first interactive television service for staff-development in European companies began on 27 October 1992. Between October 1992 and June 1993, 12 one-hour programmes on core topics in the "English for Banking" and "English for Telecommunications" courses were broadcast live throughout Europe from the Strasbourg studios of Arte, the new European culture channel, and also by Eurostep. Two other MTS courses, "Environmental Awareness" and "Camelia" (Agrofood) have each broadcast another four programmes to date.

On 26 October 1993 the new series "Business on Line" was launched, which is targeted at "English for Telecommunications" as well as "English for Business" participants. At three-weekly intervals, all the learners follow their 90-minute live programmes, and many of them are linked directly with the tutors and experts in the studio via video-conference using ISDN technology.

3.2 Course structure and technology

Course members in the European branches are, of course, also linked up with the television studio via the Teleschool's computer-conferencing system. It is via this system that all students receive their study assignments lessons from the Berlitz Correspondence-Course Centre in Eschborn, Germany, and also use the system for returning homework to their tutors. In addition, the conferencing system is used by students for studying in groups with other course participants across Europe, for putting questions to the experts during live broadcasts, and for making their own contributions.

The broadcast comprises a presentation by the experts lasting about 20 minutes, followed by 15 minutes of film on the topic being studied, and concluded by a discussion lasting about 20 minutes which deals with student queries and contributions. Additionally, of course, a large amount of time is dedicated to live interaction between a number of tutors, present at each broadcast, and the learner-groups by video-conference This can take the form of debates, presentations, negotiations and role plays. The tutors in the studio also process incoming computer-conferencing responses and pass them to the experts. Student input such as simulated negotiation sessions are prepared with the tutors in the accompanying correspondence-course

2 Packet Switched Data Networks, e.g. Datex-P in Germany, Transpac in France, etc

4. Technology

Recent developments in the field of computer-conferencing and satellite technology were used in the initial phase in order to provide the MTS Teleschool with technical support. The "Teletutor", developed by the Berlin company Condat, and videoconferencing are used during the second (current) stage and enable ISDN-mediated synchronous multimedia communication between students and tutors.

The computer-conferencing system is installed on a host computer in Berlin and is ideally suited to the needs of the MTS Teleschool. This is where all interactive processes are carried out, i.e., distribution and return of course material, tutor support, group work, and direct access to the television programme. Individual participants work locally on PCs which are networked with the host computer via PSDN. All the basic functions required for communication are controlled via a Windows interface adapted to the Multimedia Teleschool.

The computer system is also configured as a distributed system with several host computers in different countries. This means that conferences can also be transmitted to other host computers, opening up the way for sup-national conferences in which students do course work together. Such "cross-border" learning is an important element of the Teleschool's approach.

Television broadcasts from the Arte studio in Strasbourg are being broadcast by the satellites TDF 1 and EUTELSAT. The computer-conferencing system and videoconferencing via ISDN with 128, 256 and 384 transmission rates provide communications facilities for live interaction by participants in the TV studio.

5. Learners and their companies

The following companies are currently financing MTS courses for their staff:

France:	France Telecom, SNVB-Bank
Italy:	University of Catania, Sicily
Spain:	Universidád Politecnica de Madrid
UK:	British Airways
	Exxon Chemicals
	Carneaud Metalbox
	Earthwatch
	IPC
	Orfeus
Germany:	Bundespost Telekom
	DeTe Mobil
Greece:	Agricultural Bank of Greece
	Macedonia Thrace Bank
Sweden:	Ovemi
Finland:	Ammatti-Instituuti
Russia:	Russian Academy for Administration, Bauman Post Graduate
Czech Republik:	SPT Telecom s.p
Portugal:	Linha Verde

In 1993 and 1994, more than 1,600 working people in Europe will be following courses organised by the Teleschool.

6. The MTS Consortium

Management and co-ordination activities associated with the Teleschool are carried out at Berlitz International. Courses are currently offered by the University of Nancy (F), Open University (GB), Southampton University (GB), and Berlitz (D). The communications software for the computer conferencing facility is supplied by CECOMM (GB) and CONDAT; responsibility for interactive television and satellite transmission is borne by the European culture channel ARTE, Eurostep, France Telecom, University College Dublin and Berlitz. Evaluation activities as to acceptance and cost-effectiveness are being carried out by the Scientific Institute for Communication Services in Bad Honnef and the Polytechnic University of Madrid.

German Experiences with Communication and Information Technology for Updating Teachers in Germany (North-Rhine Westfalia)

Rudolf Hambusch

Leitender Regierungsschuldirektor, Germany

Abstract

This paper describes the problems of updating teachers in the field of information technology under the special aspect of the educational system in a federal State n Germany. A special emphasis is given to issues relating to organising and funding on-going retraining for teachers. Issues and experiences from North-Rhine Westfalia are summarised and discussed.

1. Goals

The technical problems which arose only 10 or 12 years ago with the introduction of the personal computer (PC) in German schools have now been solved. This is impressive, as the time from the very beginning is just 10 or 12 years ago. A standardised, cheap, mtelligent machine for everybody enabled this to occur so quickly.

However, in this short time it was not possible to recruit enough teachers in the ordinary way of training at universities. So new ways had to be found to put teachers with the knowledge of communication technology into schools. A general teacher-training Institute, the Landesinstitut fur Schule und Weiterbildung in Soest/Germany had to solve the problem of how to bring a great number of trained teachers into schools. The solution was a strategy by which teachers developed a programme for teachers, and this knowledge had then to be disseminated over the country by a snowball-system.

This way of bringing knowledge to the teachers and from there to the students was, as regards to both the aspects of quantity and quality, successful. So it might be good that the approach be documented, which is the intention of the following paper. This model of a course system, run by teachers for teachers who know the problems of teachers, is a good model for "Teacher Education and Communication and Information Technologies: Issues and Experiences for Countries in Transition".

2. Analysis of the situation

2.1 The constitutional reality of the Federal Republic (after 1945)

After the war was lost and dictatorship abolished in 1945, life began again in the Federal Republic of Germany. It was manifested in the proclamation of the Basic Law on 23 May,1945.

2.1.1 Educational autonomy to the Federal States.

Characteristic of the new democratic constitution is the so-called educational and cultural autonomy not being part of central State power but being given to the 11 or 16 federal states (16 today after the re-unification of East and West Germany in 1989). This federal concept was meant to and was able to avoid the possibility and perhaps misuse of centralist propaganda power over educational and cultural policy. Conversely, it made different structures of a German education policy possible.

> *"Federal states and local authorities are required to provide schools, education is compulsory and is carried out in mainstream and vocational schools. The teaching in the primary and vocational schools is free of charge. Adult education is to be promoted. " Cf. Constitution of the State of North-Rhine Westphalia, Art. 8 f.)*

2.1.2 Educational financing (budgeting).

The constitutional setting of areas of emphasis in educational policy in the federal states can be expressed in a comparison of the budgets (1982) of the Federal Government and the respective federal states, exemplified here (Table 1) by the State of North-Rhine Westphalia:

AREA	REFERRING	BUDGET DM 1000 Millions	%
Bund (FRG)	total:	480.0	100.0
	Labour + Social Affairs	130.4	27.2
	Federal Debts	67.1	14.0
	Transportation	53.8	11.2
	Defence	48.5	10.1
	Youth, Family, Health	18.7	7.7
	Research + Technology	9.4	2.0
	Education + Science	6.2	1.3
Land (NRW)	total:	82.8	100.0
	Education, Science, Research	24.5	29.6
	Social Affairs + Health + Labour	6.7	8.1
	Home Affairs	6.4	7.7
	Ministry of Justice	3.6	4.3
	Housing	3.1	3.7
	City Planning + Transport	3.1	3.7
	etc.		

Table 1: Relation of Educational Budget to Total Budget, N-RW

From time to time, the question is discussed as to whether--for the purpose of a national unity and the co-ordination necessary for it is the jurisdiction of the government should be increased.

2.2 North-Rhine Westphalia: Educational policy in a Federal state

If the population figures of the 16 states of the Federal Republic are compared, Table 2 shows the result:

16 STATES (1989)	POPULATION in Millions	PERCENTAGE
Baden-Wurttemberg	10.0	13 %
Bavaria	11.2	14 %
Beriin	3.5	4 %
Brandenburg	2.7	3 %
Bremen	0.6	1 %
Hamburg	1.7	2 %
Hesse	5.6	7 %
Lower Saxony	7.2	9 %
Mecklenburg-Vorpommern	2.0	2 %
North-Rhine Westphalia	17.7	22 %
Rhineland-Palatinate	3.9	5 %
Saarland	1.0	1 %
Sachsen	4.8	6 %
Sachsen-Anhalt	2.9	4 %
Schleswig-Holstein	2.6	3 %
Thuringen	2.6	3 %
total:	**80.0**	**100 %**

Table 2: Comparisons of States, by Size

It is superfluous to mention that the solving of problems in educational policy must vary according to the different sizes of the federal states. Transport, communication and organisation of education in the so-called city states (Berlin, Bremen and Hamburg) are structured differently from the way they are handled in a large state such as North-Rhine Westphalia (NRW).

2.3 School types and school attendance

As the following statistics show, there are in North-Rhine Westphalia 163 000 teachers for some 3.4 million pupils. Table 3 shows a classification of the different school types:

School population in the area of North-Rhine Westphalia 1993-1994	
General Education (total) : Grundschule (Primary School) Hauptschule (Comprehensive School) Realschule (Intermediate School) Gymnasium (Grammar School) Gesamschule (Comprehensive School) others	**2.302. 000**
Vocational Education (total) : Berufsschule (Vocational school) Berufsvorbereitungsjahr (preparatory year) Berufsgrundschuljahr (basic year) BerufsfachschulelFachoberschule (Specialised high school) Berufsaufbauschule (Intermediate technical.school) Fachschule (Specialised college) Kollegschule (twin-track vocational/grammar school)	**683.400**

Table 3: School population in the area of North-Rhine Westphalia 1993/94

From this arises, considerably simplified, the following structure (Figure 1):

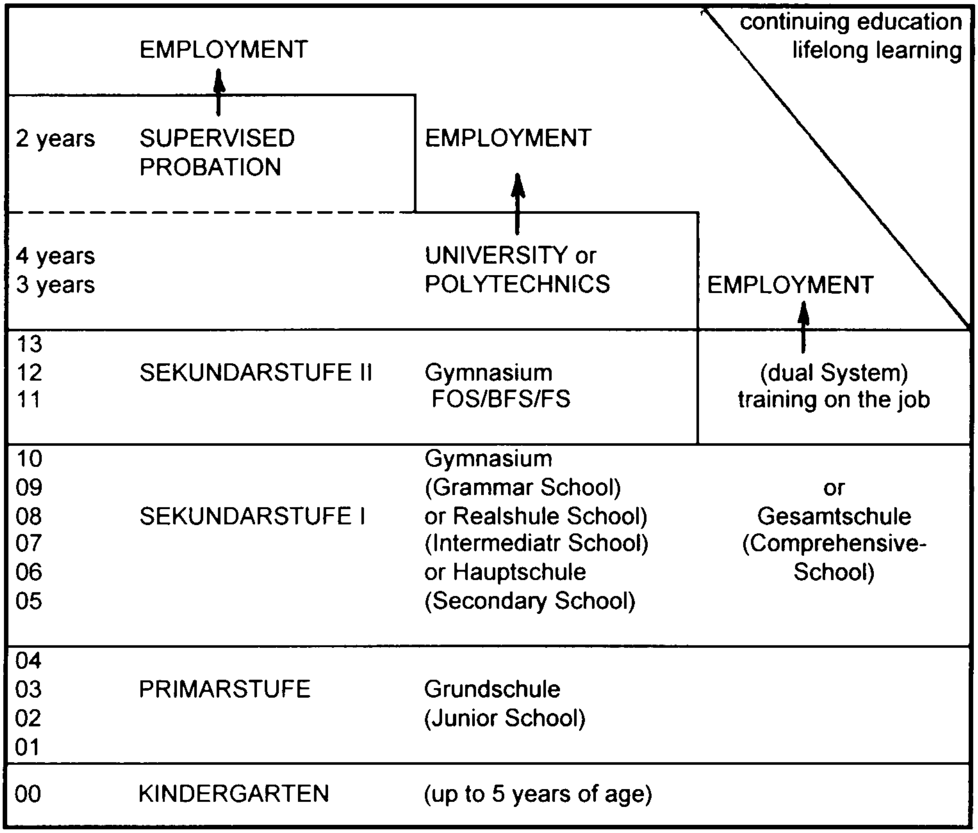

Figure 1. School types in N-RW

2.4 Teacher training in N-RW

Teacher training can be pictured by the structure indicated in Figure 2:

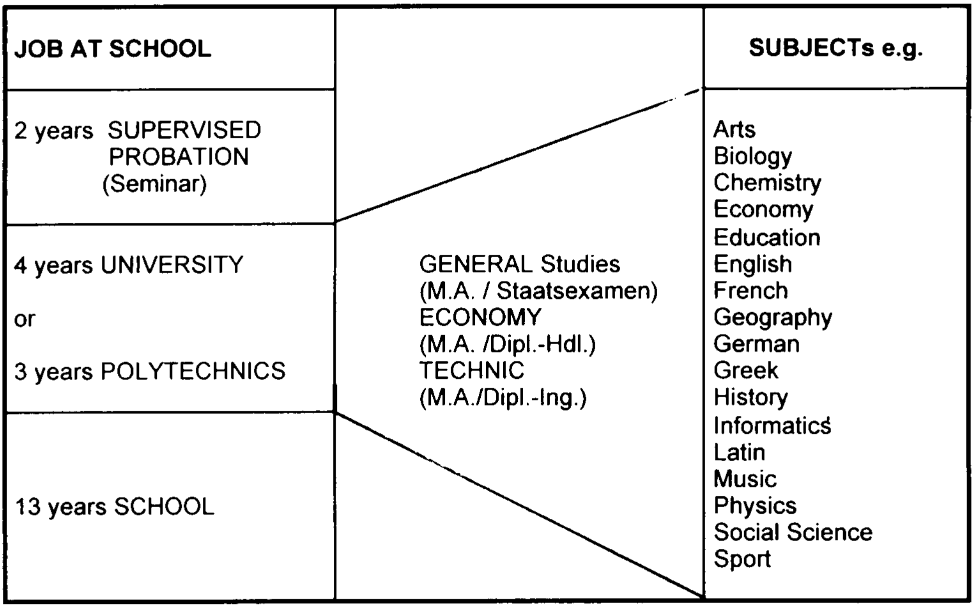

Figure 2. Organization of teacher training in N-RW

3. Plan for a project (1984)

3.1 Syllabus work

For the different kinds of schools which, as a rule, are under state supervision, the syllabuses/curricula are developed by state Institutions. This task normally falls to central institutions as, in North-Rhine Westphalia the "Landesinstitut fur Schule und Weiterbildung" (state Institute for School and Adult Education) in Soest/Westphalia. In order to design syllabuses to do justice to schools and teaching, teachers are involved intensively in the syllabus work in the development and testing stages.

3.2 Consequences for in-service teacher training

If schools want to keep up with scientific, technical and social changes, then the principle of "life-long learning" applies particularly in the so-called tertiary phase of teacher training. However, not all the 163,000 teachers in North-Rhine Westphalia can be offered all-embracing education in all subjects. That is why a concentration of in-service teacher training on certain main areas of emphasis is necessary. The priorities result from the degree of seriousness of the problem.

A programme to intensify in-service teacher training therefore came to be comprised of the following points:

- Processing of content in main areas of emphasis which are directed towards the prime needs of teachers and school. (e.g. the teaching of migrant children, information technology etc.)
- Conception and testing of model seminars.
- Developing of working materials
- Reaching understanding on the tasks of central, regional and local in-service teacher training
- Improving organisation and administration.

Effective in-service teacher training--emanating from the teachers' needs--must be as close to actual practice as possible. As well, it should take place as far as possible in the schools. That is why in-service teacher training conferences are, as a rule, held regionally.

3.3 General aspect: Continuing education for all The Educational Leave Act

3.3.1 Paradoxes for further training

Particularly in a period of high unemployment and economic changes such as we are experiencing at present, further training for adult employees assumes a position of great significance. However, just because the present job-market situation is so unfavourable, the existing forms of adult education are in danger of becoming virtually ineffective in that those taking part are running an increased risk of losing their job.

On the other hand, everyone is repeatedly demanding that employees must undergo further and advanced training throughout their whole working life. However, this demand becomes less and less credible if no additional training opportunities are provided or, even worse, the possibilities which do exist are cut back more and more-despite the growing need!

And, for a beginning, there is a lack of agreement, for example, on the introduction of educational leave. The question as to whether educational leave as release from work for aims of adult education is to be justified is hardly ever discussed. The question is merely when and how educational leave is to be instituted, and then employers draw attention to the burdens of France and employment policy.

3.3.2 Strategies for educational leave.

There are three different ways of introducing educational leave: introducing it on:

- the level of collective wage agreements,
- Governmental level (Government Framework Law),
- the level of the Federal State laws.

The parliament of North-Rhine Westphalia passed a State Act in which all employees and workers are given a legal claim to an annual educational leave of five days. Altogether six million gainfully employed persons are entitled to this claim. In the initial phase 2 to 3 % of the employees took advantage of educational leave. The technical capacity limit dictated by organisation requirements is in the order of 5 % per annum.

As of today (1993) 37 % of the German working population have taken part in further education. Of these, 21 % were in vocational subjects and 22 % in general and political subjects.

The State Act of North-Rhine Westphalia gives, in addition to the other states, the majority of the population of the Federal Republic of Germany a legal claim to an annual educational leave. Generally speaking three terms are used to define the contents of further education measures for which employees are entitled to be released: political education, vocational training, and general education.

3.4 Special Aspect: Information processing/information technology

As a key technology, information processing and the technological processing accompanying it exert a considerable influence on almost all spheres of learning and life. This is of particular significance in a country such as the Federal Republic in which people can live less from the volume and wealth of raw materials but rather from the refinement of products and thus from the know-how of the people who produce the goods.

Completely new in this context is the fact that the recognizable structural change is taking place in short and increasingly shortening innovation cycles. School as an institution cannot subject itself unreservedly to this change in structure. It must take this change into consideration, however, if it does not want to lay itself open to the charge of preparing young people with the knowledge of yesterday for the world of tomorrow.

3.4.1 Policy in N-RW.

On the situation in schools the State Government of North-Rhine Westphalia declared the following: (cf. answer to a question in the State Parliament, 19. November 1982):

- On the one hand the target is that all pupils in schools providing general education should be made familiar with the basics of this technology, above all, however, with its possibilities, limits and effects in respect of their future.
- On the other hand - especially in the field of the upper school classes - the pupils are to be given the possibility of acquiring a thorough knowledge of solving algorithmic problems and realising the solution of such problems with the aid of a computer through being offered basic courses in the subject of informatics (in the upper classes of grammar schools) and the incorporating of this subject matter in the teaching of the vocational schools.

3.4.2 Special emphasis in vocational and adult education.

In all, information processing and information technology are a special feature in vocational and adult education since

- they deal with a specialist area in which there was in the past, due to the lack of discernment and insight, no training or in-service training.
- the educational content is subject to continual change.
- the demand for specialists has increased rapidly and
- well-founded specialist education with the naturally large amount of time required does not produce experts until a late date. (cf. Figure 3 showing the increase in student figures in informatics):

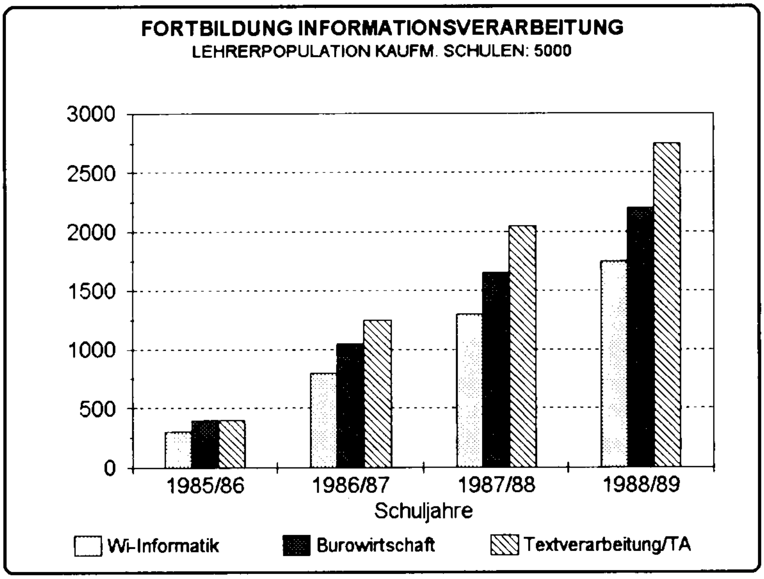

Figure 3. Increase in student numbers in informatics

3.5 Discussion and comment

As is only logical in such an open field, to which for example the schools of the computer manufacturers must be counted, numerous noteworthy educational activities have developed. For the State field of jurisdiction there was a pressing need for the following questions to be answered (1984):

- What educational content from the field of information processing/information technology must be taught at school?
- In what kinds of school and in what subjects can and must this new knowledge be imparted?
- Where is the corresponding educational content already being taught and where must it be brought up to date?
- What dependencies and demands arise when this educational content is taught at different school levels?

- Which teachers with what kind of education should teach the subjects?
- What in-service teacher training and professional development has to be planned to what extent and be carried out by whom?
- What possibilities in media must be created; do traditional methods suffice to meet possible new demands (innovation cycle, hire purchase/service/ hardware/software etc.)?
- What new possibilities of co-ordination must be developed to reach an understanding on educationally determined directives of the schools inspectorate (Minister for Educational and Cultural Affairs) and on decisions on buying equipment made by the organisations responsible for school provision?
- What status has in-service training which develops freely without planning by the state?

4. Summary (1994)

The following are main points of the situation with respect to teacher education and information technology in North-Rhine Westphalia as of 1994:

- The goals of training teachers in the new subject of Communication and In formation Technology have been reached. Two-thirds of a teachers' generation of 5000 in vocational education have been trained (see Figure 4).
- Participation was voluntary with day release on full pay.
- The way to organize this programme could not be managed by universities but by in-service teachers' organisations, which are predestined for this work.
- The programme was planned and organized by teachers for teachers. This ensured that it was fully accepted by the participants.
- Courseware was developed that was used to deliver the programme. This guaranteed the standard and enabled the same programme to be implemented at different places.
- The programme has been evaluated. This gave the authors chance to update the course from time to time.
- There was no examination at the end of the courses. Every participant received a certificate.

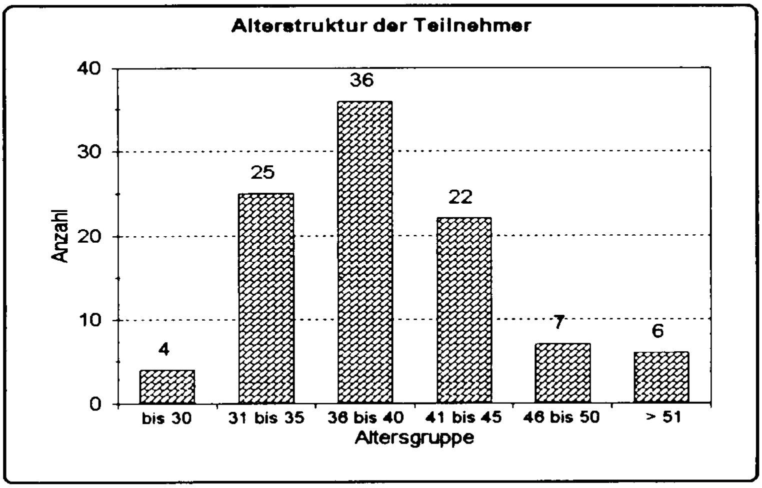

Figure 4. Teacher participation in IT retraining, by percentage relative to age group

Teacher Training and Information Technologies in Spain: Data, Experiences and Comparisons.

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Abstract

This document presents data and offers some remarks on the use of Information Technology (IT) both in teacher training and in teacher activities in Spain. In order to allow for comparisons to be made, some data are also provided concerning the curricular status of IT in different European countries. Experiences in the use of Telematics for teacher training are also described.

1. Territorial structure of Spain

The Constitution of 1978 established a territorially decentralised, quasi-federal system, whereby each of the 17 Autonomous Regions (Comunidades) of Spain (which are further subdivided into a variable number of provinces) has a different level of self-government. At the moment, only seven Comunidades have full jurisdiction on educational matters, including the power to legislate and manage the whole educational system; but the other ten may acquire the same power and jurisdiction in the very near future.

1.1 Administrative levels for education

Therefore, we may distinguish four administrative levels in the Spanish educational system:

- *At the State level,* certain matters are under the exclusive jurisdiction of the Central Government's Ministry of Education and Science (MEC).

- *At the regional level,* each of the seven Autonomous Regions with full jurisdiction on educational matters has its own Department of Education; in the other ten, education is still under the management of the authorities of the Central Government(this is the so-called "MEC-managed territory "which comprises 27 of the 54 provinces of Spain, being therefore the highest administrative zone).
- *At the provincial level*, the Central Government's Ministry of Education has Local Branch (Direccion Provincial) in each of the provinces belonging to the Regions of the MEC-managed territory. In the other Comunidades, the jurisdictional powers not yet transferred to the regional governments are in charge of local offices of the Ministry of Education (Oficinas de Educacion y ciencia).
- *At the municipal level*, town councils may develop certain initiatives on educational matters.

1.2 Ministry-sponsored IT initiatives

In the first area mentioned above, the MEC-managed territory, two institutional plans were launched in 1985: ATENEA (aimed at the introduction of computers in the educational System, excluding the university level) and MERCURIO (with the same objective, but dealing with audio-visual technology).The management of these two projects is centralised in a Ministry organisation called "Program for New Information and Communication Technologies" *(Programa de Nuevas Tecnologías de la Información y la Comunicación;* hereafter PNTIC), whose plans and activities are described below.

2. Structure of the Spanish educational system: Some figures

Education below the university level is provided by the public and the private sector in the proportions as follows:

2.1 Schools

In Pre-School and Primary Education, public schools outnumber private schools by far, whereas in Secondary Education there is a certain parity between the two sectors.

Table 1 shows data from 1993/94.

