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AND CULTURAL ORGANIZATION

ROUND TABLE

INTERNATIONAL EXPERIENCE OF ICT USAGE IN EDUCATION

In the framework of the 12th International Conference and Exhibition

Information Technologies in Education
ITE–2002

Proceedings

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These Proceedings present the reports made at the round table *International Experience of ICT Usage in Education* in the frameworks of the 12th International Conference and Exhibition *Information Technologies in Education* (ITE-2002).

The authors are responsible for the choice and presentation of the facts contained in this book and for the opinion expressed therein, which is not necessary reflect the views of the UNESCO Secretariat.

For further information please contact:

UNESCO Institute for Information Technologies in Education
8 Kedrova St. (Bld. 3), Moscow, 117292, Russian Federation

Tel.: 7 095 129 2990
Fax: 7 095 129 1225
E-mail: info@iite.ru
Web: www.iite-unesco.org

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INTRODUCTION. 12th International Conference and Exhibition "Information Technologies in Education" (ITE-2002): Objectives and Outcomes

The 12th International Conference and Exhibition *Information Technologies in Education* (ITE-2002) was held from 4 to 8 November 2002 at the State Theatre Centre "Moscvorechye" in Moscow. The Conference was convened under the aegis of the Council for Cooperation in the Field of Education of the CIS Countries and under the patronage of the Federation of Internet Education.

Prof. Vladimir Kinelev, IITE Director is opening the round table *International Experience of ICT Usage in Education*

The Conference was organized by the Ministry of Education of the Russian Federation, Moscow Department of Education, UNESCO Institute for Information Technologies in Education (IITE), Russian Teacher Support Fund, Institute of Informatics Problems of the Russian Academy of Sciences, Moscow City Pedagogical University, Moscow Institute of Physics and Engineering (state university), Moscow Centre of Internet Education, Scientific and Production Enterprise "BIT pro". The conference attracted the attention of such international corporations as Microsoft and Intel.

Reports and presentations were made by more than 600 participants from Azerbaijan, Belarus, Germany, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Netherlands, Poland, Portugal, Russian Federation, Ukraine, United Kingdom and USA. Almost 4,500 teachers from various educational institutions attended the exhibition.

The conference attracted the employees of 650 organizations (universities, academies, colleges, pedagogical institutes, etc.).

In the course of the Conference the participants worked in the following sections: methods of teaching informatics and information technologies (IT), IT in the learning process, open education,

educational management, teaching persons with special needs, control and evaluation of results of education. Finally, the Recommendations to the Ministry of Education of the Russian Federation, educational institutions, teachers and the organizers of the conference were adopted.

Five round tables were held in the framework of the Conference. The round table *International Experience of ICT Usage in Education*, organized by IITE, caused great interest of the participants and guests. At the meeting Prof. Vladimir Kinelev, IITE Director spoke about the major activities of the Institute, the projects realized in the CIS countries and the IITE biannual plans. The main objectives of the round table were: to discuss the European experience of the role and perspectives of information and communication technologies (ICTs) in education and to share the experience in this area. Russian and international specialists took part in the round table. The invited speakers were: Dr Serenella Besio (Italy), Dr Katya van den Brink (Germany), Dr António M. Duarte (Portugal), Dr Terry Haydn (United Kingdom), Dr Piet Kommers (Netherlands), Dr Boris Kotsik (IITE), Dr Eugenijus Kurilovas (Lithuania). The speakers presented their experiences and ideas on ICT usage in education and talked about international collaboration in this area with the specialists from Azerbaijan, Belarus, Kazakhstan, Poland, Russian Federation and USA. The main reports at the round table are published in the Proceedings.

The participants of the round table

Piet Kommers
University of Twente
The Netherlands

ICT in Education

Introduction

Information and communication technology (ICT) for education in the Netherlands was initiated at the level of enthusiastic teachers, students and school leaders in the late seventies. It is interesting to observe the evolution of expectation: how ICT could affect the learning process. For almost one decade the accent was on ICT as a new curricular domain targeted at computer literacy. Only in the early nineties the real impact of ICT on didactics and learning strategies became evident. At the same time we noticed that the missionary ambience of how to superimpose ICT on existing practices faded away; a sudden awareness was awoken that we do not prescribe craftsmen when to use a certain tool, likewise we do not want to prescribe teachers when to use a certain ICT tool or method. It has become common since then to orient teachers in the vast landscape of media facilities and programmes, so that the final choice how to optimize the learning is taken on the base of functional primacy rather than reasons of fashion and cosmetics. Since then it has been quite frequent to see teachers acquiring skills of a typical "lecturer", "group moderator", "individual mentor", "ICT manager", etc. From this perspective the presentation articulates dominant current mechanisms of further ICT integration in Dutch educational and vocational training systems. As a side effect, hopefully, this article will contribute to shaping of various national ICT policies and to predictions how ICT will manifest in Education and Learning Communities in the coming years.

Learning as a process of diversity and continuous care

Pedagogy and later the so-called "Domain-Specific Didactics" have attempted to provide rather consistent and prescriptive recommendations how to teach and how to learn. Traditional ideological innovative initiatives were based on a common idea that one needs to believe that a certain approach is superior. Both critical and bourgeois elements penetrated the national policies to make schools more effective. So-called "learning psychology" and "educational science" claimed to find underlying explanatory theories of how teaching should be built up on learning theories. Quite dominant was the impact of "Instructional Design" on regular teaching practices. Its main paradigm was that teaching should control the learning process in the most sophisticated way. Building and experimenting with "Intelligent Tutoring Systems" were the heydays of the instructional paradigm. Having tasted the enormous complexity of formalizing sound teaching measures like "repairing misconceptions" and "promoting in-depth" understanding, it became clear that even with rather elaborate student models it was a Sisyphus Job to make teachers' intuition explicit and to implement it in a deterministic way.

The actual rise of ICT in real schools, and real industrial training happened when rich simulation models and multi-modal user interfaces became common for home computers. Rather than the systematic approach of instruction, the vividness of visual, acoustical and now even hectic devices makes us feel immersed in other worlds and opens our mind for the unknown.

ICT transforms learning paradigms

WWW-based technologies offer a wide spectrum of communication facilities for professional organizations. Two main paradigms emerge as it comes to the question how to manage and facilitate the synergy between domains of expertise and how to make knowledge effective. The first paradigm is closely related to the traditional method of delivery courses, documentation and quality control via proven procedures. Its accent is on consolidation, validation and broadcast of expertise via courses. Lifelong learning in this paradigm is the attitude of the employee to remain receptive of new information, and to be willing to change oneself. The second paradigm is based upon human resource management, the learning organization and the impact of peer-to-peer learning. Its underlying notion is that expertise is between, rather than in the individuals. In simple words, knowledge manifests in the interaction when several persons are sparring on a certain decision or design task.

