Information technologies *in teacher education*

Issues and experiences for countries In transition

Edited by Betty Collis, Iliana Nikolova, Katerina Martcheva

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

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Abstract

Mass-scale teaching about different aspects of Information Technologies (IT) has been a reality for nearly cz decade now for school systems in al - most 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 edu - cation. The CEE countries currently face similar problems, e.g. a deep eco - nomic crisis, turbulent political life, rising percentages of unemployment, low living standards, and as a consequence - shortage of funds for educa - tional 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 coun-

tries 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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