	TOTAL	PUBLIC SCHOOLS	PRIVATE SCHOOLS
PRIMARY	19.087	13.776	5.311
SECONDARY	5.144	2.869	2.275

Table 1: Spanish Schools, 1993/1994

2.2 The students

In the current 1993/94 term, there are 7.970.139 students in Spain, including both the public and private sectors, and excluding the universities. The following diagram (Table 2) shows the figures and percentages:

2.2 The students

In the current 1993/94 term, there are 7.970.139 students in Spain, including both the public and private sectors, and excluding the universities. The following diagram (Table 2) shows the figures and percentages:

	TOTAL	PUBLIC SECTOR	%	PRIVATE SECTOR	%
PRE-SCHOOL	1.050.970	685.088	65,2	365.882	34,8
PRIMARY	4.300.832	2.810.311	65,3	1.490.521	34,7
SECONDARY	2.618.337	1.927.894	73,6	690.443	26,4
TOTAL	**7.970.139**	**5.423.293**		**2.546.846**	

Table 2: Students in Spanish Schools, 1993/1994

2.3 Teachers

The following diagram (Table 3) shows the number of teachers in the public sector for the current 1993/94 term:

Pre-School and Primary	166.278
Secondary	50.530
Vocational Training (Secondary)	6.049
Total	**222.857**

Table 3 Teachers in Spanish Public-Sector schools, 1993/1994

3. Spanish plans for the introduction of IT in education.

The above-mentioned projects for the introduction of IT in schools operate only in the public sector. Private schools have their own plans, but as they are not unified it is very difficult to provide data about them.

The training activities and curricular integration initiatives described below are those organized by the PNTIC in the MEC-managed territory, which comprises approximately 40 % of the Spanish public sector.

3.1 Multiple plans

Due to the above-mentioned administrative situation of Spain at the moment, there are eight different plans for the introduction of Information and Communication Technologies (ICT) in education (excluding the university level). These plans have been developed by the Departments of Education of the Autonomous Regions with full jurisdiction on educational mailers, and by the Central Government's Ministry of Education (which, as we have already explained, manages education in the rest of the territory):

Before 1985, new technologies where being introduced in school by some self-trained computer enthusiasts scattered among the teaching profession. It was approximately at that time that plans for the educational use of computers were launched in some of the Autonomous Regions of Spain. These plans began when the regional authorities understood the need to create an institutional framework to co-ordinate different initiatives, establish objectives and methodology, deal with teacher training and cope with technological change.

3.2 Common features

In spite of the differences between them, all these plans share some common features. In all of them, Information Technologies are viewed as pedagogical instruments to be integrated in the different areas of the curriculum. Computer Science per se is imparted as an optional subject matter in Post-Compulsory Secondary Education and also as a compulsory subject in certain types of Vocational Training.

Roughly speaking, all the plans are very similar in scope, covering Primary and Secondary Education (both Compulsory and Post-compulsory) as well as Vocational Training.

Special Education and Permanent Adult Education are also covered by some of the plans, as well as certain special projects, aimed at establishing telematic networks linking schools with the projects' institutional headquarters. These networks offer such services as teleconferencing, access to data bases, data transfer and electronic mail.

Other lines of research include the development of control materials, robotics, computer-aided experiments, infographics and computer aided musical instruction.

3.3 Participation in projects

The proportion of schools taking part in the different projects and the number of teachers who have received training are hard to estimate due to constant changes in the figures and to the tangle of jurisdictional and administrative levels involved. Nevertheless, we may provide data for the MEC-managed territory and approximate estimations of the total figures, including only the public sector (Table 4).

	MEC TERRITORY	REST OF SPAIN (estimation)
% SCHOOLS		
PRIMARY	20 %	16 %
SECONDARY	62 %	60 %
% TRAINED TEACHERS		
PRIMARY	30 %	20 %
SECONDARY	70 %	70 %

Table 4: Participation in IT Projects, Public Sector Schools

No reliable data are available for the private sector.

The above-mentioned figures correspond to the global impact of the projects in schools, viewed from the perspective of such factors as the provision of equipment and training . In actual fact, the penetration of IT in Primary and Secondary schools is very close to a 100% in urban areas, whereas small schools located in isolated rural zones are mostly unequipped. This is the reason why the percentage of primary schools shown above seems comparatively small, but the proportions would be quite different if the number of students had been taken into account instead.

4. Comparative data: IT in the curricula of the EC countries.

The Spanish component of an European-Community sponsored project called "Information Technology in the Curricula of the Different EC. Countries" was carried out in Spain in 1990. The overall project report, submitted to the international seminar celebrated in Toledo (Spain) in October 1991, was published by the Spanish Ministry of Education and Science (*Secretaría de Estado de Educación,* 1991). It provides interesting information on the context of the use of IT in the European educational systems.

For the sake of clarity, the report deals with the presence of IT in the curriculum in two sections concerned with separate age levels: the ages between 6 and 12, and the ages between 12 and 18. Some relevant diagrams are shown and commented upon below. However, data concerning Vocational Training have been excluded, as this field is organized in very different ways across Europe. Table 5 gives a general summary.

	IT is...	Is IT concentrated in a subject?	Age to start learning about IT
Belgium (French-speaking)	recommended	no, but in some schools	e 6 (in some schools), 6-12 in general
Belgium (Dutch-speaking)	in pilot projects	no	6-12
Denmark	compulsory	yes, but recommended in the others	6-12
France	optional	yes	6
Germany	in pilot projects	no	11-12
Greece	in pilot projects	no	-
The Netherlands	common practice (60%)	no	5
Ireland	Optional	no	6
Italy			
Luxembourg	in pilot project	no	as from 5 optional
Portugal	in an experimental project	no	-
Spain	in experimental projects	no	in some schools before 6 in general 6-12
United Kingdom	compulsory	yes, but present in others	as from 5

Table 5: Overview of IT in EC Countries
(Source: Secretaria de Estado de Educación. PNTIC, Madrid, 1991)

4.1 Age level 6-12

IT-based activities are carried out m schools with 6 to 12 year-old pupils in all EC countries, although there are important differences as regards their type, their compulsory or optional nature, and their presence in the national or regional curriculum (when these exist), or in the curricular project of each school. It can be stated that in those countries that have undergone recent curricular renewal there is a greater presence of IT, even to the point of its becoming compulsory. This is true of the **United Kingdom** and **Denmark.**

In some countries, such as **The Netherlands**, schools have a high level of autonomy in establishing their curricula, and although the presence of IT is not compulsory, about 60% of schools have introduced computers in their teaching practice. A specific plan has been set up to provide computers of a certain standard to schools which include IT applications in their curricula (*Comenius* Project).

The conviction of the Educational Authorities seems to grow with time regarding the importance of IT in education at this age level. In the **United Kingdom** and in **Denmark,** its use is compulsory, as has been previously stated. In the **United Kingdom,** great emphasis is given to IT within the subject of Technology, where IT is one of the Attainment Targets, but it also appears in the Attainment Targets for other subjects. Pupils should be taught and assessed in relation to the Attainment Targets. In **Denmark,** IT appears on the curriculum as a compulsory subject for all pupils, and at the same time the Ministry of Education is advocating the integration of IT in all subjects. Pupils begin to learn about IT in these two countries at the age of 5 to 6 years old.

In **Germany,** the BLK (Federal and Lander Council) declared in 1987 that Primary Education would not offer IT systematically in Basic Education, at least for the time being. However, the BLK did also decide to finance pilot projects in schools in three different Lander.

In **Luxembourg,** the primary school curriculum was passed in 1989. IT is not considered as a compulsory activity, although the Ministry of Education is encouraging its educational use in primary schools. Pupils can start IT activities from the age of 4 on an optional basis, and at the age of 12 these activities become compulsory.

In **Ireland,** each primary school designs its own school curriculum, according to ministerial guide-lines, bearing in mind local resources and environment. IT is not compulsory, but a third of the Primary schools have acquired computers. Many primary school teachers make use of computers within the framework of their own school curriculum. Most frequent activities include word and data processing, activities with LOGO, projects and remedial work. Projects in particular are developed in a cross-curricular manner, thus making use of information technology in the classroom.

In **Greece** and **Dutch-speaking Belgium,** the use of microcomputers in primary schools is not one of the Government's educational priorities. Although some research and pilot projects have been carried out since 1985, IT is not seen to be compulsory and in present curricula there are no instructions for the integration of ITin different subjects. The Autonomous Council of Community Education decided in 1989 to establish compulsory in-service training for all primary teachers as part of a strategy for a large scale introduction of IT in Primary Education. The main objective is the integrated use of LOGO in the curriculum.

Finally, in French-speaking Belgium, activities based on IT are not compulsory, although they are recommended by the Inspectorate (body of supervisors). Pupils in a small number of schools use robots even before the age of 6. Between the age of 6 and 12, the use of LOGO and word processors is becoming widespread.

It may be said, therefore, that curricular activities based on IT take place in all the Member States. In some countries IT activities are carried out through the recommendations of the Educational Authorities, or upon the initiatives of the schools themselves. In other countries these activities are developed experimentally in order to analyze the best means of integrating IT on a large scale. IT activities are compulsory in some countries which have recently renewed their curriculum. It would, however, be wrong to imply that microcomputers are widely or extensively used for curriculum purposes across Europe.

4.2 Age level 12-16

IT is widely taught as a subject at this stage. In many countries it is taught as a subject matter in its own right; in others, attempts are made to impart it as a topic within other subjects, thereby rendering separate time tabling unnecessary. Additionally, IT can be regarded as a tool for learning other subjects. Again the same choice exists: either IT can be introduced separately, and applied to facilitate the learning of other subjects, or learning to use IT as a tool can be integrated within those other subjects. Table 6 gives an overview.

	Is there an IT subject?	If there is, is it compulsory?	Others subjects withIT topics
Belgium (French-speaking)	yes	no, it is optional	Mathematics Economic Sciences,
Belgium (Dutch-speaking)	yes	yes	Mathematics, French and Sciences
Denmark	yes	In Upper Secondary schools	All subjects
France	yes	no, it is optional	Almost all subjects
Germany	yes	no	Almost all subjects
Greece	yes	yes	Technology, communication and experimental projects for other topics
The Netherlands	yes, in 80% of the schools	yes	some topics are prescribed in: Applied Maths. Physics
Ireland	yes	no	Mathematics, Physics Technology, Technical Graphs and Business
Italy			
Luxembourg	yes	yes	yes, recommended
Portugal			
Spain	yes	no, it is optional, but offered in 80% of schools. Will be compulsory after the new law	there are experimental projects using IT in almost every subject
United Kingdom	yes	yes	Technology, Mathematics, Sciences

Table 6: Overview of Secondary School level IT in the EC
(Source: Secretaria de Estado de Educación. PNTIC, Madrid, 1991)

In the National Curriculum of the **United Kingdom,** there are IT features in a number of foundation subjects, especially Technology, Mathematics and Science, where they form part of the statutory requirements. These aspects of IT are compulsory. But in other areas of the National Curriculum, non-compulsory illustrations are given of ways in which IT can be used to facilitate learning.

In **The Netherlands,** 85% of the schools offer a *Computer Appreciation Course* of approximately 40 hours. An experimental plan has been set up for the introduction of *Informatics* as a subject and there are recommendations to introduce this subject in all schools, as yet without the intended results.

In **Spain,** most Secondary schools offer an IT subject. In the new curricula, under implementation at the moment, several optional IT related subjects are planned to be introduced. According to the new Law, the final basic training in this stage recom-

In **Germany,** the BLK (Federal and Regional Commission for Educational Planning and the promotion of research) establishes in its Gesamtkonzept for education in Information Technologies of 1987:

- Basic education in IT for all students between 13-15 is offered, integrated into existing subjects.
- Compulsory Basic Education on IT for all students is offered, integrated into existing compulsory subjects.
- One optional IT advanced education subject (Informatics) in the two stages of Secondary Education.

The **Irish** Ministry of Education decided to include ITas a subject within Technology in 1989. Modules were also set up in the subjects Technical Graphics and Business Studies.

In **Belgium,** the different aspects of IT are either covered in specialized courses (for example Informatics), or integrated in other subjects (Mathematics, Economic Sciences, etc.).

In **Greece,** curricula incorporate IT as a content. A pilot project on the introduction of IT in Upper Secondary Education (age 16-18) was set up in 1986. These courses are given in all the Comprehensive Lycea and Technical Lycea (Basic+Advanced). They are also extended to Lycea and Gymnasea (12-15 age) which are equipped with computers.

4.3 Comparison of primary and secondary-level IT

The presence of IT-related topics in the curriculum at the secondary-school age level is greater than in the 6-12 age level. When each subject is tackled separately, this greater IT presence is reflected differently in each of them. However, the curricular presence of information technology increases with time. It can be observed that in those curricula which have been recently renewed, there is a greater presence and integration of IT. In the case of secondary education, most countries have introduced one or several ITrelated subjects in their curricula . The orientation of these subjects differs from one country to another. The curricula of such subjects as Mathematics, Sciences and Technology have been more affected than those corresponding to other subjects. However IT presence is reflected m almost all subjects in at least some of the countries. It has been also noted that in the majority of countries, the use of IT as a universal tool for learning is recommended by the educational administrations.

5. Teacher-training methodology in Spain: Initiatives and experiences.

What follows, although valid for all the Spanish plans for the introduction of IT in Education, is specially relevant as regards PNTIC. All the plans were based on a threefold strategy: provision of hardware to schools development of a policy on educational software, and teacher training.

5.1 Curricular approaches

The curricular approach was chosen for the introduction of IT; in other words: establishing new subject matters such as Informatics or Programming was not intended; the objective was to integrate computers and new technologies in the curricula of the existing subject matters.

This approach is much more interesting from the educational point of view, although it involves a higher complexity. Basically, it requires an efficient teacher-training infrastructure capable of providing correct, accessible, and sufficient training. It also has an impact on the organization of space in schools and on curricular contents.

5.2 Teacher training organisations

The most relevant factor in this scenario is teacher training.

As the objective is training all types of teachers, it is not intended that they acquire some superficial background on new technologies and start experimenting with them in order merely to deal with the old curricular contents; the aim is rather to transform teaching activities themselves by changing the methodology and the contents of the curriculum. In order to achieve this, the support of educational community for teacher training is organized taking into account the introduction of technology at different levels, which are briefly described below:

- *Central Services,* where strategies are devised, courses designed, and policy established in all fields (training, purchase, selection of software, experimental production, etc.)
- *Local Branch of the Ministry (Direcciones provinciales).* As has been explained earlier in this document, in each of the 27 provinces of the MEC-managed Territory there is an executive body in charge of applying locally the Ministry's policy. Within this structure, the Projects Director (*Jefe de Programas*) is the person who is responsible for the introduction of IT .
- *Teachers' Centers (CEPs).* There is a teacher-training network throughout Spain, with 113 centers in the above-mentioned 27 provinces, geographically arranged so as to ensure that each school is within reasonable distance of at least one of them. Teachers' Centers are meeting points for teachers where the Ministry's training plans are carried out. The training offered by these centers is established in each province according to the Ministry's directives. There is a variable number of trainers in each center, according to the size of the territory under its jurisdiction. IT trainers are available in all of them; they are in charge of training the teachers from the nearby schools taking part in the Ministry's plans for the introduction of new technologies.
- *The schools.* In the MEC-managed territory, there is in every school a new technologies co-ordinator who co-ordinates the cross-curricular activities carried out with the hardware provided by the Ministry. There is also in every school a team of teachers in charge of carrying out the activities previously planned and approved at the central and provincial levels. These teachers have received training at the CEPs during the first year of the teachers' participation in the Project. The Co-ordinator is the link between

this team and all the other institutions involved; he or she receives a more-thorough training (150 hours), organized on a nationwide scale, and designed and imparted at the Central Services Headquarters. This initial training is centralised, with the aim of ensuring a certain homogeneity in the approaches to the use of new technologies in the classroom. Subsequent training is provided, to both the co-ordinator and the team, at the provincial level.

6. Some desiderata on pre-service training

It is obvious that would-be teachers should have the first contact with IT methodology during their university studies. In the university schools and faculties where future teachers are trained, computers and other new technologies (audio-visual media, telematics, etc.) should be present not only as subjects of study, for the sake of their pedagogical usefulness, but also as training tools. In other words, rather than introducing new subject matters under such labels as "Methodology for the Use of IT in the Classroom", it would be more effective to use new technologies in the common training activities carried out in those institutions.

The present trend in Spain goes in this direction, although there is no guarantee that it will become widespread.

7. In-service training: Telematics and teachers' centers.

In-service training is more expensive and less effective than pre-service training, but the current training schemes, and the incredible speed at which new developments appear in this field, determine that the only realistic approach is to organize recycling plans through the CEPs, where courses and training activities are available for most teachers.

Teachers' Centers (CEPs) thus play a fundamental role in training schemes in Spain.

But there is the problem, common in other countries as well, of the mismatch between offer and demand. As the demand for training grows, so do the costs, and the teachers' expectations may be hard to meet. This is a key issue not only in teacher training, but also in the wider field of Adult Education and Training for professional recycling, where the only solution envisioned by European and even worldwide organizations points toward telematics.

The only possible answer to the massive demand for training seems to be in flexible, distance, telematics-based training, perhaps with simulations of virtual classrooms, in combination with more traditional media and live contact sessions. The problems become then of a different order: how to obtain adequate materials, how to evaluate learning, how to implement tutorial activities, the validity of the diplomas obtained, etc.

Through the PNTIC, the Spanish Ministry of Education takes part in several European and Spanish R&D projects aimed at developing tools for distance learning, including the use of ISDN, satellite communications, or television.

8. Experiences in distance teacher training.

PNTIC has set up a telematic infrastructure to connect the members of the educational communities, and to carry out curricular classroom activities as well as training activities. This was tested during the last phase of the training for future IT school coordinators. To begin with, during the 1993 course, 20 % of the training was imparted by telematic means, after some live contact sessions in which the trainees became acquainted with the use of the communications and connectivity devices. The experiment was a success, and most teachers welcomed the novelty. In future courses distance training will become predominant.

Some courses entirely based on distance training have also been designed for such topics as the resource packages for Mathematics and for Primary education . These resource packages contain examples of the use of IT in different areas and levels, and are widely used for training purposes at the CEPs. The above-mentioned courses, almost completely telematics-based, include the help of a tutor or group of tutors operating from the PNTIC's headquarters.

9. The permanent electronic forum.

The above-mentioned serving center has been equipped with a BBS-like program containing X400 electronic mail, and will operate as a contact point for the members of the Spanish educational community, and as a training service, as has been explained above. It was set up in 1991 and became fully operational in 1992. It currently provides such services as bulletin boards; a forum for teledebates; access to data bases with information of relevance for teachers (IT-based experiences, the catalogue of the Ministry's Media Library, administrative information, etc.); educational and satellite TV timetables; information on public contests and competitions; news of general interest, etc.

9.1 Problems and projections

Nevertheless, certain problems have arisen. Budgets are usually low and telephone services expensive. Financial problems (telephone bills) involved in the use of telematics have been tackled by resorting to the Spanish Videotex network, whose fees are affordable for educational institutions. In the future, in order to provide faster and more sophisticated data flow services, the Ministry of Education will sign agreements with the companies managing those services in order to ensure that schools are charged special, affordable, fees.

The serving center has about 2.000 users at the moment, and it is planned to grow as much as necessary in the future. The next planned step is to link this net with the INTERNET in order to provide international contacts to schools or people involved in IT projects.

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The Implementation of Communication and Information Technologies in Teacher Education in The Netherlands

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Abstract

The introduction of information technology into Dutch education was started by the beginning of the 1980s. This article consists of three different parts each describing the experiences and activities of the authors in the field of CIT in educational practice. Part One deals with (case-study) research into new policies for co-operation between teacher training institutes and higher secondary schools. Part Two deals with the efforts of improving the pedagogy of initial-teacher training programs for primary and lower secondary education, and Part Three will focus on the current national program focused on implementing IT in the schools.

1. Introduction: The context in the Netherlands for introducing IT in education

1.3 Broadscale start.

Two subsequent nationwide programs (INSP and NIVO) were financed by the government and hardware manufacturers. Top-down innovation strategies were used, aiming at the standardisation of hardware, the development of educational software and inservice training for limited numbers of teachers. Each Dutch secondary school having three teachers attending inservice training was provided with hardware.

1.2 Limited initial results

Results of these nationwide programs were limited as far as the actual use of the computer in the classroom is concerned. The experiences in secondary education taught us that:

- the teacher is the linchpin of any educational change;
- long-term and institutional development is necessary for schools attempting to implement IT in classroom-practice;
- translating foreign software for the educational home market is cost effective.

1.3 New programs

These experiences were taken into account when national innovation programs in primary education and follow-up activities in secondary education (PRINT) started in the early 1990s. Three basic assumptions were made:

- schools participating on a voluntary basis were to co-operate in their innovative activities;
- curricular innovations should go hand-in-hand with the implementation of IT;
- teacher-centred support should be linked to institutional (school) developmental support.

1.4 Reconsideration of teacher education

As a consequence of the school situation as described above, the role of teacher education in the implementation process of IT has been reconsidered and new policies are emerging aiming at:

- the improvement of initial teacher training pedagogy;
- specifications of subject-matter pedagogy in relation to IT;
- Long-term co-operation between teacher education institutes and schools.

Part One: THE TEACHER AT THE CORE OF EDUCATIONAL CHANGE

At the Institute of Education, Utrecht University, several research projects have been dedicated to identify critical factors influencing the implementation of IT in classroom practice and to specify conditions for long-term inservice training programs involving IT.

From 1989 until 1991 four case studies were undertaken to describe the day-today practice of teachers who were implementing the uses of computers in their classrooms. The project has made clear that the teacher is the most important factor in educational change but that factors at the school level are strongly interrelated to teacher's perspectives.

In another project[1] during 1992 and 1993, four schools for vocational secondary education were supported in their first experiences in the use of telecommunications. This project has generated insights and recommendations for the many interrelated aspects of an nation-wide communication and information system for Dutch education.

2. Computers in the Classroom Practice

2.1 The project setting: Providing access to computers

In the case-study project, four teachers were provided with a computer at home, an additional computer and a transviewer in their classrooms, and a fully fledged computer laboratory in their school. The selected teachers included both average and experienced teachers, but who were novices in the field of information technology in education. The four teachers were given a standard inservice-training course on computer-assisted learning in order to bring them to a similar level of computer competence. After the course the teachers had an overview of the software available for their subject-matter areas and they were able to use the computer for file handling and word-processing. Then any further support was withdrawn. The teachers were free to use or not to use the computers in their classrooms and at home. There were no compulsory goals to be achieved by them during the subsequent two-year research period.

The main question to be answered was: 'If they have adequate resources, what are these teachers going to do with computers at school and at home, and how can their activities be explained?'

2.2 The Results

Two major categories of factors explaining the uptake of computers by the four teachers were discerned: factors at the school level and factors at the teacher level.

2.2.1 School factors influencing teacher use of IT

School factors played an important role. First, hard and software had to be easily accessible. Teachers wanted to make reservations for the computer lab efficiently and they counted on the support of the technical assistant for making the required copies of software. Secondly, the principal played an important role. She held a positive view on information technology in education and she provided the necessary technical support for the teachers by allocating a technical assistant for twenty hours a week. More over, she implemented a IT-committee that was to be a platform for discussion and policy-making. Financial support was given to the teachers so that they could purchase the required software. And last but not least, the principal gave moral support through informal talks with the teachers showing her commitment and interest in their efforts.

[1] The project was carried out in collaboration with two other partners, Twente University and University of Leiden.

2.2.2 Teacher factors

However, teacher factors far outweighed the school factors. These were divided in two subcategories: beliefs and skills. Most important of these were the teachers' beliefs regarding what should be in the curriculum (content) and the way in which the subject should be taught (pedagogy). Besides, teachers had beliefs regarding their role in the classroom and in the corresponding classroom activities. Finally, they had personal views on education and on themselves as teachers.

The skills of teachers were related to their competence in managing classroom activities, to pedagogical skills and, less important, to technical skills. These interrelated beliefs and skills can briefly be described as 'routines'. In this research, beliefs seemed to determine or influence skills more than the other way around. For example, the English teacher believed that 'teacher-centred' classroom situations lead to more effective learning, so he was not willing to develop skills for pupil-centred classroom situations. On the other hand, the French teacher was convinced of the advantages of group-work, without having the teaching skills to organise it, so he was eager to develop these necessary skills. The uptake of computers in the classroom was strongly affected by the beliefs and skills or 'routines' of the four teachers. They tried to fit information technology into their beliefs and their well-known skills. Although three of them tried to enhance their skills, their beliefs were hardly changed by the influence of information technology.

3. Telecommunications in the Classroom Practice

3.1 The Project: Stimulatory educational use of telecommunications

The second research project aimed at the investigation of the various factors that need to be considered in the implementation of an on-line communication and information system for Dutch education. The project had as its goal to contribute to the long-term development of the use of telecommunications for communications and information-related activities in Dutch education.

3.2 The Results

Through the research, recommendations have been specified relating to the successful establishment of an educationally oriented on-line communication and information system. In order to come to these recommendations a variety of activities and explorations were stimulated. A major activity in this respect has been the participation in the project of four vocationally oriented secondary schools whose experiences with a variety of existing on-line communication and information systems were carefully supported and observed.

3.2.1 Teacher in-service

A strategy for teacher in-service and support relative to the use of on-line systems for professional and lesson-related activities was developed. This strategy was based on two different assumptions. First, the concept of collaborative learning shaped the form and sequences of the in-service training. Trainers and trainees deliberated frequently on the activities and usefulness of different communication and information systems. Second, the idea of fitting new activities into existing needs influenced the content of the in-service training. First, those needs were met that fitted the curriculum, the teaching style, and the organisational circumstances in the schools.

3.2.2 Telecommunications for teacher professionalism

The major conclusion of the project is that the use of telecommunications in education is especially appreciated by teachers for its services for communication and for information retrieval during lesson preparation. Thus these teachers think that a communication and information system for education would fit their need for professionalization. Two major levels of professionalization have been defined. At the teacher level, professionalization of the teacher gets on the move through better relevant information concerning the subject matter, collaborative working with colleagues in other locations and through the development of new possibilities to enhance pedagogical skills. At the school level, professionalization is in progress through better internal communication, communication with other schools and the offering of a greater variety of learning environments.

4. Implications for in-service teacher training

What can be learned from the research described above for the training of teachers? Comparing the results with other research some common findings can be discerned:

4.1 Persistence of teacher opinions and practice

First, teachers hold views that persist during innovations. Educational change is a slow process and teachers need time to gain experience with computers or new ways to communicate and use information systems. For much of their efforts, the teachers described above did not start with implementing the overwhelming educational possibilities of information technology, so often described of in literature. They did not even consider these possibilities. Instead, they started using the computers for their own convenience by doing word processing or by browsing information systems for their own professionalization. Then they only did carefully set out for the use of CIT in their classrooms, where they varied familiar pedagogical conditions as little as possible. Gradually, they experimented with pedagogical settings that were more difficult for them. The need for control over the learning process of the students was an important issue for them.