The intriguing question is how new methods and tools allow teams to share expertise, so that the quality of the team solution exceeds the best of any individual solution. The strategy to achieve this result is to assess cognitive styles and make team members aware of the added value of

complementary personalities. As e-technologies offer new unique pedagogical methods to enhance student learning, it seems to be an urgent and valid question to ask how to manage learning communities within and between business sectors that have only few disciplines in common. The key mechanism in the procedures for generating, sharing and managing expertise is in finding appropriate representations that allow specialists to express and apprehend conceptual networks. Concepts "Mapping" and "Mind Mapping" are such techniques that elicit the human mind to become aware of tacit knowledge. Moreover, conceptual representations make it easier for partners to accept the difference between the generated ideas and to share underlying intuitions for critical stages in problem solving. In demonstrations it will be explained how conceptual representations influence orientation and navigation and how these new methods affect crucial stages of learning in Virtual Environments like VR learning games.

Conceptual awareness for learning the unknown

The introduction of technology in the domain of learning and teaching is not new. Mankind has used external representations from the very beginning in order to get a grip of the world, as well as of his/her own mind. Famous examples are a drawing, a map and, in particular, nowadays a video registration. When object-oriented (also called "vectorized") representations were introduced, a question appeared, if and how this flexibility could be used as a tool for learning. Computer Simulations, Expert Systems and nowadays Virtual Reality and Agents for extending our actions, are good examples. In this presentation I will elaborate on the continuous tendency to reify knowledge and concepts as informational objects rather than processes. Concept mapping is one of prominent members in the family of cognitive tools. Its role is not restricted to learning; its functioning can best be classified as "a facilitator for idea generation". The question to be addressed in the presentation and discussion is if and how we can further extrapolate the concept-oriented approach for further formalization of media-based learning.

Conceptual support for learning

The intelligent support of learning cannot be simply built upon existing didactic or pedagogical theories; the nature of learning is to be re-analysed, as theories from the past were developed in contexts of a different infrastructure. Furthermore, the existing theories of learning were created because of "new" technological paradigms and artefacts rather than "clean" psychological or hermeneutic research. The current dominant paradigm in learning and teaching is still one of "shaping behaviour": the teacher, the situation and the media should provide the right information and control for the student. The leading themes are behaviourism and control theory. Alternative approaches from the era before the information age were scrutinized or forgotten.

- The narrative learning theory is the first. It claims that learning is essentially an existential process where learning partners can really share experiences and understanding if they are willing to access the level of one's life story. *Woven Stories* is a research project elaborated in cooperation with Erkki Sutinen, Joensuu University (Finland); Gerdt et al (2002) and Harviainen et al. (1998). Its basic attempt is to formalize the building and dynamic reallocation of story fragments so that learners experience semantic transitions rather than endpoints of information trails.
- Learning by imagination (Anschauung[1]) is the second. It postulates the main approach that learners need to get access to the essence of a topic under study by exhaustive observation and contemplation. Quite often this paradigm is narrowed down to the attempt to present more realistic visualizations. In fact, the Kantian thesis on "Anschauung" pleads for mental not visual imagination. As far as Virtual Reality is concerned, it is entirely the question if and how far visual expressiveness helps the learner to understand and remember. Egan and Nadaner (1988) have again articulated the interdependence between narrative discourse and imagination.
- Conceptual awareness is the third dimension that seems to be ignored in the attempts for new learning systems.

[1] See the overview by Hans Zimmermann http://home.t-online.de/home/hanumans/sais.htm, in reflections on Herbart's work: Vgl. Herbart, Johann Friedrich: Pestalozzis Idee eines ABC der Anschauung als ein Cyklus von Vorübungen im Auffassen der Gestalten wissenschaftlich ausgeführt..... http://pestalozzi.hbi-stuttgart.de/forum/hinz/herbart.htm

...So our initial teaching might begin with the myth stories that explain, in an affectively engaging way, the vital importance of heat to human life, along with its attendant dangers. Thus we can tell the stories of Prometheus and Zeus and of Sol and Phaëthon, and we can tell of Hephaestus limping around his smithy. The daring of Prometheus in giving fire to humans and the terrible punishment meted out by Zeus show the importance that control of heat has played in human civilization. It is a power that has made us like the gods. Phaëthon's escapades show what destruction can follow when this terrible servant gets out of control...

From: Memory, Imagination and Learning: Connected by the Story. Kieran Egan[2]

Though a long tradition of the development of concepts during the early schooling phase is well-known, it has not well penetrated the practice of learning tools nowadays. The basic principle of concept-formation (which states that the omitted measurements must exist in some quantity, but may exist in any quantity) is the equivalent of the basic principle of algebra, which states that algebraic symbols must be given some numerical value, but may be given any value. In this sense and respect, perceptual awareness is the arithmetic, but conceptual awareness is the algebra of cognition.

From: Ayn Rand in http://www.aynrand.org/objectivism/pobs2.html

The central thesis to be defended here is that the information age has articulated the informational aspects in learning. The WWW is the obvious manifestation of the learning resource. Searching and exploring are the dominant ways to reach the information that you may need. The reorientation toward the three aforementioned developmental aspects of learning is supposed to bring a necessary complement in the resource-based learning approach that is dominant today.

Learning and the nature of concepts

Human learning and development is a process that occurs even in rather poor conditions. Information management, meta-cognition and incentives like competition and cooperation are stimulators, but not exclusively prerequisite for learning. In many situations we see the learning process as a side effect. At the same time the pre-arranged learning (often called "instruction") tends to incorporate more elements of the incidental and situated learning. These and more epistemological studies make it clearer that concepts are not abstractions; they are situated in real episodes of human life, and it is hard to overrule them by formal facts or procedures. One of more observational phenomena that support the experiential nature of concepts is the fact that they allow a quick and diverse generation of new knowledge. This would be difficult to describe, in case concepts were systematic and formal derivations of subsumed objects or categories. The power of concepts is in the fact that they serve both formal and perceptive anchors. At the moment of encoding not all features need to be included. At later stages, some of the initially trivial features can be restored so that unforeseen attributes of the encoding situation become re-activated. As concepts emerge between large and mutually irreconcilable knowledge domains, the question appears what their role actually is. An important function of concepts is their metaphoric capacity: one conceptual context can easily be mapped upon another context; for instance, the easiness by which a student takes up a social mechanism of parents and applies it making an excuse to his/her teacher. The swiftness of concepts brings us to a deviant apprehension of its nature. And again we see here an unnecessary side effect of our perception of a human mind as an information processor: as if knowledge is data rather than a programme. Concepts as side effects of inter-situational knowledge can easily bee seen as "broken particles" that allow the larger knowledge chunks to slide side by side; they act as bearings. To make our understanding of concepts even clearer, we can say that concepts are "transitions" rather than "states"; they emerge willy-nilly during the fast interchange of topics due to external pressure or the flow of discourse. This may explain why asynchronous communication reveals a smaller idea output than the face-to-face sessions. Though often explained in terms of perceptual richness, it is more likely that the key factor here is rhythm that makes the real-time interaction more productive. The notion of concepts as transitional entities conflicts with the standard representations like concept maps. Here the nodes are descriptive entities, close to objects. The links

[2] http://www.educ.sfu.ca/people/faculty/kegan/MemoryIm.html and http://www.educ.sfu.ca/people/faculty/kegan/default.html

are relations and manifest as bridges between the given facts. The relation as operator and the node as operand seem quite evident from a grammatical/epistemic point of view, but questionable if we observe the way concepts behave as interchanges between the states of thought. A more in-depth discussion on the epistemic versus semantic natures of concepts can be found in Yeh & Barsalou[3] (1996, 2000). They claim that concepts take different forms across situations, with each form containing properties relevant to its respective situation, and that situational information enters a wide variety of tasks as long as conceptual knowledge must be accessed, not when it can be bypassed using superficial response strategies.