4.2 Implementation is a team effort

Second, implementing innovations should not be the task of individual teachers only. The school management needs to be involved financially as well as by policy-making and moral support. Using CIT has to become an issue of policy for every school with important consequences for the curriculum, the classroom practice and the pedagogical development of the teachers. Schools, as teachers, do not innovate quickly. School culture has specific conditions that makes it resistant to change. Thus, schools need time and long-term support in changing programs and practice.

4.3 Focus on teacher and school professionalism

Third, the use of communication and information systems appear to be highly relevant in relation to the professionalization of the teacher and of the school as a whole. An important issue here is that communication is a key concept in educational change. Exchanging ideas by conferencing through a communication and information system strongly enhances the possibilities for change.

5. A strategy for in-service training

A strategy for in-service teacher training programs involving CIT can be made clear now.

5.1 School-based in-service training

In-service training programs should be school-based programs. In-service courses aiming at individual teachers are missing the link to the school as an entity of change. Although teachers are at the core of educational change, implementation of information technology implies changes at school level. Thus, school managers, IT co-ordinators, and administrators should be trained together with the teachers.

5.2 Differentiation within the school

School managers have to face the fact that not all teachers in the school are equally interested in educational change or information technology. Therefore, the implementation of CIT should not become a duty for all teachers. A differentiated bottom-up approach for the different departments in the school seem to fit the best. Those departments which come up with ideas could best be honoured, and their experiences should be discussed in school on a regular basis. This discussion among teachers may stimulate the spread of innovative teaching ideas.

5.3 Long-term planning

As change is a slow process, it is essential that school managers look far ahead and persist in their support of change. In the case studies described above, two years of innovative activities appeared only to be the beginning of an integrated uptake of computers.

Educational change should get away from its actual image of being temporary. On the contrary, educational change should become inherent to education. It should become initialised in the school system. The use of CIT in education can then become a part of this on-going innovative process.

5.4 Fitting into teachers' beliefs and skills

Probably the most important feature of any in-service training program on information technology should be the effort to fit the innovative activities into the existing beliefs and skills of teachers. This opinion might upset some advocates of information technology However, only by acquiring positive experiences with computers in a way that teachers do appreciate, is there a chance that their newly developed skills will start to change their beliefs. For any educational innovator it is important to realise that it is not the view of the innovator on the blessings of CIT that matters; it is the view of the teacher that matters.

5.5 Structural and on-going collaboration between teacher-training institutes and schools

In-service training programs should be based on an on-going collaboration between teacher-training institutes and schools. There is a mutual interest for both to co-operate on a long term basis. On the one hand, teacher-training institutes need schools for their student teachers. Moreover they need schools for data collection in research projects. Schools in turn need teacher-training institutes for in-service training for staff and institutional development.

6. Implications for initial teacher training

The disappointing number of teachers working with computers has lead to the opinion that initial teacher-training programs could play an important role in changing this situation for the near future. However, is it effective to train student teachers in using information technology? There are several reasons to answer this question, to quite a large extent, in the negative.

6.1 Change is slow for student teachers, too

First, there is the demand side, the student teachers. If all student teachers come to their studies highly motivated for information technology, it would probably have been an integrated part of the teacher-training curriculum since the 1980s. Unfortunately, the population of student teachers seem to be quite the same as that of practising teachers. It might be argued that if the slow-change process applies to student teachers as it does to practising teachers, which it probably will, then most initial teacher-training programs are too short to bring about some substantial change in beliefs of student teachers. Of course, on that line of argument one might argue that many other subjects being part of initial training programs could be skipped.

6.2 Other problems for students and new teachers

However, especially with respect to the use of information technology there are two other arguments to consider in relation to the content of the ITcurriculum in initial teacher training. Initial teacher training is up against the so-called 'reality shock' of student teachers. Student teachers who have finished their training and start practising teaching are preoccupied with day-to-day classroom practice. Keeping classroom order is of primary importance, as most of them are lacking the necessary skills. Complex teaching activities such as CIT are the last things that bothers them during the first two years of teaching.

Moreover, most schools fall short of the expectations that student teachers might have once they have been convinced of the advantages of information technology in education. Working in a school where it a tough job to get into the computer lab, if there is any, where it takes time to get the necessary software purchased, or where computer-assisted learning is hardly practised in the department involved, will be widening the gap between training and practice.

6.3 Teacher trainers

Second, there is the supply side, the teacher trainers. It might be assumed that teacher trainers are well-advanced users of information technology in education. However, there is evidence they are not. So, there is another obstacle to abolish before information technology is to be implemented in initial teacher training. If it is accepted that teacher trainers of specific subject matters should acquire the necessary knowledge to teach the applications of information technology in their field, then teacher trainers themselves should be trained first.

6.4 Reconsideration for IT in initial teacher training

This does not mean that teaching information technology is not of any use in initial teacher training programs. On the contrary, information technology has to figure in any curriculum of initial teacher training programs. However, the content of the curriculum in this field should be carefully considered. Initial teacher training should emphasize on the 'know about' of information technology, that is, creating critical awareness of what could be achieved in education with information technology in specific subject matters. Initial teacher training should not aim at the 'know how' of CIT, that is, the training of skills for actual use of information technology in school.

Initiatives to implement information technology in education might be far more effective for the target group that has already overcome initial teaching problems: practising teachers in schools where the factors at school level mentioned above, can be taken into account.

Part Two: VIT-PROJECT TEACHING PROCESS INNOVATION

7. The VIT Project

Since 1984 The Dutch government has paid continual attention to implementation and use of IT. Nowadays the situation is that there are enough computers installed in secondary education schools. More and more software becomes available. Considerable training and coaching activities are being carried out.

An important problem remains integrating IT in daily teaching practice. There is little knowledge about how to use IT in school (didactics). To stimulate the development of didactics and IT in school, the Ministry of Education in the Netherlands has initiated the VIT-Project: Education Process Innovation.

7.1 The project

Three colleges of higher education in Tilburg, Sittard and Eindhoven associated with the Foundation of Higher Education Zuid-Nederland (HOZN) are involved with the project.

The project started 1 September 1992 and ends on 1 September 1995. About 50 teachers of the three teacher-training colleges are concerned with this project. In addition, there is a close co-operation with some primary education schools and schools for secondary education to approach a fine tuning between theory and practice. The total project budget amounts to about six million guilders. Both the government and the HOZN have contributed three million guilders.

7.2 The general project goal

The general project goal is to develop a new didactic for the teacher-training centre for primary and secondary education and for primary and secondary schools. The starting point of the project is that there is enough IT available indeed, but not enough didactics. With didactics we mean the whole of activities, instructions, and organisational arrangements which a teacher takes within the frame of a teaching-learning process. A good didactics is built on explicit ideas about how a teaching-learning process should develop.

Not until the teacher understands the teaching-learning process can he make the right choice for using IT. The accent thus lays on the didactics. When there are no good arguments to give for the use of IT from the didactics, education will go on with well-tried methods.

So, within this project we are looking for a mixture of old and new.

7.3 Separate sub-projects

The project is subdivided into 17 separate projects. Seven separate projects are aimed at the development of a new training didactics. These projects are aimed at for example: the development of a training concept, decision-support instruments for using IT, the organisation of renewed learning surroundings, analyses of learning processes, and general didactics. On behalf of the development of the subject didactics for Secondary Education there are separate projects within Science (simulations, electronic measurement, distance teaching), the section Geography (environmental planning, cartography, climatology), and the section Mathematics (computer algebra, and arithmetic with graphic pocket computers).

On request of the teacher training institutes and the primary schools didactics have been also developed through special emphases in four separate projects: Arithmetic; writing; environmental education; and the developing of an integrated working place, in which students have free disposal of different IT possibilities such as a computer, fax, modem, and CD-ROM.

7.4 Developmental strategy

To come to a balance in time some separate projects are being started each year. This has the advantage that not too much teacher capacity at the same time is necessary. Moreover the results can be used in subsequent projects. For example, the experiences within the section "French" can be used by the section "German". To come to a new didactic, the following developmental strategy is being used in all the 17 projects:

- literature study
- consultation with an external specialist
- making a clear description of the usual training didactics in an area
- research on available IT
- research on available software
- discrepancy-analyse between what is happening now and what is desirable related to training didactics
- choosing for one or more didactical models
- choosing for one or more suitable IT applications
- try outs of the chosen IT in instruction in school practice
- research and analyse of the results at the level of student progress, classroom management and teacher capabilities
- report with didactical recommendations
- description of a new didactical method of working related to the training of teachers and to teaching in the subjects under consideration.

8. Outputs and experiences

8.1 Materials created

The project is in full swing. We have already received a variety of different results. We have developed a totally new module of eight weeks (including (training) exercises) called "Teaching and Learning". In this module important contemporary opinions about learning with help of computers are discussed.

In the separate project "General Didactics" an extensive study of literature has been done and a series of recommendations for the construction of a module has been formulated.

Within the project "Distance Teaching" on the basis of technical opportunities and explicit views about distance teaching, a specification of how to develop and test a separate project of distance teaching within science education has been made.

Within the section "Mathematics" a curriculum about acquiring cognitive skills within the computer algebra domain has been built.

A student manual has been tested for using graphic pocket calculators. A new module "Graphics" has been made. Within the section Geography an experimental module to teach students to work with satellite pictures in the curriculum section Climatology has been completed. Within the section English a new theoretical model about teaching literature, in which the use of IT (f.e. CD-Roms, digitalized videopictures) has a special place has been developed.

Up to now the other projects have not been developed enough to report results.

8.2 Problems

Within such a large and theoretically complex project there are many problems to overcome. We discuss five here.

8.2.1 Hardware

It is extremely difficult to make all hardware fully compatible. Suppliers break an engagement, the internal service does not function optimally, older software versions do not fit onto new hardware, sometimes simply there is a lack of knowledge about how to install software. Our conclusion is that the current hardware and the limited knowledge of the users themselves still are serious hindrances in using IT in training situations in an easy way.

8.2.2 Software

It has been known for a long time that much software does not often fit in teacher-training situations or adapt itself well to a certain series of lessons.

In this project we have learned in addition that it costs very much time to penetrate all kinds of software possibilities. Surely this is the case with complicated software, such as simulations and electronic measurement environment. We still notice that software is not easily accessible.

8.2.3 Teachers

We have experienced that many teachers have little knowledge about available software and IT, and that this is the case also within teacher-training institutes.

Too often this area has been left to one teacher, who then communicates very much with his computer-using colleagues. These colleagues like that, because they too are busy with IT. But, it often comes to nothing with respect to other teachers. Many of them still cannot even handle computers. From our own experience it appears that in particular teachers in the primary education are still insufficiently informed.

8.2.4 Project contributors

It strikes us that project contributors, all of them teachers at the teacher college involved in the project, have themselves, strikingly, a less than explicit opinion about a educational concept of IT use, and little sense of a training didactic for IT use. The Tilburg PABO is a clear exception. Teachers cannot give answers to the question: Why do they do things as they are doing them? From the learning-theoretical point of view, the question remains unanswered.

This situation adds to the project complexity. It takes much trouble to get clear among the participants the present educational concept, the outlook on teacher training.

Within the project it is of great importance to be able to talk about the participants' opinions about training and didactics, because this is the starting point of an changing didactic.

8.2.5 Implementation

From the management point of view implementing the project materials is a continuing source of concern. It is not the intention that the different sections keep working in isolation. Their experiences must be used in helping other sections, which also must integrate IT in their educational didactics. It is yet not clear how to condition this implementation. In the frame of the implementation of the project materials an extensive teaching program, consisted of courses, seminars, workshops, a help desk, and consultation from the still developing expertise entre "Didactic and IT" must be realised.

9. Recommendations

- It seems to be a good idea of the policy makers to pay attention to the development of a new didactic for IT use after the long period of placing hardware. These development of a didactic must occur in dialogue with primary and secondary schools. Otherwise there will a great chance that the efforts will not work and not will be accepted.

- A training program for working teachers surely must put much attention to the demonstration of all kinds of possibilities when working with IT.

- Teachers must get or take more time to get to the bottom of the software. Teachers must be trained to distinguish several pupil-learning strategies in order to make use of the possibilities of available software. It can also be possible as a result of such investigation, not to make use of computers, but to go on with more traditional means.

- Joining teaching programs within the frame of career development and salary differentiation could be an important impulse for a better use of IT in teaching.

10. Closing remarks about the VIT Project

The Ministry of Education in the Netherlands sees the importance of using computers and other IT in education. For that purpose it has started different large national projects as the NIVO and the PRINT project for secondary education and the Comenius Project for primary education.

Beside this the Ministry has spent much money in in-service training for teachers in primary and secondary Education. It has given quite a lot of money to national and regional consulting institutes.

The VIT project "Teaching Process Innovation" is an important joint initiative of the Ministry and the teacher training institutes of the HOZN to develop a new didactic by which the use of IT takes a central place. Indeed, the first output indicates that it is possible to develop total didactics around the use of IT, but many efforts still are necessary in the field of technology, implementation, and teacher education.

Part Three: DEVELOPING IMPLEMENTATION STRATEGIES THROUGH GOVERNMENTAL PROGRAMS

11. The previous stages: The NIVO Project

The national NIVO Project for secondary education was set up in the period from 1985 until 1988. NIVO means New Information technology for secondary education. All schools for secondary education received a set of hardware (11 IBM-compatible computerizations), software tools (mainly open software) and training facilities for at least three teachers per school. Furthermore, many specific courses for teacher training were developed and carried out. And under the banner of 'let a thousand flowers bloom', the development of many courseware and curriculum related activities involving I.T. was initiated.

NIVO was the first stage of the implementation strategy. The project resulted in (a) a de facto standardisation of computer hardware within schools. It gave (b) an impulse to courseware development resulting in a vast amount of (mostly unrelated and rather simple) educational computer programs.

NIVO also started (c) the process of the adaptation of existing curricula. Almost 95% of the schools actually did organise courses for pupils in information technology.

Above all the project (d) provided the conditions for informing schools and teachers, mostly the pioneers, on the possibilities of information technology. Thus I.T. got on the agenda of most schools.

12. The first PRINT Project

Between 1989 and 1993 the first PRINT project got off the ground, also on a national scale. PRINT stands for Project on the Implementation of New Technologies. It is a project carried out by the three Dutch National Educational Advisory Centers, the National Institute for Curriculum Development, the National Institute for Educational Measurement and the National Foundation for Educational Research.

12.1 Information skills in the curriculum

PRINT aimed at a wider introduction of computers into education. The development of new curriculum covering aspects of information technology in Physics, Social Sciences, Economics, Maths and the Mother tongue was brought to an end. In four of those disciplines the new objectives have now become part of the set curriculum for the upper level of secondary education. For the lower level, so-called information skills in information technology itself, in the mother tongue, and in science, maths and the social sciences have been formulated and will be mandatory for all schools from 1993 on.

12.2 Teacher introduction activities

As to the use of computers as an educational tool, courseware has been developed within the PRINT project be used longitudinally troughout the existing curriculum of school subjects. Research among pioneer schools (in the field of I.T.) has made it clear that some software packages (mostly the relatively open programs or dedicated software with many possibilities for different content fillings) were at the top of the popularity scales, whereas many others were hardly used. But the most important element of this second phase was the description of a whole range of activities to introduce teachers to the use of computers. These activities were directed at

- entire schools in regional projects with the support of the National Educational Advisory Centres;
- school directors by offering strategies for planning the implementation of computers in their schools;
- groups of teachers in certain disciplines with in-service training on subjects of information technology and
- individual teachers in single sessions of one afternoon on certain CALpackages or on longitudinal implementation of courseware into the curriculum.
- the whole educational scene by articles, written publications, posters, conferences and a help-desk.

12.3 Results of the first PRINT project

The first PRINT project has resulted (a) in sufficient courseware to cover large areas of the existing curricula permitting the use of courseware. It produced (b) a reasoned insight into IT objectives in school subjects, the integration of IT into the lower level of secondary education, and a coherent and consistent IT-curriculum outline for use at the upper level of secondary education. The project offered (c) a clear view on realistic options of computer use in school subjects, not in the least by the experiments carried out in the so called 'pilot schools'. Part of this insight was an awareness that there are three important centres of expertise for the development of educational software playing a major role in pushing forward the use of courseware within schools. Furthermore (d) we had to face the fact that a majority of the teachers still did not accept the computer as an educational tool.

In this way PRINT made the transition from a national computer and software project to a teacher-oriented project, albeit still under national control. It moved into a second stage of the Dutch implementation strategy.

13. The new assignment: The second PRINT Project

13.1 Conditions of the second project: PIT

In 1992, at the request of the Ministry of Education and Science, the PRINT management designed an ambitious project focusing on the use of information technology within the lower level of secondary education in the next four years (called the PIT Project). The conditions for the project are:

- emphasis on the dissemination of information on how to use existing courseware;
- special support and facilities for a limited group of schools (approximately 200 out of a total of 1500), in the context of the national restructuring of lower secondary education, which started in August 1993;

- the development and customisation of educational software and accompanying paperwork, only to be carried out in relation to the wishes and demands of the participating PIT schools;
- a great variety of courses, information and other activities for all of the other schools of secondary education on the use of computers in the curriculum.

13.2 The strategy

This project is the third stage in the Dutch strategy for the implementation of new information technologies in secondary education over a period of altogether 12 years.

In this third phase, running from 1993 to 1997, information technology loses its special policy status and becomes part of the other major changes in education: changes of the contents of the national curricula and the move towards the so-called 'autonomous school'. Following this philosophy schools will have their own responsibility on how to use information technology as an educational tool.

The strategy for the next four years is that the chances of implementing information technology will be greater when the technology itself is the carrier when trying to realise the goals of restructuring Dutch secondary education. The implementation activities are integrated into this restructuring.

13.3 The approach

PRINT has invited every general secondary school to subscribe to three out of twenty-four 'projects' in eight school subjects: Dutch, German, French, English, Mathematics, Physics/Chemistry, Biology, and Technical Skills. In each subject, three projects were set up focusing on themes such as information skills, learning strategies, remedial teaching, re-teaching, differentiation in time or contents, study strategies, and laboratory experiments.

As an example, for the three foreign languages: English, French and German, the following aspects are being dealt with: remedial teaching of pupils needing special attention, acquisition strategies of FL-reading skills, differentiation in order to deal with the different abilities of children, and computer-aided learning as a pedagogic tool.

Within a three week period, the schools had to opt for three different subjects and state their preference for a theme. They were asked to write a reasoned motivation on the restructuring of lower secondary education. The local Inspector of Education had to co-sign the letter of application.

On top of enjoying an advantage educationally (free counselling and help) in joining the project, the schools would also receive 24000 guilders (about 12000 dollars) per annum (to be spent on hard- and software but also to pay for extra teaching periods).

13.4 The Networks

This approach has turned out to be very successful. Almost 500 out of the total of 1500 lower secondary schools turned out to be interested. 125 schools were selected and were called Schools with SPIRIT. SPIRIT is an acronym fur the Dutch PIT project and stands for: schools with a Special Project for the Implementation of Information Technology. The selected schools are grouped together in 24 networks each of about 15 schools.

Each network addresses one of the themes. The participating teachers are instructed by the Educational Advisory Centers. They exchange information and professional views, work on their personal and professional development, and give comment on new materials.

Each SPIRIT school is a member of three different subject networks.

The networks meet face-to-face six times per school year. The participants use educational software (existing and new) in their classrooms and report on their experiences in the network. These experiences will result in suggestions for adjustments and improvements to existing (and sometimes even new) materials.

13.5 The products

During the project, the insights, strategies, experiences, and emotions relating to the use of these materials will be disseminated in various ways. New or adjusted software will be published, new lesson materials will be made, guidelines on how to use the computer in the classroom will also be published. Furthermore, these teachers and schools will be 'used' in their own departments, their own schools, and even with respect to other schools in order to convince other colleagues of the usefulness of computers in education.

13.6 The evaluation

With the results of an 1994 evaluation, the first effects of the project will become clear. The thing to look for will be whether the exchange of information, professional development, and peer co-operation supports the effective integration of information technology within the selected subject areas. The outcome of the evaluation will play an important role in the project's organisation and contents of the next two years.

14. Spreading out

Of course many teachers are not involved in the subject-area PIT networks. They will be approached using written information, leaflets and booklets containing tips on how to use computers; afternoon sessions having an enthusiastic colleague telling about his experiences using computers; and longer sessions with the various pedagogic aspects of computer use as central themes. Also, conferences, meetings, and pep-talks will be organized to increase the number of teachers using computers.

15. The emphasis on implementation

Many people feel pessimistic about rate of computer use by the average teacher. Of course there are several reasons to be pessimistic: lack of hardware and sufficient technical support, lack of good and sufficient software, conditions in schools unfavourable to the organisation of computer-aided learning. And above all the traditional behaviour and thinking of most teachers, lacking the ability to act as a facilitator of co-operative learning.

Yet the first results of this current PRINT project are encouraging. We have touched a responsive note in teachers. We are helping them by improving their school conditions, by supporting them in a new curriculum by means of IT, by instructing them in the use of IT, and by networking, exchanging experiences with other teachers. Also we are looking at the schools as whole entities. We are coaching school principals in how to disseminate the experiences occurring in the three SPIRIT subject areas in which their schools are involved, so that the effect of SPIRIT will remain.

We do not think this third stage would have been possible without the first two stages in the Netherlands. We do think however that the first two stages could have been somewhat shorter and more directed towards the third stage from the very beginning.

Not All Birds Are Turtles
Developing Teaching / Learning Environments in Initial Teacher Training at Comenius University

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Abstract:

In this article we characterise the goals and atmosphere of reformed curricula for initial informatics teacher training at Comenius University. We believe that thanks to certain traditions in informatics education in Slovakia, thanks to the experience of other European countries, and thanks to the deep enthusiasm of teachers and educators, an innovative application of the ***project approach*** *can bring in a new creative spirit. Designing, developing, and evaluating interactive teaching / learning environments in a new implementation of Logo for Windows is proving to attract students and surprisingly, also broadens the traditional horizons of the Logo world. We are experimenting with Contends Logo for Windows as a development environment that meets the needs of children, students, teachers, and developers, and supports* ***student-centred exploratory approach*** *in (informatics) education.*

Some birds are turtles (multiple). Some are not. Find them with your mouse.

1. A mosaic of educational background (concerning informatics)

To better understand our conception of reformed informatics curricula at Comenius University, we put forward some short notes on the history of informatics education in our country:

- Informatics in higher secondary education (that is, for students of 15 - 18 years) referred and often still refers mainly to **programming.** Within the strongly centralised educational system of 1980s, informatics education was given a rather high preference. Influenced by the "programming-as-the third-literacy" opinion of the previous decade, it became nearly a kind of national sport.
- Gaining programming skills proved to be highly attractive for secondary students; local and national programming competitions are held every year - our teams are getting excellent placing even in the most ambitious international competitions[1]. Hand in hand with the broad popularity of programming, it has become a kind of myth and legend for younger students ("I want to program. I don't know what it is, but I want to do it. Let me do some serious programming ...").
- Informatics education is a separate subject (that is, not merged into other subjects in a cross-curricular way). Teachers of informatics are (often) graduates of university teacher training in Mathematics and Informatics, more rarely in Physics and Informatics.
- As far as hardware is concerned, until the end of the 1980s the most widespread computers used at schools were 8-bit monochrome computers of very poor quality, unreliable, with no disk storage, etc. And, however troublesome those computers were, they taught a lot of young people and teachers to get much more than 100% out of them, they promoted original software development (Pascal compiler, Karel the Robot 3D environment, Lisp interpreter, miniLogo) and our early research in informatics education.
- Concerning primary education, there is no regular informatics education at present, although -- initiated by enthusiastic teachers, parents, and researchers -- there are some experimental courses and much free-time activities in this direction. This situation gives us absolutely free hand in deciding what to do with children. Since we are quite sure that in the future primary informatics education will be put on a regular basis is the curriculum, we devote considerable space in our teacher-education curricula to it (which will become obvious in the following chapter of this paper),

[1] International Olympiad in Informatics; 1991 in Athens - first position; 1992 in Bonn - first position; 1993 in Mendoza, Argentina - first position; International Software Competition (for secondary schools), Singapore 1992 - second position; East European Regional ACM International Collegiate Programming Contest, Sofia 1992 - first position; 1993 - second position; Final of ACM ICPC, Indianapolis - 20th position, first European position.

- In 1993, the Department of Informatics Education was established at Comenius University which "legalised" and "professionalised" activities of a group of people with traditional informatics background, who have for years been involved in primary and secondary informatics education research[2]. We are now trying to anticipate future development of the role of informatics in schools and have started new curricula based on our strong belief that informatics is a much broader subject than its traditional reduction to programming; for more inspiration (see also ACM, 93). That is, it can and will contribute much more to education by developing general skills of abstraction, algorithmic thinking, logical mind, skills to organise information, to communicate it, to share it, to co-operate over information, and - which is by far not of the minor importance - to enjoy education, to develop aesthetic feelings, to have fun,
- A new, ambitious implementation of Logo, Comenius Logo for Windows[3], (see Blaho, 93; Kalas, 93; Figure 1), expresses our belief in a new, **project approach** in school informatics. The main objective of the implementation is to provide students and teachers with strong learning environment supporting active exploratory involvement. Keeping the original, pure, Logo teaching / learning philosophy, we tried to introduce all the new achievements of the software world of 1990s into it. We are offering a new powerful computer-activity environment to students and teachers who have already seen professional computer games with perfect animation and are often disappointed by the simplicity of some educational software packages.

To summarise the mosaic: we feel we are living in an exciting time. We as children were enchanted by electric bulbs and the binary arithmetic of huge "steam computers". Now we are trying to be in step with new trends in informatics education.

2. The project approach at schools and in initial teacher training

Out of the reformed curricula we want to present here in more detail a block of three courses closely tied together, which focuses mainly on informatics for primary and lower secondary education. (Higher secondary informatics education, as we have already stated in section 1, is much more programming-centred and in our curricula is covered more by another block of courses. By no means, however, are these two levels of education separated and separable in the initial teacher training. We believe that project approach will gradually attract more and more students and their teachers.)

Three courses in the block are:

2 Experience of Western European countries has influenced our understanding of informatics education considerably. One of the authors had been involved in the Dutch-Czech-Slovakian Comenius Project aimed at introducing modern CIT into secondary education in 1991 - 93.

3 Titled SuperLogo voor Windows, this Logo environment is distributed in the Netherlands by A.W. Bruna Uitgevers B. V., Utrecht.

- Symbolic Computations and Logo,
- Informatics in Primary and Lower Secondary Education (ages 6 - 14),
- Educational Software Design.