Concept maps as reflective reconstructions

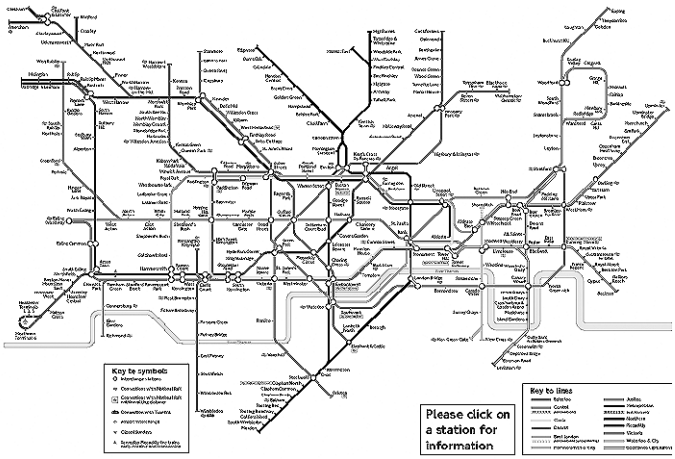

Figure 1. Optimized London underground map

Early appearances of concept maps are thought templates in the mystical traditions like heretic and cabbalistic ones. The sefiroth has been mentioned in many publications as one of the precursors to extramental representations. The static versus dynamic roles of concept mapping became clear in 1950s when the London underground map was to be displayed. Though it displays around 300 stations, still the gestalt of the lines and change stations are so clearly positioned that the reader perceives a low amount of cognitive overhead.

It is as if the eyes are led to the important centres. As the centre stations are given more space and the outer stations – less, the mechanism of the fish-eye has been used. Earlier maps were more literal representations, where the exact topology was maintained. It led to a difficulty for a traveller to understand, however. Beck has introduced the principle of a schematic overview, to know where to change a line. His contribution was partly to ignore the topographic attributes of nodes, in this case the stations. The underground map seems a reasonable metaphor for new coming orientation devices on the WWW. Its size is the limiting factor at the moment; creating of the graph structure[4] and its layout is a NP-complete problem (Aroyo, Stoyanov & Kommers (1999) and Kommers, Ferreira and Kwak, 1996). For learning new tools have appeared recently.

Star Tree Studio[5] is a solution to web navigation problems that enables web designers and webmasters to create, edit, and modify information, which is then presented as Star Trees™. Here the isomorphism between the actual location of a document and its spatial position in the map structure is completely detached. Each Star Tree is a branching structure of nodes that

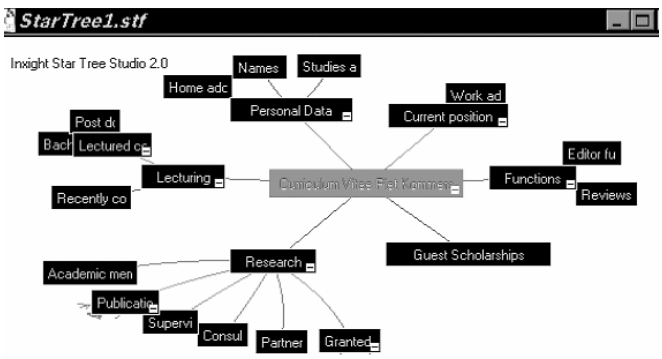

Figure 2. Fish-eye browsing in Star Tree

[3] http://userwww.service.emory.edu/~barsalou/Papers/Sit_Review_Files/situations_review_00.pdf (2000).
[4] http://www.businessweek.com/bwdaily/dnflash/jan2002/nf20020122_8839.htm. See recent news article by Stephen H. Wildstrom
[5] http://www.inxight.com/products/st_sdk/

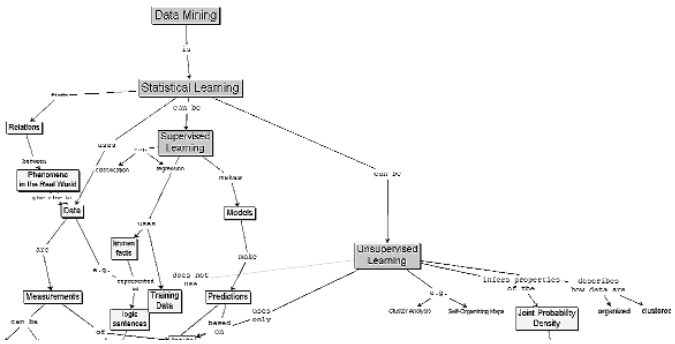

Figure 3. Concept map re-arranged by IHMC CMap Tools[6]

represents HTML pages or some other hierarchical structure, in the form of a graphical and interactive branching tree. The user typically sees the main point of interest in the middle as a red node. The circle of peripheral nodes is a mere start of long entailments. They will appear if the user goes in this direction. In this case the fish-eye browsing, as defined by Furnas (1986), has arrived quite elegantly. The fish-eye metaphor can be generalized into concept space; awareness is the capacity to enlarge the resolution of the focal field, being conscious where the second and higher order associations exist. In this presentation a number of available concept mapping programmes will be demonstrated. Each of them has its action repertoire.

The central thesis here is, if and how we can derive better models of the conceptual processes in the course of learning that may help us in arranging a closer link between the human mind and cognitive artefacts similar to new learning tools.

Learning networks and learning communities in the 21st century

The WWW-based media like multi-media and widely immersed virtual realities, allow learners to participate in high-tech environments. It seems opportune, however, to give extra attention to the fact that we know, through long traditions, that "receiving the right information" is only a small first step to learn a topic really. The WWW allows us to provide "just-in-time" and "just-for-you" information. It also helps students work closely with their peers, even with those in other countries, belonging to different cultures and participating in different types of courses. From a multi-cultural point of view, this access and communication is quite vital to make progress in bridging parts of the world. For teachers these global facilities help very much become a "learning organization". My presentation focuses on the new dynamic programmes that help learners to be aware of prior knowledge, analogies, discrepancies and omissions. Conceptual schemes have proved to be elegant and efficient to share and negotiate knowledge. Especially, in case the topic concerns moral values, belief systems and existential stories, the concept maps have an added value both for learners, teachers and co-students. Secondary school learning is the age of attempting to understand complex processes like the ones in sciences and humanoria. Constructivism is a paradigm that highlights the need for learners to "build" one's own concepts. In this presentation the more prominent tools to explore and test complex dependencies will be demonstrated. *Interactive Physics* is a clear example how learners may build up intuitive notions on the basic laws of mechanics. Addressing the question how students can actually get prepared for the 21st century, we need additional didactics in order to motivate the new generation to invest and participate in technology, hence stimulate economies and improve infrastructures. The lecture will also demonstrate "creative design support tools". It entails the question what new skills and attitudes we may expect to be in the teachers of tomorrow. As an overall thesis, it will be stated that the knowledge economy of this century cannot be attained by "teaching subject matter from the shelves"; learners *need* to learn to excavate and exploit new concepts as creative acts: learning and teaching will become a process of "developing" rather than "transferring" knowledge. In this respect it becomes highly vital to sketch architectures for "interest-based learning communities for learners" and "networks for mutually learning teachers". We may expect that larger organizations like UNESCO, the OECD, UNICEF and the World Bank will demonstrate initiatives to propel the WWW-based mechanisms. The presentation will suggest how to convey these initiatives with support and systematic research.