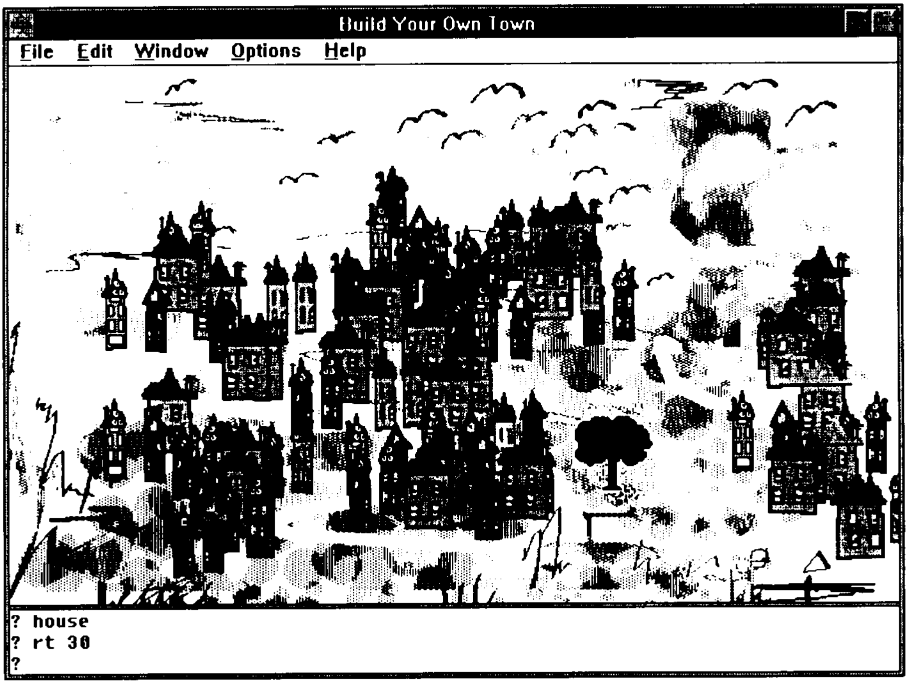

Fig. 1. Output generated through the Comenius Logo environment

2.1 The course "Symbolic Computations and Logo"

The first of these courses profits considerably from the fact that students in initial teacher education who take it are already quite-advanced programmers from their first university year (and some of them partly from their secondary schools). The introductory intensive programming course of the first year concentrates on Pascal imperative programming, therefore we can afford to thrust the students into a swimming-pool: the "Symbolic Computations and Logo" course focuses mainly on Lisp-like data structures such as lists and trees which are always present somewhere in the backyard of each non non-trivial application.

In the Logo environment we spend much time on recursion, recursive structures, recursive drawings, fractals, and polygons. From the more-traditional Logo turtle world we move ahead very soon towards some advanced features of the new implementation: multiple turtles, programming interactions by mouse, animation etc.

2.2 Rationale for the courses in initial teacher education

Our presumption is that an informatics teacher will find himself acting in many different professional roles: he will be involved in regular activities with his students (some of them will certainly be *computer hackers*); he will probably **develop** his own software applications[4], he will **modify** (or at least dream of modifying) another applications to better fit his needs and needs of his students. He may as well **co-operate** with other non-informatics teachers to help them integrate information technologies into their subjects, he may act as a kind of *school informatics coordinator*, he might be asked to support *school administration*... In (Blaho, 93) we put forward our belief that a powerful and appropriate (but not: powerful OR appropriate!) software environment may somehow unify all of these different roles and different needs: spanning from the children-oriented computer world of a turtle to a development tool for educational applications. In our reformed curricula we are trying to use Comenius Logo for Windows as such unifying environment.

2.3 The "Project Approach"

What are the main objectives of the block of three courses? Let us start from the other end: we will describe a simple environment, which we have been using in our experimental Informatics class for children ages 10 - 11 years. In this way we will illustrate our goals, conception, and methods used in the courses. Because this characterises the whole process, which our university students - future teachers - should go through.

[4] In the Netherlands, for example, when visiting several Comenius Project schools, we met a lot of very enthusiastic teachers deeply interested in developing their own small applications and sharing them vividly with other colleagues throughout the region.

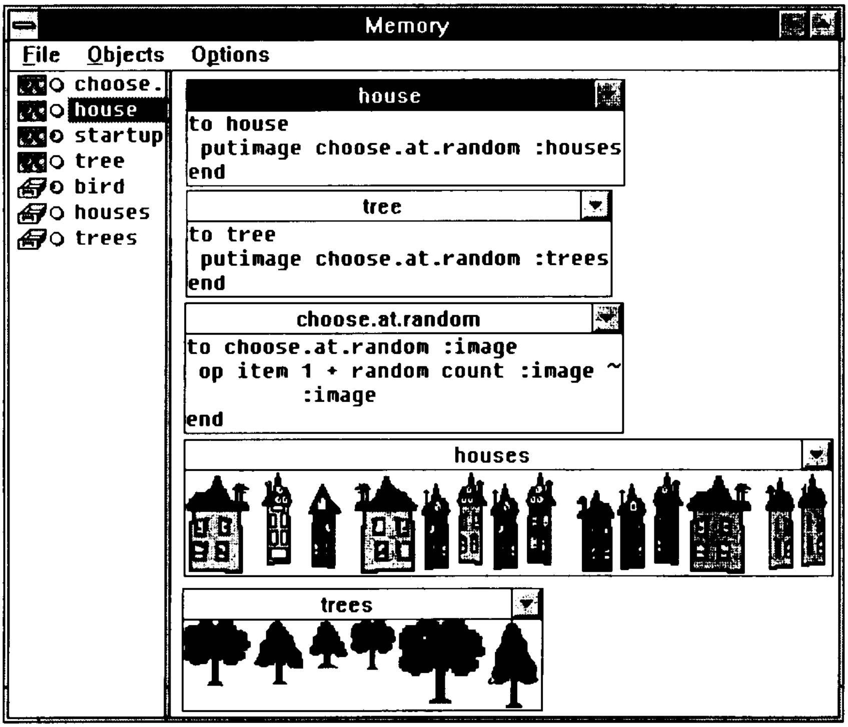

Fig 2. Example of commands

2.3.1 An example project "Build Your Own Town"

We are talking about the **Build Your Own Town** project, which is an elementary introduction to Logo and its turtle geometry. The children involved will have just started their Informatics class one or two weeks previously by the 'Windows with your hands on the keyboard' method inspired by (Stuur, 93). The children can then fluently work with mouse, and are already able to produce their own *text-and-picture stories* in Paintbrush. They have already spent two lessons exploring the Comenius Logo environment by going through demonstration projects we have developed. They know that there is a turtle "living" in the screen. They know that it can walk around with its pen on or off (`penup` or `pendown`).

2.3.2 Goal of the project

Our goal is to make children explore the environment mainly by themselves. They are building a town by making the turtle navigate through simple background picture with its `penup` using only basic `forward` and `right, left` commands. They are trying to investigate new features of Logo at the same time, and we are trying to make them find these features at the time when they really need them (not sooner). To build a house and plant a tree they use special commands `house` and `tree`, which put on the screen an image of randomly chosen house and tree at the actual position of the turtle.

2.3.3 Experiences with software features

Typing in simple Logo commands like `forward, fd, right, rt,` or `house` is quite simple because Comenius Logo supports national language, that is, complete communication within its environment together with all commands of Logo language are realised in the children's natural language (for this example, we use English.). Figure 2 shows an example.

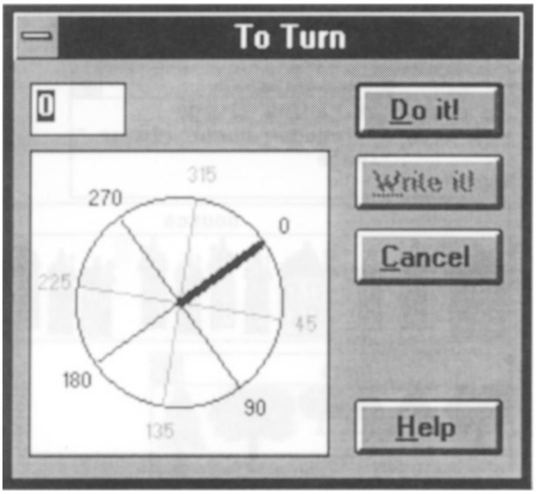

Fig 3. Example of "Turn Chooser"

As every teacher using Logo knows, many mistakes happen when children type inputs to commands[5], such as `forward 30` (abbreviated to `fd 30`). An even more complicated situation arises for children of this age when they need to express angles in degrees. We expected this but we let them try. In this way they discovered several **choosers** - they found out that it suffices to type in `right` and immediately press Enter. Instead of causing an error, the selection of **Turn Chooser** option makes a compass open in which the child can qualitatively (not measured in numbers) express how much the turtle should turn and in which direction. When the child now presses OK, the command with the proper input will appear in the command line (so that the user can see the complete instruction) and is executed. The same holds for `forward` (and as it will show up latter during their school year, nearly for all commands) -- pressing Enter after the `fd` command means that a **Ruler** is displayed to help the children say: "Go that much!" Figure 3 shows an example.

We then showed another tool to children - **Buttons** with some pre-defined texts and associated behaviour. Instead of typing the `house` and `tree` commands children start to choose buttons with `build.a.house` and `plant.a.tree` texts and select them

[5] More exactly, when they type **Logo instruction**, that is, name of a **command** together with its inputs.

by the mouse. However, quite soon they demand to also use some other buttons of the **Buttons** window which were until then empty. It is very easy: They can just click on a button with the right-mouse button and type new text - any Logo instruction - in the dialogue box **New Text for Button**. From this point on, children do not need the text screen in this environment any more. Instead, their buttons soon become occupied with commands such as `fd 50` for long moves, `fd 10` for short moves, `rt 30` for "turning a little bit" etc. Now the work they do in the environment is much more effective for them.

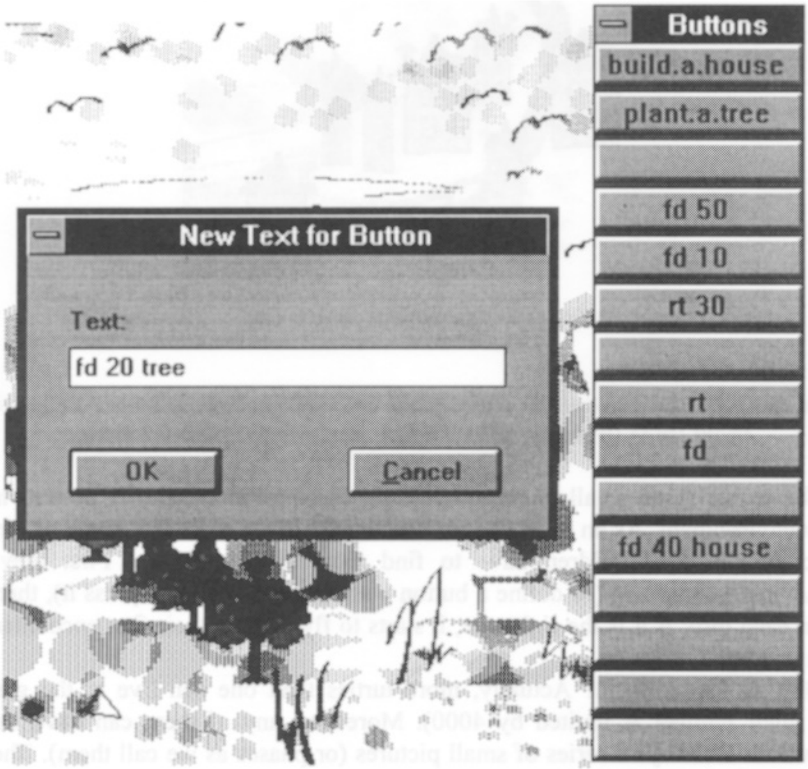

Fig 4. Defining a button

It is also possible to define a button with an incomplete instruction, for example, `right` without any input. Such a button opens **Turn Chooser**, in which the user can specify the angle by dragging the hand of the compass. (See Figure 4.) Children are soon demanding more - some boys for example want to build roads among the houses. As we haven't planned such an option, we start to improvise together with children: we define new buttons `setpenwidth`, `setpencolor`, `penup`, and `pendown`. To build a road now means to put turtle's pen down, press the `setpencolor` button and choose a color from **Color chooser**, press the `setpenwidth` button and choose pen width in its chooser, and start to move the turtle by `fd` commands.(See Figure 5).

Fig 5. Decreasing complexity

Some more tricks: follow the same road with white and narrower pen to add short lines in the middle. Define and use following button:

We believe that some small unexpected surprises or jokes should be present in any activity environment. As an example, we announced in the class that some of birds on the picture can fly. Children have to find them by themselves. First they type `find.a.bird` command (or define a button with the same text and press it), then they click on each bird: if it is the right one, it starts to fly. This is their first encounter with Comenius Logo animation.

How is this realised? Actually, more turtles than one can live at the graphics screen (their number is limited by 4000). Moreover, any of them can have its own **shape** which is always a series of small pictures (or phases as we call them). The user can define and create his own images and assign them to any turtle.

Animation proves to be a highly stimulating topic for children, although developing a nice series of frames and making them move around the screen is not always simple. Therefore we prefer to start either using prepared libraries of such images which children will customise, colour, multiply etc. or to animate simple objects with simple movements, such as a car or a plane, traffic lights changing their state, etc. From a developers point of view, animation is one of the most powerful tools: by animation, you can present children with the problem to be solved, by animation you can interpret their solutions, you can reveal the results and evaluation, etc., (see Kalas, 93 and Figure b).

2.3.4 Other observations on the project

Some final remarks on the **Build your own town** project: although the software environment is very simple both from the developer's point of view and from the children's point of view, it is rather flexible. Children decide what they want to have available in the environment. The system used for implementing such flexible and extensible environments must be also simple in its computational and educational philosophy (children are using the same environment as the developer) and still be very powerful to support such effective activities without going deeply into technical details.

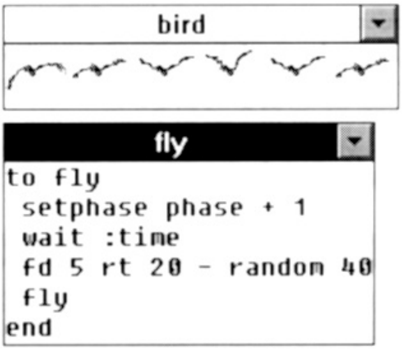

Fig. 6. Animation commands

2.4 Application to initial teacher education

We are aware of the fact that designing and implementing educational environments is only one side of the coin (maybe even the smaller one, if you can imagine such coin). Therefore we are planning to devote more than 60% of time in our block of three initial teacher education courses to educational aspects of the environments, discussing motivation and educational goals, planning and evaluating stages of development, and gaining practical experience with the 'end users'.

3. Another example - closer to programming

In the **Build Your Own Town** project children navigate the turtle so that it places 'ready-made' houses and trees around the screen. To achieve this, they use basic turtle commands `forward`, `left`, and `right`. More of the traditional turtle geometry is present when they start to build a road going through the town. There are also other turtles moving above the town in disguise - crows, but these are only actors to be watched (or to give the motivation to use the Logo Image Editor and try some more animation). In total, the environment introduced in section 2 is creative, although one more **used** by children than created. Still, there is one small but important exception to this classification: children are defining their own buttons, they are defining the behaviour of these buttons and thus customising the environment. They choose a goal, a problem to be solved, and develop their own tools to support its effective solution.

3.1 Learning programming concepts

Thanks to the flexibility of underlying Logo environment, children can start with:

- Associating a simple **complete Logo command** (instruction) with a button, such as forward 50.
- Associating an **incomplete Logo command** with a button, such as setpencolor. Such command, however simple it may look, is less fixed and conceptually more complex. To press such a button means to open a chooser and choose. In this way children develop the sense of inputs, and thus the an introductory sense of variables.
- The sequence may go on by associating **several complete commands** with one button, for example to plant a row of trees by fd 20 tree. As we have seen, to draw white lines in the middle of the road, we can construct pu fd 9 pd fd 9 button, that is, a kind of road machine which moves on without drawing by pu fd 9, then with drawing by pd fd 9. We can **repeat** the same action by clicking the button several times.

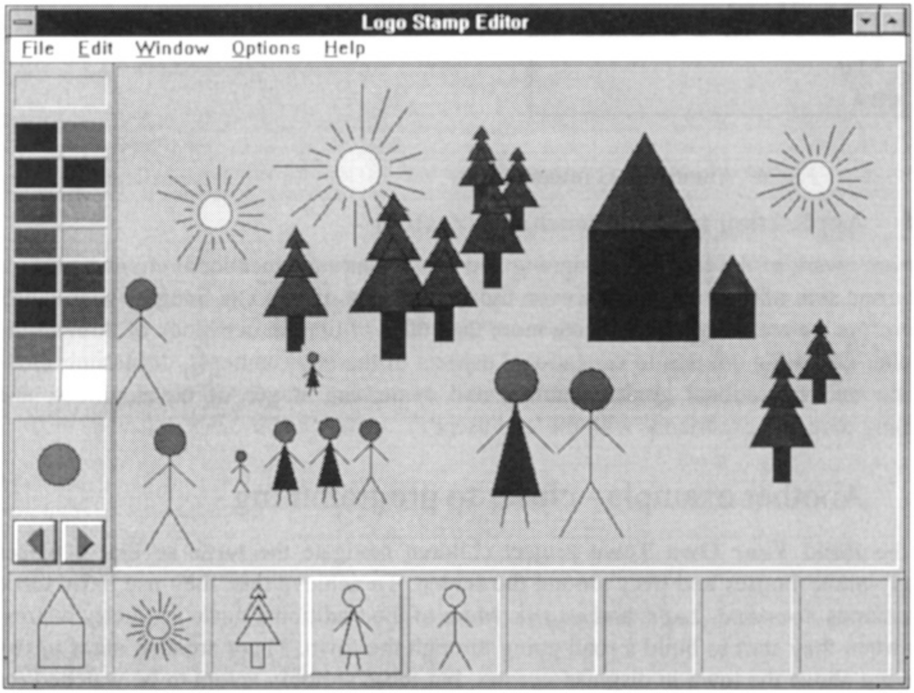

Fig 7. Defining a complete action

The complexity of the action associated with a button seems to be limited only by the size of the button. This we can call a button a step towards abstraction: a more-complex action or a series of actions is expressed by one concept - clicking this particular button. (See Figure 7). At this moment we are not far from **defining our own command** (with no restrictions related to the size of a button). In this way we are giving a name to certain complex action probably described by several Logo commands, such as:

```
to next.tree
   fd 20
   tree
end
```

Now `next.tree` command can be typed in directly in the command line, or can be associated with a button. In this way children proceed to more and more complex abstractions assigning names to combinations of other names.

This is quite natural-process for children in acquiring competence in a Logo world. Step by step they define very simple commands, such as `square`, `rectangle`, `triangle`; they combine them into more complex ones: a `house` is a square with a correctly placed `triangle`. The **Logo Stamp Editor** environment, another example of more complex program developed in Comenius Logo, goes in this direction much further than the **Build Your Own Town** project. Working with it, children define their own drawings, less or more simple, depending on their age, motivation, and abilities. Following is an example of a simple tree program:

```
to my.tree
 lt 90
 repeat 18 [fd 10 rt 20]
 lt 90
 fd 50 rt 90 fd 10 rt 90 fd 50
end
```

These drawings - a boy, a sun, a car, a tree etc., are integrated into the environment developed by a teacher. Each drawing (or better, the program which draws it) can be added by a child into a 'stamp-bar' at the bottom of the screen and later used in creating a composition. Children start to create their drawings in an *instructional way,* that is, by programming them in Logo language, and then create compositions in a *constructional way* - any stamp can be selected by a mouse, then used and coloured in the working area of **Stamp Editor.**

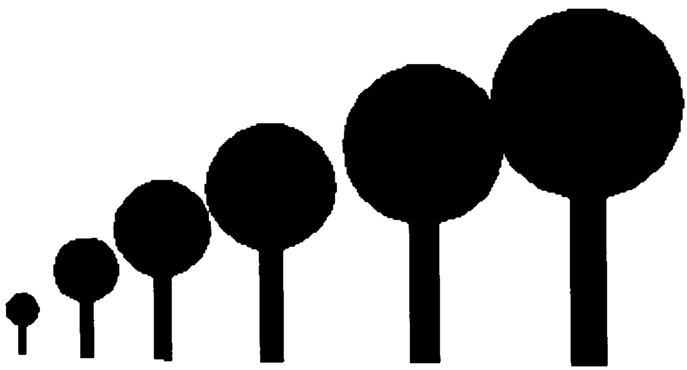

Fig 8. Shrinking and growing options

There is another interesting aspect in this environment: *shrinking and growing* of the stamps. Before using a stamp, we can select one of six possible sizes. When the turtle draws the stamp (that is, when it executes corresponding program), it makes "longer" or "shorter" steps according to selected size. Children will notice that "longer" steps of the turtle results in exactly the same drawing except that it is larger. (See Figure 8).

Logo Stamp Editor is interesting from the developer's and user's points of view in that both of them use exactly the same language: the developer has created an environment which is able to understand, accept, and process a Logo program of a child, and incorporate it into the stamp bar. The child, that is, the stamp's developer, can later use these stamps for his / her compositions. The child here is neither using nor modifying the environment - he / she is co-creating it.

4. Early results with the new curricula

Our reformed curricula in initial teacher education are quite new. In the last winter term (1992-1993) we went through the introductory course of the block, Symbolic Computations and Logo, for the first time. The exam of the course required that each student teacher develop an experimental small Logo environment. In the most cases students thought out their own topics and will spend much more time on them in the following courses.

Not all of these student-teacher projects were excellent, but several promise to result in very interesting environments. Here we presenting one of them **- Crossword Puzzle Works**, in which children should fill in a crossword puzzle according to small pictures.(See Figure 9). They drag letters from the upper part of the screen into their correct positions. This project is interesting in that its author realised how many extensions the topic offers and decided to go on considerably with its development. (The same happened with some other projects as well.) Her plan is to incorporate a feature which we find to be very important for educational software: in the present implementation of the project all assignments are chosen at random from a fixed set of possible combinations. However, children want not only to solve assignments, but highly esteem **the possibility to develop** their own assignment to be later present to a friend as his assignment.

We hope that some of these student projects will be successful at schools and will play positive role in the current initial teacher training.

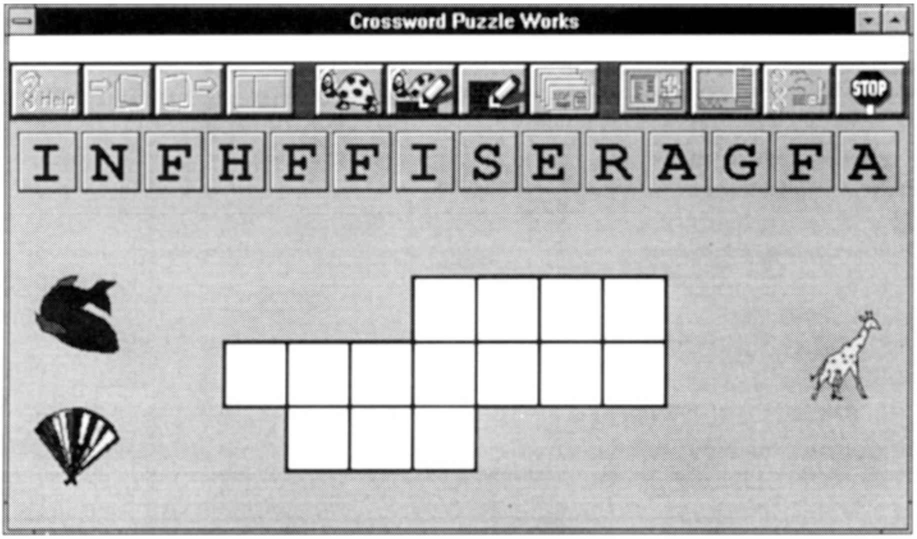

Fig. 9. Project developed by student teacher

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Part IV.

Additional Papers from Workshop Participants

Communication and Information Technologies in Teacher Education: The Experience of the International Research and Training Center UNESCO/IIP

Vladimir Gritsenko, Alexei Dovgiallo, Valery Petrushin

Ukrainian Academy of Sciences, EM. Glushkov Institute for Cybernetics

Abstract

In the Ukraine, a comprehensive approach to the application of communication and information technologies has developed and has resulted in a wide range of tools and strategies. This paper describes the general approach and identifies specific methods and modules used for teacher education at the Glushkov Institute for Cybernetics.

1. Introduction and preliminary results

At the end of the 1980s in the Ukraine small and relatively closed teams of educational software programmers and enthusiastic teachers were involved in creation and application of communication and information technologies (CIT) for education. However the range of such experiments was rather wide and covered all levels of education and practically all educational disciplines as well as large diversity of didactic functions of the software. This situation as a whole is described in the Proceedings of the International UNESCO Congress "Education and Informatics: Strengthening International Cooperation" which was held in Paris in April 1989.

At the beginning of the 90s the situation sharply changed. Worldwide tens and hundreds of thousands of specialists in large countries and proportionally smaller numbers of people in small countries, both developed and developing, were involved in research, development, and application of CIT for education. This process was promoted by the reduction of the cost of computers and realisation of national programs for introducing informatics in education, among which in accordance with P. Duguet

(1989) and B. Levrat (1992), we can distinguish between so-called "restricted" and "comprehensive" programmes.

1.1 Restricted objectives

The developed countries mostly have reached what could be called the restricted objectives of introducing computers into education and achieving a level of computer literacy for a significant part of their populations. They have provided an introduction to computer science in vocational education and secondary school

These countries are now developed comprehensive programs that are intended to stimulate more comprehensive use of CIT in education and include such objectives as:

- Individualization of instruction as a technique for developing students' creative bilities.
- Training in cooperative skills including through telecommunication. s, embedded computer training at working places, etc.
- Building interrelations among training, professional work, and research activity.
- Humanitarization of public and vocational education.

Most of the developing countries are on the way to achieving less or more, their restricted objectives in implementing computers in education and using telecommunication means for experimenting.

1.2 Comprehensive approach

A different approach has developed in the republics of the former USSR, including Ukraine, where peripheral educational establishments work at the level of developing countries while leading research organizations, universities, and select secondary schools set and successfully solve tasks connected with what could be called "comprehensive" objectives. A computer-assisted course "Expert systems in the secondary school" can serve as a good example of students' creative-abilities development. The course was tested in Ukraine, Azeraijan, Kazakhstan, and Syria (By Kov, et al, 1993; Dovgiallo, 1993). Another example of the comprehensive level of computer use is an original conception of computer technologies in education (CTE), that was formulated and received recognition and dissemination in the former USSR and East European countries at the end of the 1980s and the beginning of the 1990s. (Gritenko & Dovigiallo, 1989, Gritsenko, Dovgiallo & Savelev, 1992). The essence of this conception is:

- *a modular, multi-functional, pragmatic*
- *representation and step-by-step detailing*
- *and activation of educational knowledge.*

A representation of knowledge with the aid of computers usually is associated with expert systems and systems based on methods of artificial intelligence. The multi-functional pragmatic representation of educational knowledge assumes a more wide meaning of this new concept: computer knowledge should be not only knowledge of AI-based systems but also be written material located in computers, reference information, testing or CAI programs, etc. Each form of knowledge is implemented in the computer by a special tool.