[6] http://cmap.coginst.uwf.edu/docs/

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Serenella Besio
Fondazione don Carlo Gnocchi ONLUS
Italy

Educational Technologies in the Italian School: a Brief Overview

Education and technology: theoretical framework

The contemporary research in psychology and pedagogy, following the studies of Lev Vygotsky, is stressing the strategic value of the symbolic systems, that are culturally dependent. These systems allow the dialogic interaction among people and the activation of the Proximal Development Zone (PDZ).

Within this framework, the contemporary social constructivism proposes the activation of Communitiy of Learners of Foster Community of Learners (see the studies of Brown and Campione), as the most effective educational methodology; each participant of this Community can contribute to reciprocal exchange of knowledge and learning, by activating each other's PDZs. In this way, the amount of existing knowledge within a group is continuously increasing, since each individual is unique, knows different things, has personal experience, and is able to solve different problems.

Later on, this approach included also some suggestions coming from the cultural psychology: for example, the idea that cognitive differences among individuals should be evaluated as "cultural specific" characteristics, instead of lacks of some quality. Cognitive differences and similarities within different populations should be studied in the light of the cultural and social context. As a consequence of this, learning is to be considered as situated and distributed, and the American psychologist Bruner suggests that we should move towards the implementation of "practice communities", following the suggestions of Leontev's *Activity Theory*.

Practice is no more the "Cinderella" of the human activity, but should be considered as strictly connected to thought. David H. Jonassen recently defined learning as an action guided both by intection and reflection and related to the perception of the environmental resources.

These big changes in the theoretical field occurred together with simultaneous changes in the technological field. As Lebow noted, the main values connected to the traditional technologies (possibility to be repeated, affordability, transmission and control) have been substituted by the opposite values of the new technologies or technological environments (microworlds, hypermedia, online communication environments): cooperation, personal autonomy, active involvement, pluralism. ...

Both in educational field and in the technological field today the modern educational objectives are: awareness, responsibility and autonomy; these should be pursued all along the human being's life.

This change brings a real revolution in education: planning and evaluating activities, formerly totally managed by teachers, are now shared with the students, who are the new protagonists of their own learning improvements (Varisco, 2002).

What should we mean by "educational technologies"?

The word combination "educational technology" encompasses today a lot of concurrent meanings (Persico, 2002). On the one hand, it involves theoretical aspects: learning methods and assessment, methodologies for teachers' in-service training, distance learning, databases and documentation for didactics, educational innovation... On the other hand, it includes also tools and instruments: e-learning, school networks, services for the schools, educational software, virtual communities, educational use of the Web, educational robotics...

The educational technologies are also considered important to totally fulfil some educational objectives, such as school inclusion of students with special needs, learning assessment, raising motivation.

Whatever the meaning or the objective, the methodological aspect in using educational technologies is the preminent one. This research field includes in fact, since its beginning, the methodologies for learning/teaching, planning, carrying out and validating educational processes.

Educational technologies are considered today as learning partners…

1 st: To reach "new" knowledge, in which facts and events receive their meaning in a distributed and cooperative way; this knowledge is able to reach temporary and contingent results.

2nd: To pursue teaching that is "learner cantered", based on the learner's cognitive, social and emotional needs.

3rd: To obtain learning based on comparison between previous knowledge (including ingenuous one), formal knowledge and concrete experiences; in this sense, the meanings and causes of facts and events are continuously negotiated under the teacher's guide, who plays the role of a mediator.

4th: To consider differences (in gender, age, religion, culture, experience, socio-economic status, etc.) as precious resources for the educational community.

5th: To realize a new role of the teacher as mentor, mediator, scaffolder, guide for students' learning, responsible for increasing of their motivation to learn and study.

6th: To realize a new role of students as active protagonists of their learning, co-builders of their own knowledge, through development of competence in reflection, awareness, self-evaluation and self-monitoring.

7th: To fulfil a learning environment that is a site in which students can work together and help each other to learn and use a multiplicity of tools (information resources, both technological and material), with the common scope of learning objectives and problem solving activities.

Educational technologies in the school: are they a problem or a solution?

The research field of educational technology field can be totally explored only if the school context is contemporarily studied. On the other hand, today the school has a strong need to experiment and discover the new opportunities offered by the new technologies.

But why should we introduce the technology in our schools? Generally, two main groups of answers are given to this question (Ferraris, 2002).

According to the first group, since the information technology has a high power to catalyze change (modernization of contents, high flexibility, autonomy in learning), this is the right solution to most problems of the school. But a lot of experiences in the Italian schools seem not to confirm this point; in fact, the technology usually does not succeed in transformation the school, but it is the school that integrates the technology into its didactic methodology. Thus, the use of technologies generally amplifies the values and the faults of the specific school. If motivated teachers use a good and well organized didactic methodology, the computer is correctly integrated within the curriculum. If on the contrary, less skilled teachers adopt a bad didactic methodology and pay poor attention to the students' learning processes, the use of the computer can be merely viewed as a new discipline in the curriculum or it can become a new instrument to support obsolete teaching methods.

The second group of answers considers the information technology as a new problem to be faced by the school, since personal computers are now widely spread in modern society and are causing big changes in people's life. Thus, according to this point of view, the school must integrate technology to avoid a gap with the rest of society. But is it really possible and feasible that the information becomes a learning topic during the primary school? And, is this really a good option?

If the information technology is neither a problem nor a solution for the school, the third possibility rises: information and communication technology (ICT) can be considered a valuable opportunity for teaching and learning process and can become a useful support to the actual didactic activity. Both the students' reality and the educational objectives should be taken into account, to find the best and most useful way for the introduction of ICTs into the curricula; and the new opportunities offered by the technology development can give the best occasion to re-consider the whole educational programme. A cultural change in education should occurr from "what you can do with a computer" to "how the computer can help your learning useful and interesting things".

It's not only a matter of motivation or pleasure in using the personal computer: technology lets it possible to make things you could not make before, or to make them better, or in a more effec-

tive way. And whenever technology is the main mean that allows the adoption of a didactic approach based on play, it is the play – and not the technology – to generate motivation into the student.

A picture of the Italian school

41,745 state schools were active in Italy in 2001/2002.

Data contained in Table 1 concern the number of students.

Table 1

School grade	Number of students	Students/class
Infant school (3-5)	947,986	23.15
Elementary school (6-10)	2,534,209	18.21
Secondary school, 1st grade (11-13)	1,704,479	20.87
Secondary school, 2nd grade (14-18)	2,421,303	21.51
Total	**7,607,977**	**–**

Data contained in Table 2 concern the number of teachers and other staff components.

Table 2

School personnel	Permanent	Temporary
School managers	9,333	–
Teachers	736,134	96,915
Administrative and other personnel	196,010	61,661
Total	**1,131,037**	**158,576**

The average age of the permanent teachers is 47.13 (45.99 for the infant school, 45.30 for the elementary, 49.31 for the first grade of the secondary school and 47.83 for the second grade); while the average age of the school managers is 55.88 years old.

Women are strongly prevailing in the first levels of schools (99.54% in the infant school and 95.18% in the elementary), dropping to 74.78% in the first grade of the secondary schools and to 58.59% in the second grade. The situation is totally reversed in the case of the school managers: 45.82% in the compulsory school are women, and only 23.78% in the second grade of the secondary schoool.

Technologies in the Italian school

The history of the technology in the Italian school began more than 30 years ago; when in 1967 the first specialization in Information Technology has been introduced within the curriculum of a certain number of technical secondary schools (second grade).

Since the launching in 1980 of the National Plan for Information Technology, ICT has become a regular teaching, but only within some disciplines, such as mathematics and physics.

Only through the launching of the PSTD (Programme for the development of educational technologies) in 1997-2000 the whole Italian school system has been involved in a big innovative process.

The main scope of this Programme has been to bridge the existing gap between technical and professional schools on the one hand and scientific high level schools on the other hand, but also to reach the primary level schools, thus involving hopefully all the Italian teachers and students.

Objectives of the PSTD

They can be summed up as follows:

- to promote the students' mastery of multimedia and communication tools and their ability to use them for studying;
- to improve the effectiveness of learning and teaching processes and school organization;
- to increase the teachers' ability both in using the new technologies and in accessing the available instruments and tools for daily work.

Structure of the PSTD

The Programme is based on two main levels.

Level A, called "Operative Units for Teachers", has provided 14.5 millions Lire per each school to:

a) create an equipped room per school, dedicated to teachers, to let them study and discuss together, organize seminars, consult and produce educational material;
b) equip this room with two work stations, a colour printer, systems for image acquisition and image show, and Internet connection;
c) organize a multimedia training course for teachers.

Level B, called "Multimedia in the classroom", gave the opportunity to the schools to present a detailed educational project for the use of multimedia; fundings have been given to set up the needed equipped classrooms to introduce multimedia teaching in regular didactics.

The PSTD includes also the financing of some pilot projects which have the purpose to try and test innovative solutions for the school organization and infrastructure.

PSTD: results

The number of schools involved during the four-year Programme and the provided fundings are briefly presented in Table 3.

Table 3

Years	Schools involved in level A	Schools involved in level B	Equipment and functioning expenses (*)	Teachers' training (*)	Other support initiatives (*)	Total expenses (*)
1997	5,320	1,898	140,200	15,060	2,890	158,150
1998	5,000	4,020	240,060	21,332	6,500	267,892
1999	2,894	1,711	121,788	8,952	1,280	132,020
2000	–	4,000	181,000	0,000	1,700	182,700
Total	**13,304**	**11,629**	**683,048**	**45,344**	**12,370**	**740,762**

* millions of lire

A very short picture of the technical infrastructure available today in the Italian schools is presented in Table 4, based on a reliable esteem by the Ministry of Public Education.

Table 4

Objectives	End 2001	2001+2002
PC/Student compulsory cycle	1/25	1/15
PC/Student secondary school (II grade)	1/10	1/10
Schools connected to the Internet	All	All
Wiring internal to the schools	2000	5000

PSTD: comments from the Ministry of Education

As described in the former table, in the Italian schools we have today: 1 computer per 10 students (1/10) in the technical schools; 1/50 in the elementary schools and in the secondary schools (1st grade).

Almost all the schools have at least one connection to the Internet; there are only few work stations connected to the Internet (1/40).

Technologies are still concentrated in laboratories, while the access to the regular classrooms is limited; recently the Ministry stressed the importance of the school wiring, so that 20-25 work stations can be connected. Almost a half of the schools has a dedicated web page.

Even if the situation has greatly improved during the last 5-6 years, there is still a traditional aversion of the school system not only towards the technologies, but also towards the practical activities and the empirical approaches to the teaching process (Fierli, 2002).

Consequently, there is still an imbalance in technological practices, investments and professions between technical education and basic education.

A complex administrative structure makes the development of support policies for the promotion of the techological development still difficult.

In spite of these limits, a clear take-off took place in the Italian schools concerning the introduction of the technology in the regular didactic activity.

In conclusion, the Italian situation is quite dynamic, and is conformed to the objectives defined by the European Union, even if the parameter of our technological development is inferior in comparison with other European countries.

A national study indicates that the most serious delay in the Italian schools concerns the school wiring (only 8% of the whole educational institutes).

Other online initiatives of the Ministry of Education

The Programme PSTD included also some online initiatives sustained by the Italian Ministry of Education to support the work, in-service training and information of teachers and students. They are: the database SD2, the Internet site INDIRE and the Technological Observatory.

SD2
Managed by the Institute for Educational Technologies of the National Research Council (in Genoa), it consists of a database of cards and reviews of both commercial and free educational software.

It offers an online service for teachers' documentation, training and updating.

The following ones are the objectives of SD2:
- to give documentation on 2,500 commercial educational software (both Italian and foreign) or software produced by schools;
- to give teachers tools to choose and use educational software;
- to collect and spread studies on the use of educational software in specialized sectors.

INDIRE
Managed by the Library of Pedagogical Documentation situated in Florence, it is an online service rich in information and resources for teachers and university students in the field of education.

These are the objectives of this service:
- to store and give documentation on the innovative educational experiences both at national and international level;

- to manage online training for teachers;
- to create materials and services to support educational activities;
- to support the development of information and communication technologies;
- to cooperate with the Ministry of Education for the management of European projects.

INDIRE offers also some specialized services, such as: *Gold*, which is a national system of didactics documentation; *PuntoEdu*, an integrated environment for online teacher training; *HandyTecno*, an environment devoted to the educational technologies for disability and handicap.

OTE: Technological Observatory
Managed directly by the Ministry of Education to support the technological decisions of the Italian schools, it is an experimental national online service addressed to any school in Italy.

Its mission is the technological transfer from the most advanced ICT sectors to the school, by way of a strict connection between the University, the research, the net-economy and the school.

The following ones are the objectives of the OTE initiative:
- to monitor the main trends in information and communication technologies;
- to realize an online support to the school in the management problems of technological resources;
- to store and distribute examples of adopted solutions (best experiences);
- to give an online service in collection and distribution of free software.

A national survey: teachers' attitudes towards educational technologies

The survey has been carried out by a specialized agency in the field and it involved a sample of 1,560 teachers from all over Italy. The purpose was to understand the Italian teachers' attitude towards the ICTs and to verify their use in the different grade schools.