Thus the conception supplies:

- *For learners* - easy access to any form of educational knowledge, that is organized as a learning/teaching environment.
- *For teachers* - achievement of training objectives with a separate kind of educational knowledge as well as with their subset.
- *For authors or courseware designers* - an opportunity to use effectively as a separate tool and any of their combinations, i.e., an opportunity to design a proper educational environment, testing, or CAI program.

This conception has been described in detail in the international handbook (Gritsenko, Dovigiallo, & Savelev, 1992), that contains more than 600 survey and terminological articles on the theory and practice of CTE. The articles were written by 150 specialists of Ukrainie, Azarbaijan, Lithuania, Moldavia, Russia, Bulgaria, Hungary, Germany, Cuba, Poland, Romania, Slovakia, and Czechia.

2. Ukrainian realities and the development of the conception

The young Ukrainian state needs the rapid evolution of content and methods of public and professional education to rise to the level of international standards. CIT combined in the National Programme must help this evolution. Now there are several versions of the National Programme. The Glushkov Institute for Cybernetics together with the Informatics Research and Training Center UNESCO/IIP (GIC and IR'IC UNESCO/I1P) were involved in the activity preparing the conception of the National CITProgramme as a direction of the National Programme on informatization of the Ukraine (1993).

2.1 Main statements of this conception

This conception can be summarized in the following statements:

In the field of education the saturation of educational establishments with modern computer, communication and CTE facilities will occur. This events will lead to deep changes and intensification of training in all subject areas. Networks of educational knowledge and data bases, local and international, as well as access facility to state and foreign academic data and knowledge bases will receive dissemmation; computer-based didactic laboratories for training teachers of new generation will be organized in many educational and research establishments (National Programme in Informatization, 1993, p. 17).

In comparison with the above-mentioned conception of CTE, the modern conception of CIT for education (CITE), that is focused on the achievement of comprehensive objectives, can be characterized on our opinion with the following features:

- Intelligence in the content and methods of instruction.
- Allocation and integration (following the in spirit of (Nelson & Palumbo, 1992) levels of presentation, representation and construction of educational knowledge.
- Distant learning, instruction and cooperative problem solving.

Taken as a whole, the new CIT conception can be formulated as follows:

a modular, multi-functional, multimedia presentation, representation and construction, structuring, activation and integration as well as effective dissemination of educational knowledge for achievement of both restricted and comprehensive objectives of education.

We shall next describe aspects of intelligence in the content and methods of instruction in which Ukrainian scientists and teachers have reached, in our opinion, the international level. Our general line here is to support and improve the problem-solving activity of individuals and groups of students and teachers.

2.2 Intelligence in the content on instruction

Intelligence in the content of instruction includes:

The combination of technological and spiritual aspects in a curriculum for the harmonic development of students' logical and imaginative thinking. The following variants are possible in the "spiritual" content:

- Ecological literacy in a traditional curriculum, including problem solving for environment protection (Mel'michuk & Gryskova, 1993).
- Ecology and religion.
- Humanitarization of education and inclusion of technologies in the content of humanitarian courses (Vasilchenko & Ivakhnenko, 1993).
- National aspects in international education.

New kinds of cognitive activity such as:

- Knowledge bases and small expert-systems creation by students when studying learning material. In other words a student works as an expert on topics being studied, for example, using the BESS expert system shell (Bykov et al, 1993; Dovgiallo, 1993: Dovgiallo & Petrushin, 1993).
- Creation by students of natural languages of interfaces to data and knowledge bases, for example, using KEY (Vlasenko, 1993).

2.3 Intelligence in the methods of instruction

Intelligence in methods of instructions includes:

- Adaptive testing (see, for example, the package ETEST (Sinitsa, Petrushin, Zherdicnko, & Adrianov, 1993) and training (the teacher-oriented technology PALEVAS/I; (Kolos & Kudravtseva, 1993) whose purpose is to increase the level of individualization in educational process and more precise record-keeping on the cognitive abilities of a learner.
- Skill-oriented educational software, for example, in physics (Atanov, 1993) and mathematics (Brusilovsky, 1993).
- Participation in computer-based and video computer-based educational games as well as in creation of such games (Strizhak, Tyntyunov, & Shturmova, 1993).
- Application of learning principles (Department of the Treasury, 1989), such as problem-oriented style of training, explication of objectives of given material being studied, participation in learning process control, etc., particularly appropriate for adults.

3. Distant learning/teaching and problem solving

Today in Ukraine there are many computers which are connected to distributed networks. Of five of the worldwide computer networks (BITNET, INTERNET, UUCP, FIDNET, OSI), two networks UUCP (RELCOM) and FIDNET, are widespread in the Ukraine. Last year we have also obtained a direct connection to the INTER NET. Mostly these networks are used for the support of e-mail, or for commercial and research applications. There are also several BBSs for software exchange. At the same time communications technologies (CT) in education in Ukraine are now on an experimental level both at the universities and secondary schools.

There are already two good examples:

- about 150 schools were chosen for participation in the IBM "Pilot schools" project, which includes the exchange of letters and data by e-mail between Soviet and American participants.
- there is also a project in Crimea supported by the Crimean Young Academy of Sciences which involves students for five Crimean secondary schools in small collaborative research projects.

CT for teacher education is, however, on the "little or no application" level. The main reasons are the lack of money for at least the start-up traffic and the absence of special training courses.

To overcome the latter difficulty in 1993 the GIC and IRTC UNESCO/IIP started the DEMON Project (Petrishin, Gritsenko & Dovgiallo, 1993). One of the goals of the project is to investigate CT as new content for teacher education. The dominant teachers' activities include:

- Gathering and exchange of learning materials, courseware, and data on content and methods of education.
- Multi-language environment creation and cultural adaptation of students from different regions and countries.
- Distributed pedagogical experiments.
- Distant pedagogical expertise.

4. Educational software, CIT and teacher training: A viewpoint and some experience

The rapid development of information technologies (IT) has made a paradoxical situation in the education: computer, audio, and video means for delivering and presenting learning material became really open to general use, but they couldn't be effectively applied in classrooms because teachers can't manage to master potential possibilities of IT and include them in their didactic repertoire. This situation is common for the most countries of the world. The same is so with the Ukraine.

4.1 Strategy

To solve the problem we try to use in teacher training the strategy which in short can be named as

from teacher's own educational software to general-purpose CIT

We try to involve teachers in such kinds of activities (at their choice) as: using an expert-systems shell for activating students' learning activity; creating an electronic handbook on CTE; and using tools for creating natural language interfaces, hyper/multimedia information systems, learning environments, and adaptive CAI systems, etc.

4.2 Modules

In the last years the above-mentioned conception of CITE and intelligence in the content and methods of instruction have become essential modules in the Modular Teacher Course on CITE was developed and delivered by IRTC UNESCO/IIP in Kiev. The list of modules can be found in Appendix 1.

4.3 Teacher-Training courses

The following teacher training courses are based on the above-mentioned modules:

"Introduction to Expert Systems " (12 hours).
"Expert Systems in Education " (36 hours).
"Introduction to Informatics for Ecology Teachers " (30 hours).
"Introduction to Informatics for Humanities Teachers" (30 hours).

The starting point in these and other teacher-training courses is the electronic handbook "Computer Technologies in Education", produced with the WISS authoring system. This handbook contains more than 600 articles on pedagogical, technical, software, medical, and ergonomic aspects of computer-based learning and tutoring. Teachers studying topics of interest learn the hypertext technology implemented in WISS; as a result of training they may produce their own small electronic handbooks.

4.4 Courseware

As examples of courseware we also use our applications and educational modules:

4.4.1 Hypertext and hypermedia information retrieval systems on:

- Parodontal tissue diseases and adjacent terms (INFODENT).
- Ukrainian song folklore (UKRFOLK).
- A system for choosing proper educational media to fit objectives of a lesson (MEDIA).
- Data about enterprises which pollute the environment in Ukraine (ELOLOGY).

4.4.2 Natural-language question-answering systems

Produced with the KEY tool for flight schedules in Europe (FLIGHT), for data about students of a college (STUDENT), and for documentary database of military school (PRIKAZ).

4.4.3 Tutorial courseware (in Russian or Ukrainian language) on:

- User-interface design for educational software (DIK).
- Training for communication operators (TOS).
- MS DOS and programming languages (SEZAM).
- Engineering: details of machines.
- Training m Ukrainian grammar.
- Intelligent tutoring system on theorem providing (SDT).
- Training in mine machinery (SHAHTA).

4.4.4. Programs for testing and diagnosis:

An adaptive testing package for secondary school graduates.

After personal experience with the tools and the application modules teachers are involved in using the tools for constructing educational software in their own subjects. If their training course is large enough we introduce them to general purpose CIT, such as utilities related to the system, text processors, data bases, graphics packages, etc.

5. Conclusion

Having many years of experience with teacher training in CITE, not only in the Ukraine but more generally, we must say that we are still at the very beginning of a long journey. "Teacher of CITE age" specialisation has still not developed, through there are some good achievements such as at the University of Twente in The Netherlands with the Master of Science Programme in Educational Systems Design being developed by the Faculty of Educational Science and Technology. A key point is the psychological aspect of involving teachers in CITE and CIT study, "we haven't succeeded yet in demonstrating to teachers that there are real educational needs that IT tools can help them address more effectively than they could using other tools" (Collis, 1989, p. 421).

To address this problem we have started the Ukrainian-Azerbaijan project "Computer-Based Didactic Lab: An Information Environment for Teachers", as a proposal submitted to UNESCO/IIP. The project would integrate, internationalize, and develop the above-mentioned experience on a modern technical and software base. The CBD Lab would give an opportunity for teachers to learn how CITE and CIT would be used in education in effective way and how teachers can actively participate in courseware development and application.

One of the most important and decisive issues has the need for international collaboration in teacher training on CITE and CIT in order to prevent costly "reinventions of the wheel" in this field. We concur with the statement that "There is no real accumulation of knowledge. Especially in the field of computers and education, it is very frustrating to find out that problems stated 25 years ago are very often presented as if they were discovered yesterday" (Muylwijk, 1.99f, p. 703). To solve these and other important problems of CITE and teacher training, the IRTC UNESCO/IIT is ready for cooperation on the projects that are listed in Appendix 2.

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Appendix 1. List of tools

The set of our tool modules consists of:

A. *Modules for supporting learning activity:*
- Authoring systems HELENA, WISS, and CHAKLUN for creating hypertext and hypermedia application.
- Expert-system shells BESS and TRAPEZIUM for students working as experts on topics being studied (so called "Expert-System-Shell Assisted learning").
- A package for creating natural language interfaces (KEY)>

B. *Modules for creating tutoring systems:*
- An authoring language ABC-1.5 and teacher-oriented technology PALEVAS/I for creating intelligent tutoring systems.
- Authoring means for knowledge testing and diagnosis(CONTRAST, HIT). - An authoring system Q-ALL for constructing and running tests.

C. *Means for educational management, investigations, and administration:*
- A program GRUZ for designing lesson timetables.
- A system CONCORD for processing experts' data on the content of a subject
- A Russian-Ukrainian machine translator TRANSU.

Appendix 2. List of projects

1. Computer-Based Didactic Lab: An information environment for teachers (V. Gritsenko, A. Dovgiallo, V. Petrushin, E.I. Ivakhnenko, N. Vlasenko, A. Branovitsky, J. Zagura). The project for IIP/UNESCO, Kiev, 1993, 18 p.
2. Kiev - Twente Research Cooperation in Educational Technology: Proposal for a support and scientific cooperation program submitted to the Dutch Organization for Scientific Research; Enschede, August, 1992, 52 p.
3. Agreement for Scientific Cooperation and Exchange Kiev - Twente; Enschede, August 6, 1993.
4. Distant Computer - Based Educational Technologies: Creating an information environment for teachers & students (N. Vlasenko, V. Gritsenko, A. Dovgiallo, E.I. Ivakhnenko, V. Petrushin): Proposal submitted to UNESCO and UNIDO, Kiev, 1993, 2 p.
5. Computer-Based Vedic Knowledge for Education and Training of Students of the Secondary School (V. Gritsenko, A. Dovgiallo, E.I. Vakhnenko, V. Stogny). The Project for UNESCO, Kiev, 1993, 11 p.
6. Cognitive Support Technology: A Proposal from Lancaster University (UK, Coordinator Dr. John Self), Glushkov Institute for Cybernetics (Ukraine), the University of Twente (The Netherlands), and the International Center of Scientific and Technical Information (Russia), TEMPUS programme, 1993, 6p.

CIT in Teacher Training at the Charles University in Prague: Examples from the Czech Republic

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Abstract

The paper describes some impacts of COT into pre-service teacher training in the cases of two faculties of the Charles University in Prague as an illus - tration of today's situation in the Czech Republic. This brief view is com - plemented with some information about the support of CIT implementation into schools and about CIT in-service teacher training

1. Charles University

Charles University was founded by Charles IV in 1348. Prague Charles University began with four recognised faculties of a medieval university (Arts, Law, Medicine and Theology). Many famous persons have been part of the Charles University, for example Jan Hus (XV century), Jan Jesenius (rector of Charles University in XVII century, the person who realised the first post-mortem); Bernard Bolzano (XIX century), Ernest Mach (XIX century); and at the German University in Prague, Albert Einstein (191112). Johanus Kepler, although he was not a member of the academic staff of Charles University, did his astronomy observations in the University's garden (XVII century).

Today Charles University is comprised of 16 faculties in several towns of the Czech Republic: five Faculties of Medicine, three Faculties of Theology, and Faculties of Philosophy and Letters, Law, Education, Social Sciences, Natural Sciences, Mathematics and Physics, Pharmacy, Physical Training and Sports.

The University has approximately 30,000 students and 3, 000 teachers.

2. CIT and Teacher Training at the Faculty of Education

The system of the teacher training at Charles University reflects the scheme of the Czech Educational System, as it has been changed after 1989. What does the Czech Educational System look like? (See Figure 1)

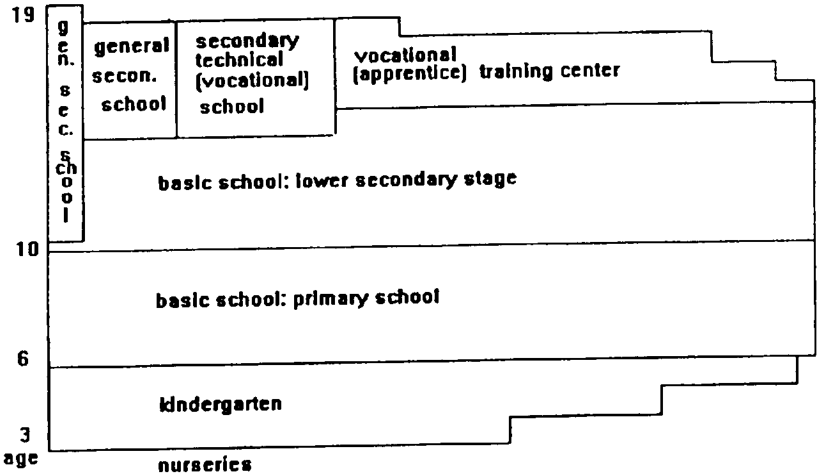

Figure 1: Overview of the Czech educational system

Many faculties of the Charles University train primary and secondary school teachers. This is the reason why the following text is not a complete overview of CIT implementation in teacher training at the Charles University or even in the Czech Republic as a whole.

In this paper we shall pay attention to the Faculty of Education at Charles University which trains more than 600 students and the Faculty of Mathematics and Physics, which trains more than 150 future physics, mathematics, informatics teachers per year.

At the Faculty of Education with 301 full-time teachers there is a Department of Educational Technology that organises pedagogical and research activities in the field of the educational technology including CIT. The Department guarantees training in CITfor pre-service (for more than 600 students from the 1st year) and in-service teacher training (for more than 140 students from the 1st year) and the postgraduate study in and Ph.D. study of Educational Technology (see Faculty of Education, 1992; and also Cernocova, 1993).

The Department is involved in the international TEMPUS JEP 2063 Project "Development of University Level Training for Secondary Teachers in the Use of Information Technology" with coordinating organisation the PLUTO European Network in the United Kingdom (directed by Dr Rhys Gwyn from Manchester). This Project is very helpful for all activities of the department in the area of implementation of CIT into the Teacher Education Programme at the Faculty of Education.

2.1 Compulsory initial training in CIT

Topics such as word-processing, databases and graphics editors, statistics software packages, LAN and WAN, Internet services, and communication via modems are the base of the compulsory course for all first-grade students (Cernocova, Novak, & Sinor, 1993). The course takes two semesters and ends with a practical exam. The goal of the course is the development of skills useful for the students in their following studies at the University.

The educational applications of Information Technology (topics such as applications of video, videocamera, computers, CD ROM, television, multimedia, etc.) belongs to the third-grade course "Technical Educational Media".

2.2 Additional initial training in CIT

The Department of Educational Technology organises many additional courses about applications of computers and audio-visual media for students who are future teachers for primary and secondary schools. The courses include: Problem Solving and Development of Child's Thinking, Development of Databases, Graphics Editor in Art Education, Computers, Computer Networks, Information System for Support and Control of Educational Process, etc.

3. CIT and Teacher Training at the Faculty of Mathematics and Physics

Compulsory CIT training for primary-school mathematics and physics teachers aims at the development of general knowledge about and skills in using word-processors, graphic editors, spreadsheets, databases, systems for dynamic modelling, and MBLsystems. The first-grade course takes 60 hours.

Another compulsory course for secondary mathematics and physics teachers involves all the topics mentioned above and selected elements of programming. This first grade course takes 120 hours and ends with an exam.

The output knowledge and skills from these courses are expected to be used during the students' following studies at the faculty. Students meet these CIT applications naturally integrated in physics lessons, seminars, and labs (experimental data acquisition and processing, computer modelling).

Students have the possibility to take part in many different (hardware, software, programming languages, networks, informatics, etc.) additional courses. They use LANs and WANs, especially Internet and Bitnet, from the first semester. They can have their own e-mail addresses and some of them are linked up with international projects.

CIT classroom applications are topics in the second part of initial teacher training. The compulsory courses for physics teachers contain training in MBL school-lab applications. Additional seminars offer training in the use of CIT (educational software, multimedia tools, Internet services, MBL, computer modelling) in schools.

4. CIT in education at primary and secondary schools

Czech secondary schools seem to use computer technology more often than primary schools. This could be a result of personal, hardware and software support. The subject "Informatics" at the secondary-school level is compulsory for all students.
A few years ago an additional subject "Informatics" was put on the curriculum of the primary schools; the content and teaching of the subject depends on the staff and equipment of each primary school. There is a lack of primary school teachers trained in CIT

Some schools have reached very good results (see Brdicka, 1993) especially in communication with foreign schools due to the enthusiasms of a few teachers. These CIT applications are strongly limited by the low level of Czech telecommunications.

4.1 Software and technical equipment in primary and secondary schools

All secondary schools have an average of ten computers (PC 286 and higher or Apple Macintosh). They are used mostly for school management and for supporting the subject "Informatics".

A few secondary schools have gained technical equipment and software from international projects (for example 92 secondary schools in the Czech Republic and 8 regional centres are involved in the Comenius project) or from the national projects supported by the Czech Ministry of Education.

There are many examples of educational software made in Czech and some pieces of foreign educational software have been localised into Czech.

4.2 Information and consultancy services, in-service teacher training,

Information and consultancy services are given by the Centre of Information Technology in Prague (an institute of the Ministry of Education) and in addition by district school authorities. The Institute publishes "Bulletin of Information Technologies for Schools", offers information about software licences for schools, a list of educational shareware, a list of books about using computers in schools, etc..

In-service training in CIT is performed by all faculties involved in teacher training, by the Centre of Information Technology, and by district school authorities.

For example, the Faculty of Education in Prague organises a three-semester course "Computers at School", free of charge. It consists of five modules:

Introduction to Work with PC and E-mail Communication
Educational Aspects of Applications of Computers in Education
Computer as a Teacher's Tool
Multimedia
Projects

Each module takes 60 hours, and there is a hot line available for participants.

Workshops and short seminars are organised by the institutions mentioned above, sometimes with the help of foreign experts, often in the frame of projects, namely TEMPUS (CEC, 1992; and Cernocova, Andelova & Krous, 1994; Tempus Project documents, 1992, and COMENIUS).

5. Conclusion

Introduction of CIT into initial teacher training has occured due to the enthusiasm of a small group of people. This corresponds to the overall uncontrolled process of CITimplementation into the Czech school system.

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Hungarian Teacher Training

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Abstract

In this paper a comprehence overview is given of teacher education in Hungary and of radical changes which are being proposed with it.

1. Hungarian teacher training

1.1 Political and educational changes

There was a change in the political system in Hungary in 1989 which strongly influenced education. After the change, the Educational Act and the Higher Educational Act were accepted by the members of Parliament. Before the change the Hungarian public educational system and our curriculums were quite central-orientated, strict, just like in politics. However now there is freedom in Hungary which is very hard to get used to, in educational life as well.

A National Curriculum was passed by the Educational Ministry in early 1994, and also in the government.

1.2 Hungarian higher education

Let us examine the present situation of Hungarian higher education

There are 25 state universities in the country.

Non-state: 5 religious, private
Number of state colleges: 34
Religious colleges: 24
Private, foundation colleges: 4
Kindergarten teacher-training colleges: 3
Teacher training colleges for junior level: 8
Teacher-training colleges which belong to the universities: 6
Independent teacher-training colleges: 4

In higher education there are 103,618 students (see Figure l). Out of this, about 38,000 students take part in different fields of the teacher training. Within this an average 25,000 are learning to be teachers.

Number of students at the Hungarian Higher Education

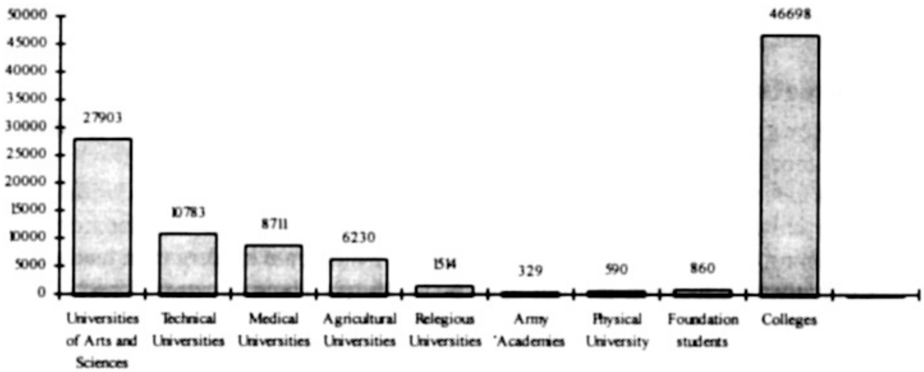

Figure 1. Students in Hungarian higher education, 1994

Examining Figure l we can see the following: 26.9% of the students study in Universities of Arts and Sciences, 10.4% at Technical Universities, 8.4% at Medical Universities, 6% in Agricultural Universities, 1.5% in Religious and 0.3% Army Academies, 0.6% at Physical University, 0.8% from the foundation institutes, 45.1% from the colleges. What is important for us is that most of the college students go to the Teacher Training College or to the college faculties of the universities and a great number of students (about 30%) plan to become teachers, working at the junior level of the elementary school.

1.3 Teacher training

The teacher training in Hungary structurally consists of two systems: the training of those who teach in the upper level of the elementary school and those who teach in the secondary school.

During the 1992/93 Academic Years the Hungarian Budget was 953.4 milliard forints in 1992 and 1145.4 milliard forints was in 1993. Out of this, the money spent on the universities of arts and sciences was 3.281%, and the money used for all kinds of teacher-training colleges was 1.8074%. We hope that the Higher Educational Act will change this situation in a positive way.

2. Education in Hungary

2.1 Support

The scholarship system is used in Hungary. This means that the students don't have to pay school fees. Probably however the government is soon going to introduce school fees. This will be introduced gradually and eventually involve the 30-40% per cent of the educational expenses (money spent on one student is 65,000 forint for an academic year by the government).

2.2 School organization

Figure 2 shows the Hungarian Public School System from the kindergarten level up to the higher educational system.

The kindergarten age is from 3-to 6 years. The kindergarten life is critical to the life of the children because this early age influences their later development. The teacher-training time is three years for the colleges which train kindergarten teachers.

Compulsory education is from ages 6- to 16. (in Hungary, now, 91,4% of the children go to school.)

The traditional elementary school system is called "4+4" which involves the following:

Now there are 3717 elementary schools in Hungary. 1044,164 children attend school of which 52.7 per cent goes to the upper level.

Within the elementary school there are 8 grades: The period from the first grade until the fourth is called the junior level. We have special teacher-training colleges which train the students for this period. In the junior level there is only one teacher for all subjects. The period from the fourth until the eighth grade is called the upper level.

In the past few years new structures have developed within the elementary and the secondary school: the "4+8" system and the "6+6" system. There are 47 secondary schools with eight grades and 54 with six grades.

Both systems help the students to go straight to the secondary school. So these are very useful for not only the children but also for the parents, too.

The study time is four years in the secondary school and also in the vocational section from which the students can go straight to different kinds of higher educational institutes.

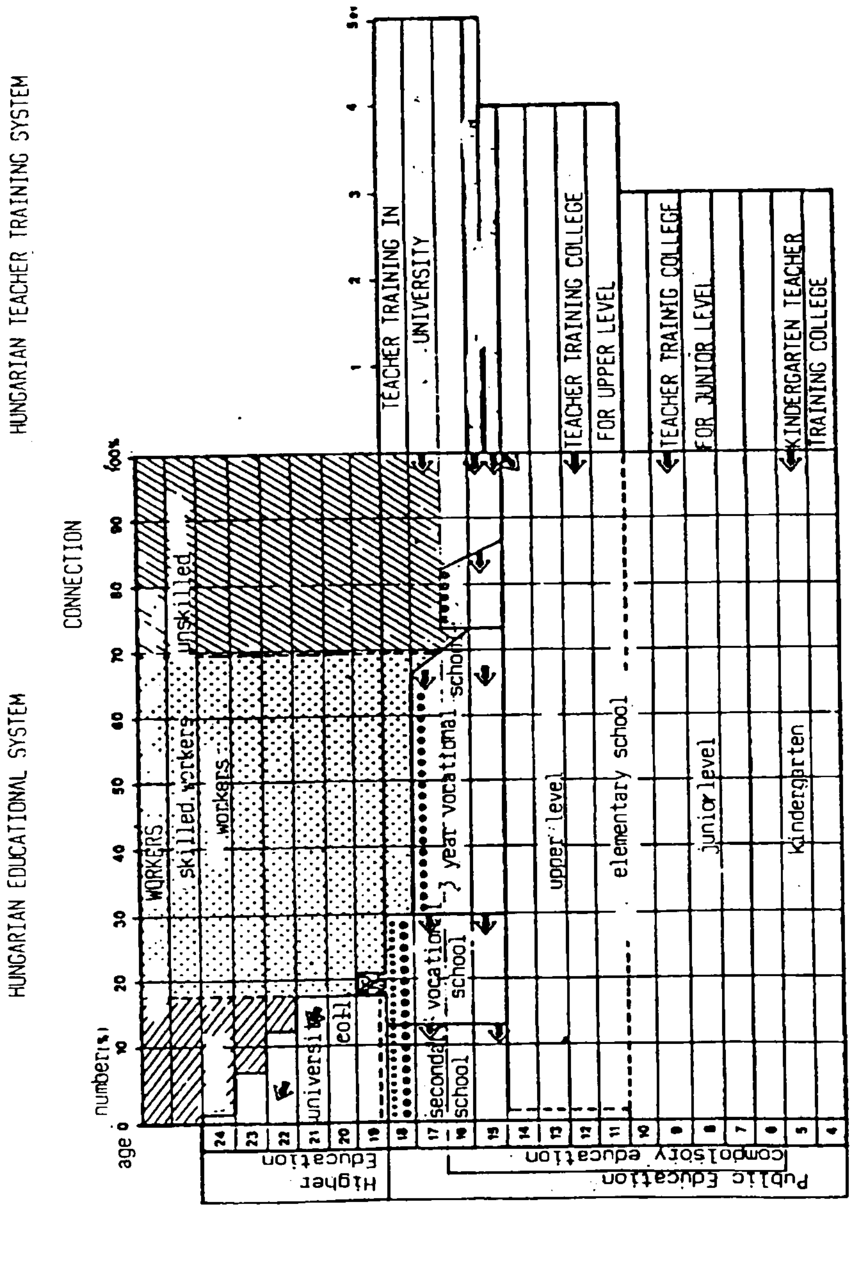

Figure 2. Hungarian Public School System

Number of secondary schools	Grammar schools		Vocational schools	Grammar and vocational schools working under common leadership
	State	Religious		
824	220	31	427	146

After the primary school 36,.289 students enrolled in the grammar schools and 48,521 in the vocational schools. This means altogether 84,810 students.

But there is also a vocational school system where the teaching time only three years. From this kind of school system there isn't a straight way to the third grade of the four year vocational institutes. In Hungary there are 329 of this above-mentioned type of school with 66,380 students who have decided to enroll in this type.

Teacher training in Hungary structurally consists of two systems: the training of those who teach in the upper level of elementary or vocational school or higher educational institutes. The training time at the colleges is three or four years and at the universities 4.5 years and five or six years. Teacher training for those who teach special subjects such as music, painting, technical, agriculture and economics, happens at their own universities or colleges.

Now there are six teacher training colleges which belong to the universities and there are four independent ones (Figure 3 shows the universities and colleges).

Figure 3. Teacher-training Institutes in Hungary

2.3 National teacher training society

In 1990 the National Teacher Training Society was formed which is a help for the colleges to be in contact. Primarily this forum deals with professional matters.

In the past few years the professionals have decided to improve teacher training. We tried to discuss this matter in different circles. The opening speeches and suggestions made during the meetings all have very strong connections with the legal conditions of the Higher Educational Act. We all agree that the aim is that teacher training should be much more successful (output regulation).Many agree with the intention that one separate system should be formed for training all teachers who will teach children aged 10-18. The teacher training for universities would be five years and for colleges it would be four years according to this system.

The following section written by Professor Beno Csapo (Professor of the University of Szeged), sets up a new conception about the structure and the content of teacher training. This is one of the many suggestions made during the meetings. The different ideas were collected in a book and can be read by those who are interested.

3. Forming a new structure in teacher training (by Prof. Benô Csapó).

3.1 Introduction

There are many reasons for saying that there should be one institute for all those who teach children aged 10- 18. We mean here a university level of training which takes five years giving equally high knowledge of pedagogical psychology, common knowledge and a fairly high levels of the major subjects. This idea however cannot be achieved through a short period but we mustn't wait to begin making the first steps now. For this we need to connect the teacher-training system of the colleges and universities. This essay will only deal with the structure and system of the new method, it will not really take the teaching material into consideration.

3.2 The basis of the reform in teacher training

1. The teacher training will integrate into a two-step-system involving both the universities and the colleges. The first step is the lower level but in the same time it is the basic and the main part of the training in the second, higher level.
2. The students will have more freedom in choosing how many degrees they are going to have and, if they have two degrees which are those two.
3. The degrees will have same value by the new system. The special knowledge needed for a good teacher can be reached with the help of the great varieties of the new method.
4. The universities and colleges give the conditions of getting a degree. However it is the student who has to decide when the wants to graduate.

5 In the art faculty it is important that those who don't want to become teachers can get a degree so teacher training has to be more independent from the subjects of the majors.
6. It will be possible to take postgraduate courses during having a job as is the practice in the western universities.
7. It will be possible to accept the courses taken abroad as part of one's studies in a more flexible way.
8. The method used today will be changed into the new system without difficulties.

3.3 The structure of the training.

The main unit of the training is a half-year-course which means 2 hours weekly during the 15 weeks. This method will help the students get used to the credit-system of the western universities.
The courses have 3 main groups:

1. Subjects improving common knowledge
2. Subjects of teacher training
3. Subjects of the major subject

The subjects of the colleges and universities can be almost the same. The main difference in the two institutes is that in the college one has to concentrate on getting only less knowledge of the majors as he teaches a younger age group. While in the universities one has to be more advanced in the knowledge about the major subjects. This is why is longer.

The subjects of the majors have to be one-third of the whole studies while the subjects for teacher training and common knowledge should be two-third altogether.

3.4 Courses for the common knowledge

These courses help to create a good connection between the major subject and the other subject. So, the different departments should organize courses for all university/college students, who could choose any of them. Those who train to be teachers should choose the ones having connections with teacher training. Four out of the ten courses of common knowledge should be those recommended to all by the university, four should be the ones connected to the teaching profession (for example the sociology of teaching), and two courses should be optional.

The two-hour-a-week courses should be taken in the first four terms.

3.5 Subjects improving teaching abilities

This involves one-fourth of the training in the university and one-third of the college training. It has four main parts. The plan is similar to the method used now. The only difference is that it suggests more practice in the fifth year instead of the passive practices.

3.5.1 Pedagogical and psychological basic training (8 courses), can only be taken one after the other in one order

Two optional pedagogical or psychological courses

3.5.2 Practice

During 7 courses:
- Psychological courses of the development of the personality
  - Practices to develop the personality of the university student
  - Methods can be used in teaching one or in the case of groups.
- Exercises to develop teaching abilities
  - Pedagogical analysis of situations (with the help of video recordings)
  - Practice to develop the teachers' communicative abilities
- School visits and educational practices
  - Observations in the school (pedagogical, psychological)
  - Practice in educational establishments

3.5.3 Pedagogy of the subject (depending on the level the student wants to reach):

- College level:
  - Teaching Subject X from Grades 5 to 10
  - Teaching Subject Y from Grades 5 to 10
  - Optional subject
- University level:
  - Teaching Subject X from Grades 7 to 12
  - Teaching Subject Y from Grades 7 to 12
  - Optional subject

3.5.4 Teaching practice

- College level:
  - Teaching practice in Subject X from Grades 5 to 10
  - Teaching practice in Subject Y from Grades 5 to 10
- University level:
  - Teaching practice in Subject X from Grades 7-12
  - Teaching practice in Subject Y from Grades 7-12

Each teaching practice equal five two-hours weeklys course, so for the student it means 10 hours weekly. The university students can do the practice in Grade 5-10. It will be indicated in the degrees.

3.6 The major subjects

In the two-step-training-method the more detailed, deeper subjects should be in the second part of the training. In the new method, however the fifth year of the university should be saved for only the teaching practice.

There are altogether 40 courses to take concerning the major subjects. Twenty eight of this means a college degree and has to be taken in the first four years. The rest (12 courses) has to be taken in the 5th year and it means a university degree.

3.7 The organizing of the training and connections between the two levels

The student gets a suggested training plan which lists the possible order of the courses in the 4 years. The student is free to change this, there are only a few limitations.
Those who have taken all the subjects of the majors and teacher training gets a college degree with which they can teach in Grades 5-10.

In the case of satisfactory results the student goes on and takes the necessary subjects for a university degree. The colleges and universities using the same credit-system as change from one to the other and his/her results can be accepted.

3.8 Having one, two or three majors

This method has to make it possible for the students to become teachers of only one major but they can have as many as three majors. This is important these days, especially in the case of language teachers. They should have the same system of training. Likewise they should have the opportunity to continue their training any time, later on.

For the degree of one major one must take 30 courses of common knowledge and teacher training and 28 courses of the major subject, so 58 would be enough to get a college degree of one major.

The student taking one major in the university would take 10+24+40=74 courses to get a degree.

In the case of having three majors one would have to take less subjects on common knowledge and teacher training having almost only the teaching practice apart from the subjects of the majors.

3.9 Complementary training

It should be useful to introduce the six-year-training which would help the training of "schoolteachers" .

In the sixth year the student could have part-time jobs in schools or even in the university. The 7th and the 8th year is for getting a doctoral degree. These students should be part of the training and the research work.

Mostly after the third year it is possible to take a pedagogical "expert" course which gives a pedagogical expert degree of some parts of pedagogy (curriculum development, evaluation...)

3.10 The regulation of training time

As the training time will be quite flexible there should be certain things to regulate training time so that it will not become too long. This should involve scholarship policy.

According to the present situation for the college level, the student would not have to pay for the studies for four years (for the university it would be 5 years, if studies involve special courses it would last for 6 years, in the case of post graduate it be 7 years). For the studies longer than the normal time the student should pay school fees. If someone learns less than the normal amount in term, this person should get less money. For example those who take 10 courses a term should get the whole amount and those who take less than 6 courses shouldn't get any money.

In this method there wouldn't be term/year repeating; one should only repeat the failed courses. It is useful to register the number of extra exams that should be paid for. There should be a limit for the number of the exams that can be taken in the case of a subject.

The number of students in the training should be regulated by the scholarship system. It very important however that all changes that happen should be clear to everyone long before the change.

3.11 Equal validity of degrees

According to the principles of institutional autonomy, teacher-training colleges and Universities can make an agreement on the courses for assuring the equal validity of degrees, flexible transition between institutions and making a base for common notes and coursebook edition. In order to achieve this we need to form and made function corps consisting of representatives of different departments.

3.12 Organizational frames

The changes of the framework suppose the change of other conditions of teacher training, on the long run.

The biggest trouble is that the formational styles of Universities of Arts Science are becoming multicolored, although earlier they used to train only teachers . If actual tendencies go on like this, the number of students in teacher training will decrease. In this situation teacher training has lost its owners (also for political reasons) and there are no organisational frameworks such as the ones at European or American universities. First of all we need to transform groups of methodology and educational technology into departments and educational and research workshops. There is a need to differentiate pedagogical departments and to form groups organizing teaching practice.

These units could take the responsibility for the tasks of teacher training, inside the frameworks which provide technical autonomy.

4. Reflections on the need for change in teacher education

The dilemma of the past few years was that teacher training institutes should be established which would be the only places for teacher training instead of the teacher training colleges and the universities. This means that special institutes would train the teachers not only for the upper level of the elementary school but for the secondary school too.

However, here were many who said that the teacher-training system should be part of the universities so the colleges should integrate into the system of universities with different training time.

Other professional opinion felt that we need a separate college for teacher training purposes. In spite of the fact that the teacher training institutes weren't formed yet, some changes have happened during the last years:

At the universities pedagogy is not compulsory beside the one or two or three majors subjects, so for the students, pedagogy is optional.

However at the teacher training colleges the pedagogy is of course compulsory. The state exam in the colleges consists of two major subjects plus a complex pedagogy exam.

The opinion of our college teachers and mine as well is that we need teacher training colleges which train people for the upper level of the elementary schools. In the same time it should be possible for the universities to take up pedagogy whoever is interested.

5. Eotvos Loránd University

5.1 General

I'd like to introduce my college and the work at my Educational Department.

The Eötvös Loránd University is one of the most prominent and comprehensive schools. The university was founded in 1635.

Our college belongs to the Eötvös Loránd University. The training time is four years at my college, as I have already mentioned, and the students leave college with degrees for the upper level of the elementary schools after a successful state exam.

There are altogether 1313 students at my faculty in the 1993/94 academic year. The number of the first year students: 447. The number of the fourth year students: 321.

They must take up two majors and they continuously take pedagogy subjects during the 4 years.

Figure 4 shows the structure of the college.

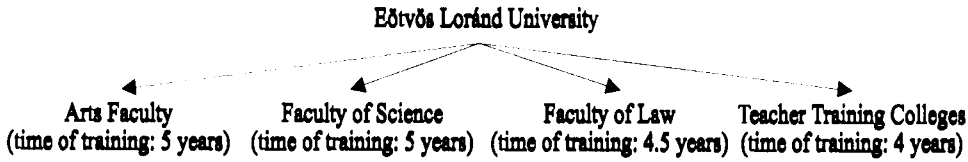

Figure 4 Structure of Eötvös Loránd University

Dean's Office
Office of Administrative Services for the students

5.2 Department of Educational Science

The following is the composition of the Department of Educational Science:

Art Departments		Science Departments
Hungarian Literature		Mathematics
Hungarian Linguistics		Physics
History	**Department of Educational Science**	Computer Sciences
Library		Biology
Department of Social Science		Geography
Music		Chemistry
Foreign Languages Departments		Physical Education
English		
German		
French		
Russian		
Italian		

After the political change the Russian language is no longer compulsory. Now the students can choose among different languages for example, English, German, French, Italian, and Spanish.

The college trains teachers for these languages. So it is possible for the former Russian teachers to tram themselves and be teachers of other languages.

5.3 Curriculum of the department

The Educational Department has a central position within the college: as the pedagogy is a compulsory subject, it has close connections with all the departments. In the Educational Department the main plan is to train high-quality specialists and we would like to raise the level of the training and to reach a practical orientated system.

During their four years the students take the following pedagogy subjects:

- Educational History
- Educational Theory and Sociology (recently integrated into one subject)
- Didactics methods:(visiting schools from the first half year)
- Microteaching
- Independent teaching
- Summer camping

Optional subjects (one of them is compulsory for two half years)

- Arts Pedagogy - Museum pedagogy
- Reform pedagogy
- Talent Education
- Crime at an early age (under 18)

5.4 Evaluation

In Hungary there is a traditional examination system in higher education. Obviously we would like to use the European credit system of which we already have experience, for example the Agricultural University of Godollo. It can only be achieved by putting the above conceptions into practice.

The improvement of teacher training in Hungary is still not completed. The Higher Educational Act will greatly develop the system but for achieving all these concepts we need the hard work and enthusiasm of both the teachers and theoreticians.

The Computer: The Medium Stimulating the Development of a Teacher Education Workshop (illustrated by Geography)

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Abstract

Advances in computer technology are bringing new didactic possibilities to geography education. This paper gives an overview, and highlights in - novations in teacher education in geography in Poland.

1. Computer - a new medium in education.

1.1 Overview of developments in computer technology

New information media such as magnetic floppy disks, TV tape, digital audio-visual recording (Digital Compact Disc) do not only raise the quality of the transmission of some contents but they facilitate access to any part of the recorded contents as well; they generate new didactic possibilities. Didactic media into which we as a rule, include natural objects, differents kinds of pictures (statical and dynamic ones), sounds, and, primarily, printed materials, become "new media" due to the use of modern technology. A traditional book becomes an electronic book when it is recorded on an aluminium foil and read by a laser reader. Simingly, the picture which traditionally is projected onto a screen or displayed against a nontransparent background, now can be created in a three-dimensional space thanks to holography.

As the new media are based on electronic technology and enable information processing, interaction and fast communication, the computer is a prime example of the phenomenon. At the same time the computer is significant part of the contemporary model of multimedial education because of different forms of information transmission (text, graphics, sound), the possibility of collaboration with other media (overhead projector, video, mockups, real devices), the possibility of monitoring and control that it offers.

1.2 Computers and their educational impact

Extremely efficient information processing connected with its effective storing, structuring, easy updating and developing aimed at the generation of new information makes the student active in a both creative and cognitive sense. The computer facilitates teaching through acting. Computer-based information processing allows us to save time while preparing discussion materials and problem considerations and thus teachers can better concentrate on the discussion, conclusions and instructional designing, which adds a new dimension to the process of teaching.

The user-computer interaction (computer-assisted communication) allowing the dialogue of the user with the medium, and dynamic following of the results of the activities taken in the space simulated by the computer including the possibility to modify one's own decisions can release some inner motivation in the user to study problems and solve them. So the technical medium not only enlarges the information field and accelerates its circulation but reacts to the decisions taken by the user as well (messages). We begin to enter the area of so-called artificial intelligence. On conducting dialogues with the computer, teaching it, we teach ourselves. Thus is it possible to study individually, independently and for oneself.

The systems of computer networks and telecommunication technology, including satellites, enable a full, multidirectional, and nearly simultaneous exchange of information and an easy access to it. There is electronic mail. Systems of distance education, conferences, computer-based discussion groups are being created. The educational dimensions of such computer applications iare suggested in the following statement: "We learn from others".

The computer contributes to a interdisciplinary approach in education. Introducing an interdisciplinary approach involves leaving rigid subject arrangements, sunk in an enormous number of special notions difficult for the student and contributing to memory training whose results are not very useful in future life. An interdisciplinary approach to knowledge makes it possible to see relations among different fields of knowledge, to systemize the knowledge scattered in narrow specialisations, to see on the screen various arguments for and against while solving problems, to acquire the skill of making use of different fields of knowledge in practice, to create one's own information base, and to store information and to compare it. The computer makes it possible to leave a flat Cartesian structure of problem solving. The use of stimulation programs allows us to make use of a variety of creative and active learning activities in the process of education.

Geography and the use of computer in its practising make a good example of the practical realization of interdisciplinary educational ideas.

2. Computer in the geographer's hands

Information technology created the basis for two revolutions in modern geography development namely a statistical revolution and a model revolution.

2.1 Statistical revolution

The statistical revolution disseminated statistical methods and techniques among geographers. In the precomputer era statistical methods were rarely used in geography due to multidimensional regional structures and a large number of data.

The dissemination of computers resulted in the use of standard statistical methods in geography (ego correlation and regression analysis) and initiated the development of new methods of spatial analysis. Special attention should be paid to the development of computer cartography and other methods of graphic analysis which make it possible to obtain a significant flexibility in the research and to introduce a number of new methods which would not be put into practice without the computer (ego maps of spatial trends or animation maps). Computer technology significantly decreased the amount of work and time devoted to research and surveys.

As geographical space should be considered in aspects of processes such as division, integration, cooperation, organization, etc., the matrix is an efficient tool for geographic analysis. In the rows of the matrix there are places and in the columns there are characteristics of the places. Each box of the matrix represents one geographical fact.

On the basis of such a matrix, efficiently created by means of the computer (spreadsheet), one can carry out different types of geographical research, namely, the analysis of one row (place), the analysis of one column (characteristics), the comparative analysis of two or more rows (places) or columns (characteristics), simultaneous analysis of many columns and rows. One can also add the third dimension -- time -- in in the form of successive, overlapping matrices (dynamic analysis).

2.2 Model revolution

Model revolution was created as the result of a demand for the formal reflection of theory in geography. It was connected mainly with social and economic geography in the context of urban development. A number of models were created: the increase of town areas, transport, the land use, and localization models. The use of the computer and simulation methods made it possible to start working on some unsolveable reasearch problems and now it is much simpler to model social and economic systems and processes in the analytic sense of the word. Testing spatial diffusion by means of Monte Carlo models and simulations are a good example. Models in geography, apart from their purely cognitive character, also have some practical meaning, eg., spatial planning and forecasting or in didactics efficiently facilitating the explanation of many geographical phenomena and processes proving that geography is a practical science.
For example:

If T, H, L denote initial theory, hypothesis and law respectively, T', H', L'—denote hypothesis and law which we deriive by means of M model ; D denotes the existing set of data and D' denotes the set of the forecast data; then we can write:

1 T,H or L=>T',H',L',
2 T or L => M=> D,
3 H=> M> D (H~L'),
4 T or L=>M=>D',
5 D => M> T. H or L,
6 T, H or L => M.

In the first case the model is used to enlarge or rebuild a theory, hypothesis or law; in the second case it can verify a theory or law by means of data; in the third case it can verify a hypothesis or create law; in fourth case it can forecast by means of a theory or law; in the fifth case it can identify a theory, law or put forward a hypothesis on the basis of the existing data; in the sixth case it can be used to present a theory, hypothesis or law for, eg. didactic purposes.

2.3 Objectives and methods of teaching geography

Geography is not, by its nature, an experimental science - it is difficult to have experiments involving whole social and economic systems, but computer experimenting and simulation of geographical phenomena and processes (eg., localization and economic or meteorological experiments) can make a good replication of the geographer's research and didactic workshop. Simulation methods are especially valuable while collecting and processing quantitative data. Here the role of computer is self evident.

There are many moments in the didactic process in geography when one can use the computer, however the most efficient areas to use the medium are as follows,

- knowledge updating
- analysis of dynamics of phenomena and processes
- deepening the analysis of the particular subject, stressing cause andeffect relationships
- map construction and cartographic picture operation
- extra subjects.

As far as methods and forms of teaching are concerned the computer allows the dynamise facilitation of the following forms of training:

- individual
- interactive
- multimedial
- based on didactic games
- through practical activities
- and others.

The computer operated by a teacher or student can be both a means of teaching and a tool for one's own work, allowing the creation new curricula; the preparation of articles and reports and didactic materials in the form of printouts, thematical maps, and foils. Both the teacher and the student can participate in a creative and active way in preparing materials for the classes. It is especially useful in geography concerning local areas which are close to the student. Reading geography in such a way is more comprehensive for the student, it is more sensible and practical. A contemporary geography teacher should be responsible for showing the relations between geography and practice i.e. diagnosing, planning and forecasting the social and economic impact of human activities on the environment, showing at the same time modern tools and methods of work.

Based on my experience connected with practising geography both in the field of research and of education, and on the experiences of other geographers who work with the computer it was possible to identify three basic areas of objectives, methods, and tools (software) in which the computer is used to dynamize and increase the efficiency of training. The following represents the idea:

OBJECTIVES		METHODS		TOOLS - SOFTWARE
Focusing student's attention on man -environment relations; the skill of finding cause and effect relationships	=>	collecting and arranging information, statistical and cartographical analysis, thematic map construction	=>	utility programs: data bases, spread sheets, geographical information systems, graphic programs
Learning contemporary geography and research methods, forecasting	=>	constructing models, geographical experiment, computer experiment	=>	computer models and simulations
Shaping and creating: the ability to take decisions, initiative, activity within a group, imagination, the skill of rational planning; reinforcement of the motivation to study	=>	cause and effect analysis, learning through acting	=>	simulation games

3. Teacher training involving the computer

In order to train active teachers to use the computer in their work, there have been some training courses in Poland which have already been conducted for several years. The courses cover the use of the computer in the teaching of particular subjects, computer science, mathematics, physics, geography, history, chemistry and biology. There are many courses concerning the basic use of the computer in several dozen teachertraining centers all over Poland. There are special one-week-long computer training sessions for geography teachers. There are two levels of this training and they are arranged within so-called across-curriculum workshops. The curriculum of the training of which I am the author is explained in Sections 3.1 and 3.2.,

3.1 Computer geography workshops - Level I (WG1)

The basic aim of WGl workshops is to present the software which can be used in a practical way in the geography-education process to teachers who have acquired basic skills in operating an IBM PC. The teachers who have not computer experience can fully participate in the workshops as well because there is a special system of reviewing and consultations. The proper selection of software allows us to expose those fields of geography where the computer can be used in a sensible and efficient way.

There are the following modules of the workshops:

Module 0

Reviewing basic skills concerning microcomputer operating (DOS, NORTON COMMANDER) plus practising - 6 hrs.

Module 1

First didactic contact programs - educational programs (teaching and practising), tests, simple didactic games - 6 hrs.

Module 2

Utility programs in geography teaching - data bases, dynamic spreadsheets, graphic programs, geographic information systems - 12 hrs.

Module 3

Simulation games - the strategy of teaching through practical activities - 8 hrs.

Module 4

Computer modelling and simulations in geography - computer geographical experiment, simulation of the spatial diffusion process and dynamic modelling - 8 hrs.

3.2 Computer geography workshops Level II (WG2)

Computer Geography Workshops - Level II (WG2) are the continuation of the above classes plus a course in the operating of a chosen word processor.

WG2 workshops are earmarked mainly for the teachers who participated in WGI workshops and for other teachers who have intermediate knowledge about the use of computers in education. The basic aim of the workshops is to enlarge and consolidate the knowledge and skills concerning the use of the computer in geography education in primary and secondary schools and to create one's own didactic applications, by means of the presented software.

There are the following modules:

Module 0

The review of didactic and technical uses of the computer - 6 hrs.

Module 1

Utility programs (data base, spreadsheet, graphic packages) creating a system of geographical information, computer cartography in order to prepare and develop data and thematic/subject maps - 12 hrs.

Module 2

Integrated geographical package (PC MAP; PC CHART) creating one's own didactic applications - 8 hrs.

Module 3

Computer modelling and simulation of spatial diffusion of a selected geographical phenomenon - 4 hrs.

Module 4

Computer pseudospatial modelling of a real area locality (hypsometric study) and social and economical space by means of SURFER program - 6 hrs.

Module 5

Multimedial training with the use of microcomputer, collaboration of the computer with selected peripheral equipment (overhead projector, digitizer, scanner) - 4hrs.

The workshops are continued in courses dealing with the operation and applications of the QPRO spreadsheet, DBASE, WINDOWS, and multimedial systems.

3.3 School computer education

School computer education focuses on teaching the basics of computer science as a separate subject (but not in all schools). Unfortunately learning computer culture through the use of the computer in the teaching of various school subjects is not very popular yet. There is a need for a closer relation between the teaching of computer science and the teaching of other subjects. As long as the problem of computer education of teachers remains unsolved there self-education groups working on the operation and applications of computers should be formed. Many teachers having graduated from computer training become animators of such self-education groups in their local environment.

It is also very important that geography teachers should cooperate with computer teachers at school. The cooperation should embrace, apart from developing one's knowledge, the following items:

mutual running of a geography class,

mutual work on obtaining didactic software,

selecting appropriate geography software to be used at computer classes,

the help of computer teacher in preparing a geography class with the use of the computer,

obtaining information on groups and events concerning the design and demonstration of didactic software.