Concerning the role of the new technologies in the curriculum, the most represented answers are those listed in Table 5.

Table 5

A tool for in-depth study	81%
Improve students' attention in the classroom	74%
Generically effective	73%
Introduce a change in educational methodology	59%
multimedia give only a superficial knowledge	31%
In the future multimedia will substitute the paper manual	14%

In spite of these results, 4 of every 5 teachers state they are not competent in using the new technologies, and that a multimedia product can offer only a superficial knowledge of a topic to the student. Only 14% assert that the technology will substitute the book text in the future.

Table 6 presents how teachers prepare their lessons: traditional instruments are clearly the majority.

Table 6

Traditional instruments	96%
Electronics tools	26%
Information technology tools	23%
Internet	7%

Here is another evident contradiction: even if 84% of the Italian schools have a connection to the Internet, only 3% of the Italian teachers usually surf the Internet; less than 3% use electronic forums or discussion lists.

School inclusion of SEN[1] students

Almost total school integration of students with some type of impairment is a fulfilled objective in Italian school since the early seventies. Students who have some kind of impairment can find a qualified and consolidated competence in the public school; they are a resource for the whole community. Table 7 presents the detailed picture of the school integration of SEN students in Italy during 2000/2001.

Table 7

School grade	Total	In special schools	SEN students/total students
Infant school	13,023	234	0.88%
Elementary school	54,561	1,735	1.86%
Secondary school (Ist grade)	43,709	508	2.37%
Secondary school (IInd grade)	21,736	406	0.87%
Total	**133,029**	**2,883**	**1.52%**

Table 8 presents the typology of impairment of the SEN students in the same years.

Table 8

School grade	Psycho-physical impairment	Visual impairment	Auditory impairment
Infant school	90.77%	2.54%	6.69%
Elementary school	93.69%	1.70%	4.60%
Secondary school (Ist grade)	95.65%	1.31%	3.04%

SEN students and the technology

In 1992 the National Law for Persons with Disabilities (no. 104) established funding for schools to acquire technological tools and instruments for SEN students, and in some cases these computers were the first ones in the Italian schools. But the needed training initiatives have not been implemented to support a right use of these new tools in the curriculum for special education purposes, so that the expected improvement in the quality of teaching did not occur.

It is worth mentioning that the use of technology for SEN students is complex and involves a lot of qualities: in fact, it implies the acquisition of a good technical competence, a specific knowledge in special education, as well as specific abilities to face particular devices designed for special kinds of impairment (Braille printers and devices, enlarged keyboards, mouse emulators, etc.). In most cases the use of the technology for SEN students is difficult because of accessibility problems of some tools, such as CD-ROMs, Internet sites, etc.

Since 2000 the National Permanent Observatory for the School Inclusion, a study group promoted by the Ministry of Public Education, has promoted some initiatives to support an efficient and effective use of the new technology in special education. The Handitechno Internet site is one of these initiatives (www.bdp.it/handitecno). Being part of the already cited INDIRE service, Handitechno is an information, counselling and communication service devoted to the technologies

[1] Special education needs

for students with SEN; both Assistive Technologies and Educational Technologies are taken into consideration (Fogarolo, 2002).

It contains a database of suppliers of software and hardware in the field and offers some research tools, that can help teachers and families in getting the right information before purchasing the products.

It contains also information on the most relevant information and counselling services on Assistive Technologies and Educational Technologies for SEN students.

Since continuous updating and information exchange and spread are needed in this field, some private and public services have been established here and there on the Italian territory, which give advice on Information Technologies for SEN persons. They are addressed to persons with disabilities, to solve their needs in daily life and help them in living an autonomous life: for this reason, they take into account not only educational technologies, but also Assistive Technologies. These services are also connected into the so-called GLIC (Inter-regional Group of counselling services on Information and Communication Technologies for SEN persons), a network which aims at improving the quality of the services and whenever possible standardizing the proposed solutions.

Contemporary research on educational technologies

In conclusion, we can say that technology has been firmly introduced in the Italian school system. Often the instruments are insufficient and their use is limited both in quantity and in quality. But the route has been clearly traced, and the expected results will follow.

Consequently, the main question for the research in the field is: which are the main topics to investigation today, which are the unanswered questions?

According to Olimpo (2002) the contemporary objectives of the research on educational technology are the following ones.

1. To prepare the individuals to live in the knowledge society.
   The term "knowledge society" does not refer only to the importance of knowledge in the individual's life, or to the complexity of global knowledge, but mainly to the need of a new individual competence for relating to knowledge. Knowledge in fact increases and changes fast, it is difficult to be stored, classified, coded in a stable way. Learning is now distributed all along an individual's life, and is fulfilled through the access to a lot of information and educational resources, as well as through interpersonal relationships. The individuals are now considered responsible for their learning and for the acquisition of knowledge. If it is more and more difficult to teach how to learn, it is perhaps easier to create the right conditions in which one can learn to how to learn.

2. To give them the needed competence to access the technological memory.
   To build such knowledge it is not possible today to rely only on one's own personal memory. To be able to access the technological memory is a must, both the one stored on the Internet and to the knowledge of people one can reach via the Internet. It is not only a matter of technology, but above all of methodology: individuals should acquire a new conceptual competence. They must be able to understand what they need, to find it by surfing the net, to compare these results with different sources.

3. To build the competence to integrate together different kinds of knowledge.
   Since in the modern society the Illuministic model of Encyclopaedia does not fit with the new characteristics of knowledge, the ideal site of the modern encyclopaedia cannot be external (a book, a CD-ROM, etc.), but it must be internal: the learner's mind. To answer the purpose of using our internal encyclopaedia we will need to be able to access the various distributed knowledge sources, and to access the conceptual instruments to integrate different kinds of knowledge into a unique personal mental structure.

From the educational technology point of view, the research has the mission to define and explore the environments, situations and learning processes able to favour the development of these instruments.

4. To integrate the new technologies within the school system.
   One of the main objectives of the research in this field must be to produce innovative proposals that can concretely be introduced into the didactic process. The symbol of the marginal role of the educational technology is the "technological laboratory" containing the computers that students can enter only occasionally; it is for that reason that research should also face the organizational, structural and systemic components of the technological innovation process.

5. To support the growth and diffusion of the new technologies in the schools.
   One of the first points is teachers' training: and the educational technology research gave a great contribution to the development of innovative solutions. It introduced the online education methodologies for the teachers' in-service training; it supported the experiences of the virtual communities and the cooperative learning techniques.
   Other issues should be still explored: which are the factors that favour or forbid the penetration process of educational technologies in the school? Which are the important variables in this context? What is the relationship between technologies and curriculum innovation? On these themes the research on educational technology should reflect in the next years, in Italy.