4. The future of geography education with the use of the computer

4.1 Multi-disciplinary approach

Geography, especially at its school level, is a subject of integrating functions thanks to the subject of its research which is geographical space, nature and man in the society, and a specific tool which is the map. Geography overlaps some other school subjects, namely history sociology, biology, chemistry, and physics. The future of geography teaching should tend towards the correlation of its contents with the contents of adjacent subjects, for example in the form of blocks of integrated training or education. While discussing natural conditions on the earth for example, the geography teacher should get in touch with the teachers of chemistry, biology and physics and to have joint classes. (for example, in lessons about surface waters we discuss their chemistry, fauna and flora, and when speaking about orogenetic movements we step-into the regions of geophysics, etc.) The computer is located clearly in this process, through the possibility of preparing packages of subject-integrated software.

4.2 Geographical information systems

Systems of geographical information are the future of geography and regional arrangements. Such systems are based on a network of geographical information sources (stations situated on the ground, sattelites, data processing centers); networks of information transmission, all of them based on computer technology; and a system of tools to process data. The future of cartography is created by computer atlases, including school atlases, with the possibility to store full information on the country, region, local space. Geographical data can be processed and presented in the form of screens (a net of regular fields) or vectors (such as traditional maps). Schools as possible sources of geographical information on a nearby area (students are usually very active then) can play quite an important role in such systems, but the information should be properly verified.

4.3 Information exchange

There should be a multilevel information exchange in school system. The lowest level is created by the exchange of information between the teacher and her/his students and among the students. For the time being it is realized, not fully and not everywhere, by a class microcomputer network placed in a single classroom. A higher level is created by information exchange inside the school among classrooms, the library, and the school administration. It can be realized by means of school computer networks. It this case all the didactic software could be kept in the school library.

Successive higher levels go as follows: information exchange on the local and regional level (several schools connected in a network plus the possibility to connect with the local computer centre, or to an interschool software library) and a proper domestic and international networks respectively. The latter would assure a full circulation of updated knowledge and the exchange of experience. Such a network would require using telecommunication lines. Distance education belongs to the future in Poland but still it works occasionally on higher-secondary school level.

4.4 Integrated software

The future of subject-integrated education using the computer lies in integrated software packages which are multifunctional and have a variety of forms presenting work outputs. They include elements of both a data base and a spreadsheet and graphics. It is possible to use the same package in different subjects and in different didactic situations. There is also a possibility of co-operation of the computer with other media, to use satellites pictures as the source of geographical information and to have digital development of pictures. And what is very important you needn't any advanced computer knowledge to operate such devices. The much work is being done on software in

the form of so-called hypermedia. Enormous stores of information recorded on CD-ROMs enable us to penetrate multilayer space of contemporary knowledge.
In the world of such media, the teacher, preserving his/her humanistic identity, should "tame" these resources skillfully and adopt them to the needs of modern education. In connection with such enormous possibilities of new educational media, first of all the computer, there appears again the question "Will the media replace the teacher?". We answer, No! But, undoubtedly the teachers who do not use the media will be replaced by the teachers who use them.

The author has been employed in Research & Development Centre for Educational Aids in Warsaw since 1988. He started as a research worker dealing with the use of computer in geography teaching. Now he is the manager of Publishing Department and he is still faithful to the use of computer in education. He is also a trainer in Computer Education Centre, Warsaw, where he has already educated many in-service teachers.

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Final Reports of the Working Groups

Betty Collis, Editor

Task of the Working Groups:

A major aspect of the Workshop was the organization of the participants into four working groups. This was done in order to foster personal interaction among the participants, and to generate concrete suggestions and proposals based on issues raised during the Workshop as a whole.

The task of each of the working groups was to develop an intervention plan, in written form, for presentation to the Workshop as a whole during the Plenary Session, and for subsequent presentation to UNESCO. Thus each intervention plan was to be realistic, feasible, in tune with the goals of the Workshop, and within the framework of a possible subsequent UNESCO-stimulated intervention.

Organisation:

Four themes were chosen for the Working Groups:

- Communication and Information Technology in support of teacher education
- Curriculum issues relating to CIT and teacher education
- Organizational issues relating to CIT and teacher education
- Policy and strategy related to CIT and teacher education

Four persons involved with the Workshop Organization were given the tasks of being the Chairs of the Working Groups:

Working Group 1: Betty Collis
Working Group 2: Iliana Nikolova
Working Group 3: Rouman Nikolov
Working Group 4: Ivan Stanchev

Each of these persons invited someone who had served as a case study author for the Workshop to serve as the reporter of the Working Group. These reporters were:

Working Group 1: Jan Wibe
Working Group 2: Niki Davis
Working Group 3: Erling Schmidt
Working Group 4: Rudolf Hambusch

The Working Groups met on three occasions. They were given the option of subdividing into Themes if they wished, each with its own Theme Reporter. Three of the Working Groups chose this option. In some cases, participants were specifically invited by the Organizers to join a particular Working Group; in other cases, the participants could choose the Group they wished to participate in.

Results:

The Final Reports of the four Working Groups follow. As a summary, it can be said that the main conclusions of the various Theme and Working Groups showed a remarkable convergence, and this convergence can be based on a single word:

« NETWORK »

The results can be summarized in more detail as follows:

1. Change in schools, and in teacher education institutions, is complex and slow and difficult. Integrating CIT into instruction remains difficult, despite years of interventions. Thus we need to learn from each other's experiences and see examples of each other's approaches to a greater extent than now occurs.
2. Teacher educators need to be able to communicate more easily with each other, independent of time and location and at minimal cost
3. Teacher educators need to be able to exchange relevant ideas and learning resources, independent of time and location and at minimal cost
4. Teacher educators occasionally need support in working with each other on collaborative projects, independent of time and location and at minimal cost
5. Each of these needs involves first, a human network of colleagues, and second, an electronic network to allow the flexibility in time, location, and cost of interaction that now critically constrains interaction
6. Human networks need a starting point, and need support, stimulation, and facilitation.
7. The Internet is now available to academic institutions throughout Western Europe and increasingly in Central and Eastern Europe; what is needed is help for access in countries for which this is still difficult, and a co-ordinating service, to facilitate appropriate and relevant interaction and information access for teacher educators.

Recommendations.

The central goal of general education, from an individual point of view, is to stimulate and enrich the intellectual and attitudinal development of pupils. Information technology can significantly contribute to this goal. From a societal point of view, the goal of general education is to contribute to the social and cultural development of pupils, and to prepare pupils for future professional activities. Communication and information technologies are creating new opportunities for substantial contributions in that direction.

As teachers have and will keep a central and crucial position in the educational structures, they should have the conviction that IT and CIT are necessary aspects of current and future educational systems and curricula.

As 'teachers will teach as they have been taught or as they learn themselves', using IT and CIT in preservice teacher education, as well as in inservice teacher training, is what has to be realised. At the same time, such training programs have to take into account practical constraints of time and money. Therefore new training paradigms using CIT have to considered.

These remarks, together with the summaries of the working groups, lead to the following *recommendations:*

1. *Create facilities in order to:*
   a. *organise training 'when it is needed'*
   b. *provide specific help to teachers 'when it is asked for'*
   c. *make available a set of didactic case studies 'to serve as examples of class - room practice'*
   d. *connect teachers and teacher trainers with colleagues on a national and international level 'to broaden perspectives, insight and understanding'*
2. *Use electronic networks to serve as a backbone for the facilities as described in -1*
3. *Through an integrated collection of on-line services (regional, national and inter - national) and resources managed by educational specialists, provide a help facility and a stimulus for the activities as described in -1-.*

Working Group 1.
Primary Focus on the Technologies: CIT as Delivery and Support Agent for Teacher Education

Chair: Betty Collis, Reporter: Jan Wibe

Development of the Task.

Working Group 1 met first in plenary form to suggest various ideas for interventions related to the overall theme of CIT as Delivery and Support Agent for Teacher Education. Many different suggestions were contributed, grouped together, and listed on a white board. Participants came forward and put their own names next to the group of suggestions that seemed most useful to them as a focus for an intervention. Various iterations of this process occurred, resulting in the decision to divide the Working Group into three Themes:

Theme 1: Networking Regional Support Centres for teachers
Theme 2: Developing On-Line Support Environments for teachers
Theme 3: Sustaining Collaboration Among Teachers via an International Project

The participants then met two times in their chosen Theme Groups, to develop an intervention. The reports of these interventions follow.

Theme 1. Networking Regional Support Centres for Teachers

Reporter: Cargos San José

CIT in regional support centres for teachers getting started, making selections about CIT, supporting personnel, using communication technologies to link the support centres.

General Description: Creation of some national human networks and developing further technological links within and across the European countries.

Proposed intervention:

In order to achieve teacher education about CIT it is advisable to create a human network as first step.

Places should be located at the local level to accommodate the network resources and means.

This sites can have the structure of "teachers clubs" or didactic laboratories, with all the possible computer based facilities available.

The next step is both the national and international linking of this networks, presumably by means of existing facilities (universities,...) and standard (INTER NET,..)

Successful methodological models can be diffused to the rest of the countries, building a database accessible to all of them.

The same can be done with pieces of software, documents and teaching materials.

This could lead to the creation not only of a electronic common database, but of a collection of actual training materials that could be interchanged over the network.

European platforms, as Leonardo and Socrates can be used to obtain financial support to these plans.

Actions:

A working group will be created aimed to:

Write a project to present to LEONARDO or SOCRATES to give support to the actions.

Make a report on the actual situation in all the countries partners: existing networks, standard, etc.

Select a set of tasks to be addressed in this action: short, concrete and not too ambitious. (example: collecting and evaluating all the available software for the teaching of mathematics in primary level).

List of contact persons:

Alexei Dovgiallo (Ukraine)
Peter Hanak (Hungary)
Stanislav Zelenda (Czech)
Adrian Petrescu (Romania)
Carlos San Jose (Spain)

Theme 2. Developing Support Structures for Teacher Education

Reporter: Harvey Mellar

Description:

This Theme Group identified the value of having a range of information available for teacher educators, but also the need for the information to be relevant and well managed. The human network making use of the networked resources must be carefully researched, to better understand its information needs and practical constraints. Given this condition, various categories of on-line databases can offer valuable support to teacher educators.

Databases:

- Information about software
- Pertinent literature
- Models of good practice, didactic models and examples
- Database structures that allow teachers to share and add information
- Different but integrated databases for individual needs, for institutions
- Information about project opportunities, funding, commercial collaborators

Support for On-Line Conferencing and Co-operative Work:

Conferencing and discussions among teachers should be organized, but the importance of good moderation was stressed

Specialist workshops and in-service courses can be managed on-line

Ideas to support teaching practice can and should be exchanged across national borders

Example Project:

The Theme Group concluded its report with a suggestion for such a network service for physics teachers, across Europe, supported by both personal, professional, and network links.

Theme 3. Strategies for: Motivating & Sustaining Collaboration among Teacher Educators.

Reporter: Prof Stephen Stepped ULTRA LAB, Anglia Polytechnic University

Introduction

We were faced with two questions by the brief for our working group:

What kinds of CIT-related projects are likely to be most productive for teacher educators from Central, Eastern Europe and Western Europe working in long distance co-operation with each other?

What might be a particular project involving West, Central and Eastern representatives from this meeting that would be likely to be sustainable after this meeting?

We were fortunate to have in our working group a team of Group Participants with vision and imagination but who also represented a diversity of cultures and learning environments. This project's initial strengths is the result.

We identified anecdotally several key factors in building, maintaining and sustaining collaboration between our different countries and cultures. We spent some time analyzing successful collaboration and learned much from the debate. For example, in looking for successful models we should look not only for the infrastructural and resource components of successful activity but we should also seek social and interpersonal features. The features we identified are built into the project outlined below.

From our initial discussion it seemed that good collaboration would at least feature the following:

- Clear goals, that are valuable to all members.
- Outcomes that are useful to us at the personal, cultural, national and international level are important.
- Opportunities for the personal professional development of the participants.
- Most important of all the project should offer a "parity of esteem" between collaborators. They should have an equally valuable part to play and should equally value each others contribution.
- The proposal should take account of the many differences between our social, organisational, resource and cultural infrastructures at the local and national level.
- The proposal should be long term and should allow collaborative relationships, friendships, to grow over time - perhaps for a decade.

Seeking to meet the workshop objectives, but also because we were enthused by the idea we formulated the following proposal:

Project Proposal: "A Decade in the Learning Life of a Young European "

Brief description of the proposed intervention:

Our proposal is for the longitudinal 10 year study of the learning lives of children from around our European continent. The study would follow them from the beginnings of secondary school, through to the end of their post compulsory education (11-21). It would look at learning in the home, learning in the community and in learning in their educational institutions.

Why this choice?

There are six reasons:

1. A long term study of the diversity of learning on our continent offers the opportunity to investigate those aspects of our learning and information lives that we can discover from each other. In particular, to investigate those aspects that we do not want to lose as our learning environments increasingly look for support from computer technology.

   In particular we would seek to deliver a regular 'bulletin' of design guidelines for learning environment designers helping them to recognise, acknowledge and preserve important aspects (general, regional and cultural) of the learning process and in this way improve the nature of computer supported pedagogy.

We have, between our cultures, many millennia of experience of making learning successful. We must not lose sight of this experience as we design new learning environments and there is much to gain from each others experiences.

2. The longitudinal nature of the proposed project affords us the opportunity to uniquely track the impact of technology on the learning lives of our children. The very diversity of learning environments across the continent are a unique resource for this study. The relative contrast in the speed of penetration of technology into learning environments offers a 'once and for all' chance to carry out, and learn from, this work.

   In a few years our cultural and learning differences will be greatly reduced and the opportunity to learn from this resource will be missed.

3. The challenge of representing the rich multimedia content generated by this project provides an opportunity to disseminate techniques and capabilities across teacher education institutions on the continent of Europe. It is envisaged that harnessing the technology to display, archive, communicate, present and analyze this content will offer both the development of high level local / national capability the work will be done with cutting edge technology (but see Draft Method below) - but will also inform the debate about the use of multimedia as a learning support across cultures and between remote centres.

   The proposed project is designed through its 10 year cycle to continually refresh the technology used and in doing so to continue to offer exemplary use of multimedia and communications technologies.

4. In particular we intend that through a careful study of the learning lives of our children we be able to discern and taxonomise the emergent capabilities that they exhibit as a result of increasing exposure to technology in their social lives as well as their school lives. We are hypothesising from shared anecdotal evidence that children are developing new information confidences and capabilities.

   Identifying, harnessing an progressing these new capabilities will be a key task for teacher educators and for our European economic future.

5. The proposed project is attractive at the personal level: it offers the community of long term collaboration, it also offers the key motivation of personal development, it addresses local, national and international cultural needs, it has clear goals and milestones, it contains the key element of delight for the participants, not the least because of the opportunity to represent our own cultural strengths as equal partners in the project, and it is highly significant as an international research project.

Collaborators will want to be, and to stay, involved.

6. Finally we are seeking to build a model of good collaborative endeavour that will sustain and develop relationships among teacher educators.

This proposed project delivers on those objectives precisely.

Action Plan

Clearly more time will be needed to design the details of the action plan. But here is a suggested outline of some of the activity.

Each participant country will survey the learning lives of two learners - (perhaps the children of the participants in some instances?) - and record some predetermined aspects of their learning lives within the community, the home and the school.

This material will be locally authored into a multimedia archive using state of the art, but not the most expensive, hardware and software technology. The principle of Symmetry is important here - resources will be browsed, interrogated and annotated in many schools, homes (?) and centres around the continent of Europe. It is important that the hardware used to develop the content will also be the hardware used to interact with material generated by the project. Thus the project local centres will be equipped with state of the art, but desktop, computers. For example in the current year PowerPC computers running a shell authored in Script X might be likely because this is a reasonable indicator of future affordable technology. The project will always be forward looking, not backward looking in these decisions.

The personal professional development of the project collaborators will be developed by their work with developing the media but also by their on-going interaction.

There is more to do however, how to organise personal / professional development, communication structures, costs, how to manage a long term project founded in technological change, etc.

Summary:

Everyone in the group was motivated and animated during the discussion.

Here is a project proposal which delivers the initial aim of building a delightful collaboration that both motivates and sustains collaboration among teacher educators. However, the proposal offers real and important outcomes in the professional development of teacher educators, in the development of a transcultural, transnational brief for the developers of educational software, offers a local exemplary use of emergent technology in every partner institution that can evolve and develop as further technological advances emerge and, finally, will generate the unique resource of a longitudinal study of current learning across Europe and the way in which the emergent capabilities of our young learners can be harnessed.

Feasibility Prediction:

Because this project grew specifically out of an examination of the nature of motivating and sustainable collaborative projects as a support for teacher educators, its feasibility is designed to be high.

It was designed to deliver the factors we had identified as most important to eventual realisation; this was our brief and the working group were enthusiastic that we have a useful, viable, enjoyable project with a high level of feasibility.

Contact Person

Group reporter: Prof. Stephen Heppell, ULTRALAB, Anglia University

Working Group 2:
Teacher Education and Curriculum

Chair: Diana Nikolova, Reporter: Niki Davis

Intervention Documents.

Background

It is necessary to consider some general points to our intervention documents.

We acknowledge and appreciate the cultural, pedagogical and didactic differences between countries. At the same time we value the existence of analogous problems in innovation and development with CIT in education and teacher education.

We stress the importance of local and regional infrastructure for supporting communication and collaboration.

We are convinced of the importance of direct communication between institutions, teacher educators and teachers to assist in the solution of problems arising from the introduction of CIT.

Intervention 1:

Build an open communication structure between teacher training institutions, teacher educators and teachers which will assist colleagues in countries in transition to:

- formulate their problems
- find relevant information
- find resources to adapt or generate their own
- increase collaboration at more local levels
- use of CIT to enable these, Eg BBSs

Also collaborative development:

- exchange of courseware and case studies
- course materials
- team teaching courses remotely using CIT
- multimedia, especially images

Action Plan:

Each country to identify a focal institution and individual who will enable and stimulate communication and collaboration within that country in as open a manner as possible.

All kinds of communication to be used, such as: visits, electronic mail, and delivery of printed publications

Information to be linked across distributed systems which hold relevant collections, centres and people. 'This information to include on-going projects.

Who involved?

- Teacher trainers for national centres

- International experts volunteering time
- Teachers access through initial teacher training centres

Feasibility prediction:

This is an eclectic intervention because personal and electronic means have their own problems of access and opportunity.

Resources are required for:

Production of a guide to Internet resources relating to CIT and teacher education
Guide for BBS applications for teachers within countries
Names willing to be contact persons:
Niki Davis, Iliana Nikolova, Bronislav Burgis, Horia Georgescu

Intervention 2.

Description:

- Exchange of school teachers
- Assistance to establish good exchange schemes.
- Teacher training institutions to help to provide places where teachers will experience good practice: first study visits and then possibly teaching itself.

Names willing to be contact persons:

Bronislav Burgis, Ivan Kalas

Intervention .3

Establish aims for CIT

The group felt that it is possible that teaching aims are more similar between counties than is recognised by policy makers. Teachers and learners can and do collaborate usefully across countries.

The main suggestion for action is to investigate the commonalties and the differences in this area. In doing so, common aims could be listed before the World Congress. Difference should also be identified to celebrate the cultural diversity implicit, rather than censure different approaches. For example, the Norwegian application of telecommunications was recognised to provide an insightful approach for that country.

The common aims could then be put into action in a number of countries. The results would not be the same because results would be context specific. This in itself would provide valuable insights when researched.

Who involved:

Teacher educators in several countries, possibly through associations

Feasibility:

Countries which have not identified this may find it difficult to describe.

Resources for meeting and access to common means of communication. This can be difficult for those in countries short of funds.

Willing Contacts:

Niki Davis, Iliana Nikolova, Brent Robinson

Working Group 3. Focusing on Organization

Chair: Roumen Nikolov, Reporter: Earling Schmidt

Orientation Discussion

Rumen Nikolov started the group work by presenting the Goal and Task, the Procedures and expressing hope for the Results. Second there was a short presentation of all the members.

The first conclusion of the group was that it was given a very complex problem. Harald Haugen put up this matrix as an starting point:

	Pre-Service	In-Service	Further	General
Integration				
Pedagogical Tool				
As a Subject				
Distance Education				

In the following discussion Arno and Erling stressed that our group was dealing with organisation. There was a general frustration over this limitation as it is hard to discuss organization without involving the focus of the other three Working Groups. Bronislovas pointed out, that the group also should deal with the three aspects: Partnerships, New Programs and the World Congress.

It was mentioned that new EU project would be connected with the 'partnership' concept. A number of activities (ERASMUS and COMENIUS) were mentioned.

Rumen stated out that teacher education for a long time had been neglected in Eastern Europe, and that we should bring attention to this in our recommendations. It was particularly emphasized that many times activities only consisted of short-term schemes: what was needed was long-time commitment!

Harold agreed and pointed out that this problem was the same in Western Europe.

Erling raised the question of the level at which we should present our recommendations - recommending a more general and 'higher' level so that we would not become lost in details.

Rumen commented that we could address several levels: National, regional and local. In connection with this it were said that we had to face the fact that earlier the East was centralised in its decision making - but now everything was decentralised, which in some aspects makes decision making more difficult.

Pieter drew attention to the description of an 'intervention document' and commented that we should aim in that direction and get closer to practical issues.

Arno had calculated that around our table was represented about 600 years of experience in teacher education, and that we were capable of - and should! - be able to come up with heavy and serious recommendations given that background.

The matrix was then extended with a third dimension consisting of the different levels in education: Pre-School, Primary, Secondary, Post-Secondary, Adults and others.

Defining the Task

General insecurity was expressed relative to the task, but the discussion ended up with the formation of three sub-groups dealing with the themes:

Pre-Service Training,
In-Service Training and
Training of the Trainers

The Theme Reporters were appointed, respectively: Arno Libotton, Pieter Hogenbirk and Wim Veen.

Interim Activity

The Theme Reporters gave during the following meeting of the Working Group short 'presentations' of the themes formulated as statements/questions.

Arno (Theme 1): There are many possible viewpoints on Pre-Service: Quality? Organisation of curriculum? Modular structure? Should we aim at modules that fit a bigger world/Europe? What kind of connection should be developed between Pre-Service institutions and schools and research-institutions?

Pieter (Theme 2): How do we organize Formation for the teachers in schools? How do we help them to be able to choose between software-A and software-B? We have to consider the implementation level: Teachers should try out IT in their teaching and then get back and evaluate results. We need a network for this.

Wim (Theme 3): We still have a problem getting IT into the classrooms! We need at strategy that involves all levels in our system.

The group had then a general discussion on how to cope with the spreading of IT in schools. A model could be that a number of schools were set up with use of IT and that teachers from other school then visited these schools. Also the idea of having experienced computer advisors from the IT-schools work for some time in schools starting with IT use was mentioned.

The discussion involved the following points:

- Rumen stressed the importance of keeping in contact! We should form some kind of a panel - some kind of a formal structure. We should offer expert knowledge through an expert-network. Perhaps we should build up and offer an expert panel for the World Congress in Moscow?

- Erling pointed out that it probably was important that suggestions clearly showed a two-way exchange of ideas and experiences. Otherwise it would be harder to get money from decision makers.

- Sigurdjon reminded the group of the importance of money: We have to keep in mind that projects should have a realistic possibility of being carried out in reality. Otherwise generating a proposal is a waste of energy and time.

- Harald stressed the importance of a network. Not only supported by electronic communication but also the possibility of meeting head to head. We should recommend and aim at realising such network and solve the practical and economical problems.

The group split up and worked in its three theme groups

Results were presented at the Closing Plenary Session, based on the following three sub-group reports.

Theme 1. Pre-service Teacher Education Organisation of Teacher Education: Issues Related to CIT

The subgroup identified the following issues at different levels

Classroom and school level

- Integration of IT in daily school and classroom life, classroom and school organisation.
- At school level an "information technology lab" has to be organised and an IT advisor should be appointed.
- Any teacher-training institute needs a network of satellite practice schools where student teachers can experience IT-rich learning environments and receive guidance and consulting.
- Organising of the time schedule with the accent on flexibility and modular course structure.

National level

- Organisation of an IT in Teacher Education platform to define ITTE policy and curriculum development and monitoring.
- Establishing links between TE institutions and schools (via global electronic network).
- Adoption of a global national ITTE policy with communication to and from decentralised institutions.

- Special attention should be paid to horizontal working and reflection groups on an interdisciplinary basis (including socio-cultural environment, industrial world, policy makers, etc.)

International level

- Bringing the global educational community into TE institutions - for students, teachers, etc., as an innovation Objectives: global education by means of IT
- Institutional co-operation (contact groups, conferences.)
- To develop starting competence in relation to new profiles and training models and carriers.
- Linking TE institutions to global networks and multi-media projects.
- Establishing bi-lateral and multi-lateral partnerships.

Conclusions.

Towards 'partnerships"

School level:

establishing a group for the use of IT in a cross-curriculum manner.

promoting the idea of IT as a medium for the developing a new culture.

making links with the surrounding world (economic, educational, social, cultural and administrative.)

National level:

establishing links between TE institutions and with research institutions.

International level:

developing bilateral and multi-lateral partnerships via international organisations.

developing collaborative projects oriented towards R&D activities, implementation or dissemination.

Towards "new programs":

modular structured courses (credits, flexibility, relationship with in-service TT)

availability and development of programs on an international scale.

Towards "The Second World Congress ":

links between pre-service and in-service TT together with the career development of teachers.

empirically based curriculum development

integrating research in IT in Education and TE

establishing a research policy

Theme 2: The Organization of In-Service Training

Intervention document. Working on strategies and activities for organising the implementation of IT within in-service training

There is much experience with using IT in pilot schools and among individual teachers. How can we stimulate more teachers use IT for their personal development and in the classroom? There are different strategies for organizing the needed in-service-training, depending on the present situation in a country, on cultural and political aspects and on finances.

Action plan:

Organizing an international network of teacher trainers.

Exchanging data about key people involved, institutes, projects and experiences.

Making brief descriptions per participating country of the present situation.

Identifying subjects to use computers in the curriculum.

Identifying and describing the organisation of the implementation strategies with emphasis on the role of teacher networks and the support of those networks.

Working out possibilities for carrying out those strategies in actual projects.

In the meantime start with active co-operation between countries by:

- co-operation between networks of teachers on foreign language instruction
- exchanging advisory teachers

For whom?

Key persons in Institutes for in-service teacher training with connections both to the basic institutions and to the policy makers.