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Katja van den Brink
University of Landau
Germany

Learning and Teaching with ICT: Experiences from Germany

Information and communication technology (ICT) in education can be considered as well as a learning tool and as a means of communication for fostering learning regarding important learning goals, such as the construction of meaningful and understood knowledge and its transfer into applicable knowledge. Using ICT according to these goals can support the teaching and learning processes within our educational institutions. However, nowadays, ICT is nothing very new within German educational institutions but still there is a lack of a proper and efficient way of implementing and using ICT. It might be important, to foster as well educational policy and teacher education and confront them with approaches which might help to implement and use successfully ICT in education.

Before heading the specific measures in Germany, this article introduces into learning and teaching with ICT.

Learning self–regulated and deep: an efficient approach to using ICT in education

Learning in a self-responsible, active, self-regulated and deep way can be supported by the construction characteristics of many ICT applications, such as interactivity, feedback function, and simulations of complex interrelations. Furthermore, the independency of time and locality when using ICT helps to individualise learning, which might be a positive aspect under certain learning goals and conditions. Learning self-regulated means that the learner is able to determine his or her learning needs and goals, identify ressources for the learning process, such as people, books, web sites, multimedia applications. Furthermore, he or she has to choose adequate learning strategies and to use and evaluate them and finally, the learner evaluates the learning results (Knowles, 1975). This way of learning can be seen as loop, so if the learner evaluates a step as not satisfactory, he or she goes back and tries again (i.e. different materials, different strategies or different learning goals, etc.).

Learning in a deep way means that the motive for learning is intrinsic – the learner enjoys and continues learning without expecting a reward, or more particularly, interest (Duarte, 2000). The learner's curiosity and interest are only satisfied when the content to be learned is meant to be understood. Furthermore, deep learning involves a personal commitment to the ongoing learning process, so the learner relates the content to be learned to personally meaningful contexts and/or to existing prior knowledge concerning to the specific topic. The advantages of deep learning (summarized in Duarte, 2000) are, that the learner enjoys the learning process and its continuation, he or she has a better retention of the content to be learned and achieves a better quality of the learning product (in a sense of the structural organization of the learned material, the mental representations are more structured, the level of abstraction is higher, there is a deeper comprehension) and the learner shows a higher level of creativity, comprehends in a deeper way, relates different aspects of the learning task and the learner's previous knowledge and solves often new problems in an adequate way. The disadvantages (also in Duarte, 2000) show that the learners spend much time for learning and can forget the orientation to a learning goal demanded by the institution or organization. But if the learner is self-regulated successfully, as described above, he or she will be able to keep on the learning goals, etc.

How can we learn in a self-regulated and deep way with ICT? ICT does not promise per se a better learning. Because self-regulated and deep learning is supporting academic success (Wild, 1995), teachers and learners involved in the learning processes should be familiar with these approaches for an efficient and successful use and implementation of ICT in education. Teachers must have not just knowledge about the content of what is to be learned but also about learning in itself and the learning process, how to learn optimally in a self-regulated and deep way (such as knowledge about learning strategies, motivation, metacognition, etc. and to support learners by developing these competencies) (for a deep introduction into this topic see Duarte & van den Brink, 2002).

But at the same time, ICT can be used for fostering learning according to a self-regulated and deep way. By implementing ICT in educational institutions within the classrooms, this new learning environment fosters these forms of learning if the teacher uses a student-centred and student-activating method of teaching (see role of the teacher).

Furthermore, the adaptation of the learning material, such as ICT applications, can support the learning process, especially if (Behrens, 2000) the aspects, such as focussing on the learners activities, self-regulation and learner's control of the learning process, communication and the construction of relationships, authenticy, situated learning, multiple perspectives, structure and organization of the interface and the opportunity of maintaining attention, have been considered.

Teachers and learners competencies

But to use adequate applications within education demands competencies from teachers and learners.

Teachers' competencies
First, they need general pedagogical/didactical competencies. Here, especially the student-centred teacher didactics with specific knowledge about approaches to learning (Entwistle & Ramsden, 1983), where teachers and students can learn about learning strategies and forms of motivation might play a big role. In the learning situation with multimedia, the teacher's role is often changing from being an authority or the source of knowledge to being a facilitator or a conductor of the learning process. Students have to find their own individual access to the ICT applications and, therefore, they need support for finding appropriate motivation and individualised strategies, which enable them to be active and critical learners.

Furthermore, teachers need to be ICT literate, they need to know where and how to find materials on the web, using the web in different subjects for teaching and learning purposes, how to present the content of the subjects by means of multimedia, and how to use multimedia products and online services in education. Also, they must have a general understanding of central functions and methods of the computer use. Such competencies are also needed for being able to discuss and experience ICT issues in schools. They need to know what it means to use ICT as an end-user, this means that the application has been already developed, or as an producer, where the learner develops its own ICT with the help of hard- and software (see the scenario model of Andresen in the ICT curriculum by Andresen and van den Brink, 2002).

Besides being an expert in the subject, the teacher's role concentrates also on competencies, such as being an inspirer, moderator of the learning process, and creator of the student's environment (Witfeld, 2000 in Andresen & van den Brink, 2002).

The role of the student
If the aim is, that the student should develop into a self-regulated and deep learner, he or she will be put in the centre of the learning process by the teacher; will take over the most active part within the learning environment in a self-responsive and cooperative way. The learner will be a partner of the teacher in the learning process, supported by the teacher in learning how to learn self-regulated and deeply. According to its characteristics, ICT can help to consider the student's individual level of previous knowledge, the individual learning speed and individual interests and learning needs (Jäger & van den Brink, 1999).

ICT in education in Germany

In Germany, ICT in educational institutions has been implemented for decades. But the situation there is neither coherent within the country nor satisfactory. Furthermore, to speak about this topic concerning Germany, some pre-considerations have to be made. Germany is a country which has had historical changes in the last decade: there was the re-unification of the former two German countries, the Federal Republic of Germany and the German Democratic Republic in 1990. The re-unified Germany has a Federal Constitution of 16 countries (Länder) with 16 ministries, which deal with the education of each particular country (Land). In the very main issues, the Länder of the former German Democratic Republic adapted the laws according to the ones of the other Länder and so, they took over the educational system of the former Federal Republic of Germany. In former Federal Republic of Germany a reformation of the educational system took place in the 70ies, which gave the basics for the development of a complex system of school-education (the main types of

schools are: Primarschule (primary school), Hauptschule (secondary school, form 1), Realschule (secondary school, form 2), Gymnasium (secondary school, form 3), Gesamtschule (secondary school, form 4). Still normal is the 45-minute lesson, with in average 30 pupils and in-front teaching, and very little group work. School takes place only in the morning.

Furthermore, the disappointing results from the PISA study 2001 and from an OECD study 2002 concerning school education for the German educational system have to be considered when we speak about the measurements of the latest German Federal Government and the ministries of the Länder. The PISA study revealed that kids in Germany come off badly in understanding the German language and mathematics. The OECD study reveals that Germany drops back concerning education – it spends less money than other, comparable countries, for education; less and less people start to study at the university; there is not enough financial support for younger children's education, but very high support for students at the Gymnasium (higher secondary school). A further result is that there is no country with such a big difference between the use of computers at home and at school (see the following text) (Die Zeit, 31st October 2002, p. 33). According to earlier results of OECD and PISA studies 2000, compared with 32 other countries, Germany takes the first place when it comes to the question of the dependency of academic performance on the student's social background. Japan takes the last place (Jahrbuch Spiegel 2003).