Important factors:

The setting up of an electronic network
The willingness to share experiences from all the countries involved
Finances

Contact persons:

Erling Schmidt, Denmark
Janez Cac, Slovenia
Pieter Hogenbirk, The Netherlands

Final Recommendation:

In-service-training should more be seen as a continuation of pre-service-training. The two types should be more connected to each other. Discussions must start on how in-service-training should be organized and how it should be part of the professional development of teachers.

Theme 3. Training the Trainers. Final results

Reporter: Wim Veen

General Goals:

To identify strategies for the implementation of training programs for teacher educators in teacher training institutes.
To specify the content of training programs for teacher trainers to get ITan integrated part of their curriculum.

Preliminary statement:

Teacher trainers do not differ from other professionals (such as teachers) in the change processes with regard to IT in education: they have strong beliefs and well established routines that they will not give up easily.

Suggestions relating to strategy:

Implementation is a long-term activity.

An implementation strategy should aim at long-term goals. As change is a slow process, short innovative programs are doomed to fail. The working group mentioned a time period for programs of about 10 years.

An integrated approach is compulsory.

A successful strategy aims at integrating three fields of expertise: informatics experts, such as educational technologists; subject experts, such as educationally oriented history, geography or language experts; and methods experts, such as pedagogical experts. In many countries (Norway, Sweden, Estonia and Germany that were present) those three groups are working apart from each other and there is a gap to be filled. Teacher training programs should integrate those three fields of expertise as has been the case as far as the subject and pedagogical experts are concerned in the Netherlands.

An multilevel approach is necessary.

If teacher trainers are to be trained for new practices we should take a close look at their working fields. Teacher trainers are working within an institute and they are collaborating with schools sending their students to those schools for teaching practice. So there are three groups of actors working on different levels and all groups are to be considered in the strategy. A multilevel strategy is needed to assure the integration of IT into the teacher training curriculum.

At Level are the teacher trainers. As there is no level of knowledge above them, they must provide their own training environment. This environment should consist of interest groups (e.g. foreign language teacher trainers, geography teacher trainers, physics teacher trainers), monitored by a 'primus inter pares' of one of them, having more experience and expertise in the field of CIT.

At Level are the managers of teacher training colleges. They should be made aware of their responsibility to support those teacher trainers attending IT training programs and make them put their new knowledge into practice. Policy issues relating to the role of CIT should figure on their agendas. Easy access to equipment, software and time allocation should become issues at the management level to ensure the necessary support for the teacher trainers within their own institutes.

At Level are the primary and secondary schools. They are working together (and if not, they should) with teacher trainers by offering teaching practice to student-teachers. Schools should have the appropriate equipment and give the necessary support and expertise to let students have experiences with IT in real classroom situations. To ensure this to happen structural co-operation on a long-term basis between teacher training institutes and pilot schools are to be established.

Continual support is necessary.

During the implementation programs teacher trainers should be able to get continual support. Help desks should be established on a subject-oriented basis.

Aspects relating to content:

There are two aspects to be considered:

- teacher trainers should be trained how to use IT in their own teaching;
- teacher trainers should be trained how to teach and guide their students in getting them to use IT in the teaching practice in schools.

It would be of interest to develop a field of Educational Information Science in which teachers and teacher trainers can get a degree.

The development of course materials for teacher trainers could be organized on an international basis. As a result modules could be used in different countries.

Infrastructural suggestions:

There is a need for a network for teacher trainers that encompasses not only a electronic network but a human network too. There is no electronic network without a human network. The electronic network have national nodes and discussions should be stimulated by moderators. Co-operation between teacher trainers should emphasize on useful, that is, exchangeable materials. Partnerships could be established only by preliminary exchange of teaching materials and teaching guides of potential partners. This exchange could start by paper-mail or electronic mail as well.

Working Group 4
Primary focus on policy and strategic planning in relation to CIT and educational systems

Chair: Ivan Stanchev, Chief reporter: Rudolf Hambusch

Context: The Second UNESCO Congress

A general discussion began with the consideration of the need for UNESCO to intensify its actions concerning the use of the latest information technologies in education. This need has led to the invitation of the Director-General to the General Conference for a Second International Congress on Informatics and Education. This Congress will be held in Moscow July 1 st to 7th, 1996.

The first congress took place in the year 1989.

A11 countries will be invited to send delegates representing their national governmental organization committees, their relevant ministers and their universities. There will be state reports on national, regional, and sub-regional levels. Some reports will be delivered by invited speakers from selected countries

Different topics will be discussed in (13 to 15) working groups. During the 7 days of the Congress there will be 2 plenary sessions (on the first and on the last days) and there will be stream sessions between. Recommendations are to be developed appropriate for policy makers with respect to reorganizing or developing new CIT programs since 1989. The conference will not only be for teachers, but for all persons which are engaged in education and for training in general.

Task of Working Group 4

Working Group 4 is to have as its task the giving of advice to UNESCO related to one or more of the following different levels:

Level of content
Level of organization
Level of finance

The members of Working Group 4 came to the conclusion that they should focus mainly the first level mentioned above, the content.

From this the delegates discussed different problems of implementation strategies and saw main questions as:

- evolution
- integration
- generalization/implementation
- profession

The Organizing Committee has to remember the fact that the participants of the Congress will not be invited specialists in the field, but national delegates, governmental people and ministers etc. So the Congress will not be the place where scientists - if they are not invited - will present their papers.

Already today in 1994 we must have a good projection what we should present in 1996. Moreover we have to identify future problems of the year 2000 and beyond. So the question is: What are the strategic directions, the streams, topics?

Topics relating to the influence of CIT on the educational system are for example the:

- changes of curriculum
- changes of teacher training/teacher qualification (TT&TQ)
- changes in school organization
- changes in equipment/educational development (EQ&ED)
- changes in people

From this there was a discussion:

- should "school" change?
  (if yes, how and to what extent?), and
- does "school" change society (or the contrary?), and
- will there be an integration of teaching & learning and CIT?

The conference members were asked to deliver more recommendations to Dr. Stanchev by electronic mail within the next days (until March 1 5th l994). The participants of the workshop must find out what kind of assistance from institutions on the national level can be given from their home country with respect to organizing the UNESCO Congress in Moscow 1996.

Suggestions from the Russian Delegates

In addition, Working Group 4 also discussed and supported the following document, brought to the table by the members of the Russian delegation participating in the Working Group:

Suggestions of the Committee to the President of Russian Federation for Information Policy concerning preparation of the Second UNESCO World Congress "Informatics and Education"

To prepare the Second UNESCO World Congress I&E the Committee is ready to:

1. provide organization with regional Russian and foreign centres responsible for preparation of the Congress 2 to 3 teleconferences concerning education and training problems.
2. create in Russia regional education/training centres as basic sites for distributing modern information technologies in education.
3. consider that the main idea of the Congress is the demonstration of modern information technologies in education utilizing advanced hardware, software and telecommunication systems. Thus during this Congress teleconferences should be organized with regional centres of Russia and leading institutions of other countries.
4. provide necessary maintenance, service and support for equipment concerned.
5. prepare and realize projects concerning the review of the situation in Russia with information technologies in different spheres of life.
6. give suggestions for a database of persons and institutions from the participants of the Congress to join with the State Committee for Higher Education and the Ministry of Education of Russia.

7. give information about the Congress in ministerial editions.
8. give proposals about the contents of panels (streams) of the Congress.
9. participate in activities to organize Program Committees and Working Groups.
10. join with the Committee for Higher Education to study the possibility of organizing during the Congress an international exhibition of Information Technologies in education.

What needed is:

11. support in financing, advanced information technologies transfer, provision of privileged rates/prices while working with WANs and for access to foreign educational databases.
12. to keep the Committee informed about all UNESCO activities concerning preparation of the Congress.

Welcoming Address

Jef Moonen

Chairman of Organizing Committee

Some two years ago, Mr. Khvilon from the Division of Higher Education of UNESCO discussed with us the possibility of organising a workshop on Teacher Education, Communication and Information Technologies. The main objective of the workshop would be to enable specialists of Central and Eastern Europe countries to confront their know-ledge with the knowledge and experience gathered in Western Europe in the application of communication and information technologies (CIT) in teacher education.

We are very happy that all of you were able to respond to our or UNESCO's invitation. We appreciate your attendance knowing that each of you has a very busy and important schedule back home. The fact that you are here is a confirmation of our belief that we all want to learn from each other in order to improve our education, and as a consequence, our future. Thank you all very much.

As you have already experienced, you are the guests of the University of Twente. The University of Twente is a young, fast-developing university, which has its own campus and offers courses of study in both technical and social-science areas. The University was founded in 1961. Since the decline of the textile industry of the Twente region, the university has taken on an important role as instigator of a movement towards re-industrialization of the Twente region.

The University has 10 faculties, one of which is the Faculty of Educational Science and Technology, host for this workshop. The Faculty of Educational Science and Technology started officially in 1982. The mission of the Faculty is: "To contribute to scientifically grounded knowledge concerning the appreciation of systematic, efficient, and effective technologies, methods and instrumentation for the solution of practical problems in education, training and information exchange. This knowledge is acquired through means of innovative, internationally oriented research and development activities".

The profile of T.O. (T.O. is the abbreviation of "Toegepaste Onderwijskunde", the Dutch name for the Faculty of Educational Science and Technology) is application-directed, technology-based, and market-directed. TO has five departments, a technical laboratory and a research institute. The five departments reflect different perspectives for examining educational and training problems: curriculum, instruction, instrumentation, organisation and management, and data analysis and measurement.

This is the scientific environment in which you will spend the following days. We hope that the weather will co-operate to give us the chance to also enjoy our external environment, and in particular our wonderful campus.

This workshop is on invitation only. The organisers have tried to bring together experts from Eastern, Central and Western Europe. Given the list of participants we feel that we have more than succeeded.

Many of the participants have been asked to prepare, present or demonstrate their ideas during the conference. We would like to thank you all for your contributions. This extensive program folder with all the contributions in it proves that many people have done much work. They can be sure that the work is very much appreciated. In particular we would like to mention: Mr. E. Khvilon,. Mr. S. Vecchi, Mr. W. Janssen, Dr. R. Nikolov, Ms. J. Vingerhoets, Ms. J. Spierenburg, Ms. J. Haan, Ms. H. Snijder-Gopodarek, Mr. G. Wijnants and Mr. J. Lammers van Toorenburg.

Last but not least we would like to thank the CEC, UNESCO, the University of Twente, and the Foundation Universiteitsfonds Twente for their generous financial support.

We wish you a pleasant, useful, and memorable workshop.

Organizing Committee:

Prof. Dr. Jef Moonen, *Chairman*
Dr. Ivan Stanchev, *Secretary*
Dr. Betty Collis, *Editor*
Dr. Iliana Nikolova, *Assistant Editor*

Welcoming Address

Wim Jansen,
Commission of the European Community, DGXIII - DELTA

I will give a short summary of the directions of DELTA in the Fourth Framework Programme (FWP) followed by some initial statements on what this could mean for people concerned with the training of teachers.

DELTA

"Delta" stands for Telematics Networks and Services applied to flexible and distance learning (FDL). This initiative will enter its third phase in 1995 as part of the Fourth FWP initiated by the European Union. The Union has identified the need to increase our practical knowledge of the potential of learning technology to improve access to learning facilities Europe-wide through research and experimentation.

The technical infrastructure to support technology-based education and training (TBT) is widely divergent between countries in Europe; as a consequence TBT approaches which work in one region may be unavailable, or inappropriate in another, if not co-ordinated at the European level.

Community policies in respect to:

- global competitiveness,
- the scientific and technological basis of European Industry
- social and economic cohesion and the internal market form the basis of the rationale which underpins the research policies of the Commission of the EC.

The treaty of Maastricht encourages clearly the development of distance education, where the role of the Community is complementary to those of the member states, namely, to contribute to improving the quality of education through promoting co-operation and to develop a vocational training policy.

Telematics-based education and training schemes can play an important role for the educational sector opening-up and improvement of educational training facilities to all citizens in Europe, pooling educational resources and knowledge and interlining educational institutions Europe-wide.

The mission of the programme of R&D (Research & Development) in Telematics Applications for Flexible and Distance Learning (FDL) is in this context to improve access to and efficiency of education and training by developing and validating experimental services and technologies.

This means supporting a change from once-in-a-lifetime education to lifelong learning, improving access to learning for all citizens of Europe, and improving the efficiency of the learning process.

The improved education and training systems will then make a substantial contribution to the competitiveness of the European economy.

Priorities and Objectives

What will be our priorities and objectives in the next Frame-work programme?

1. User-led R&D
2. Enhancing the integration of technologies and learning approaches
3. Action research.

Notes on User-Led R&D

Research and development should provide adequate answers to specific learning needs of individuals or groups of learners by:

opening up the vast potential of education and training
improving existing learning facilities and
providing new ways of learning.

The following user groups are identified:

A. End users, the learners, with specific requirements:

- specialised professionals: researchers, librarians, training technology specialists (includes trainers of teachers)
- Learners from small- and middle-sized enterprises who need training in specific apprenticeship skills with short-term effects and fully integrated with their in-work environments
- Home learners, such as traditional or Open University (OU)-students, home-bound learners, physically or socially disadvantaged persons, employees at remote sites, etc. Here the focus is to overcome isolation and provide access to a variety of learning facilities.

The second type of user group includes:

On the one hand:

B. Providers offering answers through FDL services:

- learning service providers such as: educational institutions;
  vocational training variety;
  Open and Distance Learning
  (ODL) universities; and
  on-the-job training centres.

And on the other hand:

C. Designers and producers of FDL materials.

Notes concerning the integration of technologies and learning approaches:

Telematics-based scenarios may provide adequate answers to the learning needs of specific user groups. Central to these scenarios is the interplay between technological means and the learning approach.

For example:

- embedded on the-job-training scenarios made available within an integrated work / braining environment, supportive learning tools, simulations, and easy access to knowledge
- distant interactive teaching scenarios (one-to-one model) with full communications facilities with a tutor
- the virtual classroom scenario (many-to-many or few-to-few scenario) with group learning facilities such as "telepresence" and access to virtual libraries
- collaborative design and production scenarios at a distance for distributed authoring of multimedia learning materials.

Notes concerning providing new ways of learning:

- The development and validation of experimental services and technologies should be seen in a full implementation cycle whereby all the phases have to be considered within a single research project.

Planning Activities

The above-mentioned mission and priorities are at the moment being operationalised and focused into services by a group of experts in close collaboration with the Delta officials. We are in the middle of this process of formulating tasks, which will have to lead to a draft workplan which is scheduled for June of this year (1994). The most optimistic scenario for the "call for proposals" is October-November 1994. If everything goes as foreseen the new projects could start in the beginning of 1995.

Until now three areas of work have been identified, but these are subject to change:

1. *Development of experimental services for lifelong learning through test beds for decentralised education & training networks.*
2. *R&D for a new generation of tools and applications enabling new ways of learning*
3. *Accompanying measures for diffusion and implementation strategies*

The main activity will be on the development of experimental services, where the key concepts for the R&D work will be integration and validation, and where the cost-effectiveness of the different configurations should also be examined.

Notes on Area 1:

Examples of user services and their underlying technologies are:

Experimental Telematic distance education services for Education & Training institutions
Innovative distance education approaches
Experimental Pan-European telematic education and braining services
On-the-job experimental learning services for large corporations
Decentralised Raining Infrastructure of resource centres for SMEs
Experimental telematic services for the design and production of distance learning materials
Experimental telematics services for language learning.

Notes on Area 2:

The second area "R&D (research and development) of a new generation of tools and applications" should support seamless integration of the experimental learning services . Potential R&D activities are here:

Design of a telematic classroom
Advanced simulation and virtual-reality learning applications
Intelligent assessment applications for personal learning services
Intelligent tutoring applications
Multimedia applications for co-operative learning
Applications for the customisation of learning materials
Innovative design of interactive multimedia learning materials

Notes on Area 3:

The third area "Accompanying measures" could encompass:

awareness and dissemination
learning technology watch
good practice assessment and guidelines.

Applications for Teacher Education

The objective of this workshop, an exchange of ideas, knowledge and experiences in the area of teacher training on the use of telematics applications and services, could be classified under many of the headings mentioned, for instance the task on language learning. The development of new ways for language learning could be a basis for further partnerships. The training of the trainers in the use of the new telematic technologies is of vital importance for the implementation of the new information and communication technologies and hence for the future competitiveness of Europe. DELTA will foster the use of intelligent networks, interactive cable networks, fibre to the home and broad band technologies in these Raining environments.

The white paper underlines also the importance of developing "information highways" for telecommunication applications for teletraining.

A high-level group of advisors, (mainly directors or CEOs from Europe's largest industrial enterprises, who will advise the council in June in Korfu about the measures to be taken in order to be able to implement the White Book initiative, a kind of blueprint to foster economic growth, competitiveness and employment in the Union by the turn of this century), had a first meeting last week.

I am happy to inform you that this group is considering at the moment seriously to prioritise the development of training schemes for the trainers; thus, teacher education for teacher educators.

This would mean that considerable funds would become available for retraining teacher educators to meet the challenges of the next century by making optimal use of the facilities offered by the new information and telecommunication technologies.

I would like to end by wishing you all a very lively and fruitful week, and hope that in a few years you look back to this workshop as the 'cradle' of your by-that-time existing partnerships.

Thank you very much for your attention.

Welcoming address

Evgueni Khvilon

Programme Specialist
Educational Research and Innovation Section,
Division of Higher Education, UNESCO

Ladies and Gentlemen,

I would like to express my satisfaction that so many of you have accepted UNESCO's invitation to convene here in Enschede for the purpose of discussing European co-operation in promoting the use of communication and information technologies in teacher education.

It is evident that the rapid progress in information and communication technologies necessitates more frequent contacts among those applying them. The fact that this progress is not geographically restricted to one or two countries but takes place simultaneously almost everywhere not only generates a common interest but also suggests co-operation.

Undoubtedly, co-operation itself has gained new dimensions in Europe as a result of recent political changes in the Eastern part of the continent. It implies a commitment to share one's knowledge and skills, and manifest in new partnerships that make the modern information technologies available to those whose vocation is education.

The International Congress "Education and Informatics: Strengthening International Co-operation" (1989), in which some of you participated, identified similar needs, including the exchange of information and data on experience acquired, transfer of skills from one country to another, the exchange and joint production of software and selections of standards, training of specialists and teachers, research, co-operation between education and industry, as well as financial and technical assistance.

As a follow-up of the congress, the seminar "A European Platform to Develop a Mechanism for Co-operation in the field of Information Technologies in Education" was organized in Moscow, 1991, focusing on European co-operation in the field of educational technology.

The question therefore may not be so much what needs to be done but how. It requires the analysis of present practices and trends, the re-examination of current patterns of co-operation, the identification of its most efficient modalities, and the establishment of a network of potential partners for co-operation.

UNESCO has been very fortunate that a considerable number of prominent specialists have agreed not only to participate in this workshop but also to prepare documents to guide its discussions. The variety of themes is a richness, emanating from the fact that communication and information technologies touch upon all aspects of education and the systems that provide them, whether the technologies are seen as a subject matter, as a facilitator of teaching-learning processes, or as a tool for more efficient management and administration.

Therefore, UNESCO attaches great importance to the workshop and its conclusions which will be taken as advice to the Organization in planning its programme activities, and which will contribute, for example, to the preparation of the Second World Congress "Education and Information Technologies". This Congress will be held in Moscow 1-7 July 1996, and its preparation has in fact already begun.

While wishing much success to your work, I would like to express my gratitude to the Dutch authorities, notably, Prof. Dr. Popma, the Rector Magnificus of the University of Twente, and Prof. Dr. Jef Moonen, Dean of the Faculty of Educational Science and Technology, under whose jurisdiction we have the privilege to convene. My appreciation goes also to Mr. Dick Lageweb, Secretary-General of the Netherlands National Commission for UNESCO, and also to the Commission of the European Communities, both of which have contributed greatly to the organization of this important Workshop.

Thank you very much, indeed.

Welcoming Address

Prof. Dr. Rita De Caluwe

Vice-Chair of the Technical Committee on Education of the International Federation of Information Processing (IFIP)

I would like to express to UNESCO, and particularly to Mr. Khvilon, on behalf of the Technical Committee on Education of the IFIP, our formal and, at the same time, our most sincere thanks for the invitation to this workshop.

By the end of this meeting, I am even more convinced that we all do not only have common interests in the field of education, but that we are really trying to achieve the same goals, only for now organising activities alongside each other.

During this working party I enjoyed to meet a lot of people that I very regularly meet at IFIP educational activities and this confirms our common interests and the willing to serve the same purposes.

Obviously we all look in the same direction. So we would benefit from joining our efforts and I am quite sure that I can speak for all the members of our Technical Committee and all the members of its working groups, by stating that we would be very happy to co-operate in a more tightly way, and occasionally in more formal ways, in the future.

I invite you to consider this as a message as well as an invitation, with a special attention for the people of middle and eastern European countries, which, up to now, not always had the opportunity to be active in the international forums.

Programme of Workshop.

10.00-14.00: For those who arrived on Saturday, there will be an opportunity to participate in an organised visit to the town of Enschede

Sunday, February the 20th.

14.00- 17.00: ***Registration,*** Lobby of the Drienerburght Centre, University of Twente
17.00- 19.00: ***Opening Session,*** Drienerburght, Room A
17.00: Welcoming Addresses:

The Rector Magnificus of the University of Twente
A Representative of DG XIII of the European Community
A Representative of UNESCO
The Dean of the Faculty of Educational Science and Technology

17.40: Introduction to the University of Twente Campus and the Faculty of Educational Science and Technology, from a visual perspective
18.00: Pause
18.10: Demonstration of New Technologies, Prof. Stephen Heppell, UK
18.30: Panel Session 1: "Educational Technology in Teacher Education: Perspectives from the Faculty of Educational Science and Technology"
Panellists: Prof. Dr. Jef Moonen (Chair), Prof. Dr. Tjeerd Plomp, Prof. Dr. Sanne Dijkstra and Prof. Dr. Jules Pieters, The Netherlands.
19.00: Reception, Drienerburght, Dinner, Bastille Restaurant, University of Twente

Monday, February the 21th.

09.00-10.30 Plenary Session, Drienerburght, Room A
09.00 Invited Speaker:: Prof. A. Libotton, Belgium
"Computer Networks in Teacher Education: Realisations in the Frame work of the PLUTO Project"
09.45 Panel Session 2: Relating Prof. Libotton's Remarks to the Case Studies
Panellists: Mr. Rudolph Hambusch, Germany; Mr. Erling Schmidt, Denmark; drs. Pieter Hogenbirk; Mr. Carlos San Jose, Spain.

10.20- 10.30 Coffee Break
10.30-12.00 Working Groups, Drienerburght, Rooms A, B and C
12.15-13.45 Lunch, Bastille Restaurant

14.00-14.45	**Plenary Session**, Invited Speaker: Ms. Pilar Marin Santolaya, Commission of the European Community "The New Commission Programmes for Education and Training: Implications for Teacher Education"
14.45-15.45	Working Groups, Drienerburght, Rooms A, B and C
15.45-16.00	Coffee Break
16.00-18.30	Demonstrations: *Language Training through Distance Learning, L. Reif, S. Fischer, Germany* *Authoring Systems for Simulations, Dr. T De Jong, The Netherlands* *Videodisk Teacher Training, J. Nolthuis, The Netherlands* *Logo Environment, Dr. 1. Kalas, Slovakia* *CD-I, Drs. Willem Bulthuis, Philips, The Netherlands*
19.00-20.30	Dinner, Bastille Restaurant
20.30-21.30	Master's Programme Presentation, Drienerburght, Room A Prof. Dr. Tjeerd Plomp, Dr. Plon Verhagen, Drs. Jan Nelissen

Tuesday, February the 22th.

09.00- 10.30	***Plenary Session***, Drienerburght, Room A
09.00	Invited Speaker: Prof. B. Cornu, France "Teacher Education and Communication and Information Technologies: Implications for Faculties of Education"
09.45	**Panel Session 3:** Relating Prof. Cornu's Remarks to the Case Studies Panellists: Drs. Wim Veen, Dr. Frans Jansen, The Netherlands ; Prof. Jan Wibe, Norway; Dr. Niki Davis, UK; Dr. Ivan Kalas, Slovakia.
10.20-10.30	Coffee Break
10.30-12.00	Working Groups, Drienerburght, Rooms A, B and C
12.30-19.00	Visit to Kroller-Muller Museum (Apeldoorn)
19.00-20.30	Dinner, Bastille Restaurant
20.30-21.30	Non-formal presentation by Andersen Consulting-ECC', The Tower, KCT Building, University of Twente Drs. Gerhard Groen, Drs. Betty de Vries, Drs. Ivonne Harmsen, Drs. Jeroen Scholten

Wednesday, February the 23th.

09.00-11.00	***Plenary Session***, Amphitheatre, Vrijhof Building, University of Twente
09.00	Opening Perspective: Dr. Betty Collis
09.15	Working Group Reports
10.20	Plenary Speaker: Prof. Stephen Heppell, UK "Teacher Education and Communication and Information Technolo-

	gies: A Reflection on Emerging Possibilities for Collaborative Projects"
11.00-1 1.15	Coffee Break
11.15	Closing Panel, Reactions to Working Group Reports and Discussion of Further Possibilities : Panellists: The Organising Committee, UNESCO and Commission of the European Community Representatives
12.00-12.10	Conference Closing, Prof. Dr. J. Moonen
12.15-14.00	Lunch, Bastille Restaurant
14.00	Departure (or separately arranged appointments at the Faculty of Educational Science and Technology)

Technological developments and new training paradigms have a strong influence on society. Information technology is evolving towards an integrated communication and information technology. At the same time, training is evolving from a separately planned external activity towards an integrated learning–working activity.

Education and the teaching professsion have to take such developments into account: the teaching profession is evolving from an emphasis on delivering information to an emphasis on creating learning environments.

Information Technologies in Teacher Education takes a long hard look at the situation in Europe. It presents a collection of papers written for a workshop on 'Communication and Information Technologies in Teacher Education: Issues and Experiences for Countries in Transition' held at the University of Twente, Enschede (Netherlands) in February 1994. The papers range from the highly philosophical, through general theoretical discussions (such as the implications of communication and information technologies for faculties of education), to case-studies on specific subjects (such as Teleteaching '93 and a European multi-media training network for international distance learning).

About the editors

Betty Collis (Canada) is Professor at the Faculty of Educational Science and Technology of the University of Twente and chairs the International Federation for Information Processing's working group on Research in Informatics in Education and Training.

Iliana Nikolova (Bulgaria), Senior Assistant Professor at the Educational Computer Systems Laboratory, University of Sofia, lectures in educational technology and problem-oriented languages.

Katerina Martcheva (Bulgaria) of the IBM Teacher-Training Centre in Blagoevgrad, Bulgaria, lectures in new pedagogical methods for teaching informatics.

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