Let's speak about ICT in Germany. In almost each German household there is a computer. 30 million people over the age of 14 have an Internet access (Germany has a population of 82 million people). When it comes to education, all German schools were equipped with Internet access until 2001. This does not mean that all pupils have an Internet access, only that the school has one and this could also significate that only the school director has an Internet access as it is the case especially in many primary schools. In average (all schools considered), one computer is shared by 40 students (the European Commission demands 5-15 students per computer). Only 44 percent of the computers in the schools can be used as multimedia computers due to their very limited equipment. High speed Internet access is provided for all Higher Education institutions.

Federal Government Measures
There has been a programme period from 1999–2005 concerning ICT in Education (Information Society Germany, 2002):

- Schools on the Internet.
- "Internet for All" and "IT in Education – Connection not Exclusion" (Women on the Net, Internet without barriers – access for people with disabilities; kids to the mouse; starter kid brochure; etc.).
- German Education Server (www.dbs.de – Deutscher Bildungsserver.de).
- New Media in Education: developing teaching and learning software for initial as well as further education (The Federal Government provides 700 Mln. Euros for this measure).
- Networked based learning: collaboration of schools and universities.
- School sponsoring (The Federal Government has been asked for supporting the schools by companies by providing mainly computer hardware).

These measurements are very much concerned with the access of people to the new technologies, such as hard- and software.

Concerning teacher trainings for teaching and learning with ICT the situation in Germany is not very satisfactory: in-service training as well as pre-service training concerning ICT in education in Germany is very, very little. The ministries of the Länder are responsible for teacher trainings, so we have very different levels of teacher trainings along the state.

According to a study from the University of Paderborn in 2000, only 3% of all pedagogical universities in Germany offered courses on new media and a quarter of all German universities did not offer one course! Otherwise, we have a network of seven universities, which work collaboratively and Internet-oriented.

European Integration
There is a programme, called eEurope 2002 European Action Plan which gives all countries within the European Commission binding quantitative targets. Of course, Germany has to follow this action plan, which has been difficult in some fields, such as providing of one computer for at least 5-15 students, but the situation in Germany is one computer per 40 students, only in the secondary school type Gymnasium, this demand has been fulfilled (Information Society Germany, 2002).

Länder's Activities
According to different conditions concerning politics, economical situation, educational system and policy the situation related to ICT in education within the Länder is very different. We have many, but different measures in all Länder. An adequate evaluation of each Länder`s measurement is not possible here. Therefore, just some examples are given (Initiative D21, 2002):

- Media corners in schools in Hamburg – this means, that in schools we can find an area where students can meet – in and outside of the lessons and where they can experiment media according to their needs.
- One computer in each classroom – in some Länder (i.e. Mecklenburg-Vorpommern) the students and the teachers can always have access to the computer in each classroom.
- Young teachers have been equipped with Notebooks – all new teachers in Hamburg and Bremen.
- Länder Servers – all ministries involved with education offer a Land-specific server where specific information according to education can be found).
- Hardware for friends in Baden-Württemberg.
- Ambassador programme – experts from companies go to schools and give support and try to attract into ICT professions.
- Teacher training and teacher education (i.e. the ICT driver license in Nordrhein-Westfalen and see above).
- ICT as administrative support for learning (in libraries).

These different measures offer different experiences which have been shared and evaluated together on national congresses and Internet groups.

Future perspectives of the Government
The Federal Government (Information Society Germany, 2002) pretend to support trainings in ICT skills for everybody, didactical and methodological concepts for using ICT in teaching and learning, virtual studying, the creation of the Notebook University and to develop and widespread hardware and software of high quality.

Conclusions

The implementation and the use of ICT in education in Germany vary within the educational institutions and vary qualitatively and quantitatively from region to region. ICT is not widespread in German schools and other educational institutions, only in universities. There is still a strong focus on hard- and software and less on broad concepts of didactical measurements within the educational system. Of course, the integration of ICT and multimedia in educational institutions in this way (first the equipment, than the concepts) can also change the existing learning principles tremendously. The school's organization may become innovative in the sense that it adopts reflexive, pragmatic and experiential approaches which place the individual student closer to the centre of the learning processes. But otherwise, the high-level, profund and ongoing education of teachers and learners in a sense of learning to learn self-regulated and deeply seems to be a very important prerequisite for a successful and efficient implementation of ICT, also in Germany.

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António M. Duarte
Faculty of Psychology and Educational Sciences
University of Lisbon
Portugal

ICT in Portuguese Education: from One Country Experience to a View on Global Implementation

The usage of information and communication technology (ICT) in Portuguese education can be viewed as a case, among others, of global implementation of the technologies in learning and teaching.

This article has two objectives. Firstly, we try to contribute with a summary of national information, eventually useful to a comparative analysis of ICT educational usage. The second objective is to reflect on some issues of their usage in one country, which can be extrapolated in the global context.

Portugal is the western EU member state with the population of 10 million, investing 5.7% BIP (US$111,300 bln) in education. Portuguese system of education covers six levels: pre-school, 1st cycle (basic), 2nd cycle, 3rd cycle, secondary and higher education.

In Portugal, the integration of ICT in education is stated, in the official discourse, as "a priority" recognising the importance of information and knowledge society as well as the ICT potential to be developed to improve teaching and learning.

We will try to characterise the usage of ICT starting from basic to secondary education summing up the information of official reports on the subject (10) (11)[1]. The characterization is done in seven aspects: 1) ICT equipment in schools; 2) evaluation of educational applications and sites; 3) development of educational applications and sites; 4) official definition of students' and teachers' competencies in ICT; 5) school usage of ICT; 6) teachers' training in ICT; 7) research and evaluation of ICT usage. Finally, we conclude with some personal and critical comments on the ICT usage in Portugal and in the world, along with some recommendations.

ICT equipment in schools

Official reports mentioned inform on the ratio of computers/students for the 2nd and the 3rd cycles: in 2000 there was one computer for each 23 students in Portugal.

Currently, schools are being equipped with computers to reach the ratios of one computer for each 5-15 students in 2004, and one computer for each 10 students in 2006.

One computer is to be installed in each classroom as well as in other school places: libraries, resource centres, computer laboratories, science laboratories and clubs.

In 2000, few 1st cycle schools had computer connectivity. Most schools of other cycles had this connectivity, but with few computers connected. The authorities optimistically hoped to create a network embracing all schools by the end of 2002.

As for school equipment in terms of ICT applications, in 2000 few 1st cycle schools were furnished with the resources, compared with most schools of other educational levels, which were equipped with, at least, some.

At present, connectivity, applications and means of technical assistance are introduced in schools; virtual networks of polyvalent learning sites are also developed.

Evaluation of educational applications and sites

In Portugal, educational applications and Internet sites are still not the objects of a systematic and scientifically grounded evaluation. Therefore, it lacks a system of quality certification, which could enable teachers, educational technicians, parents and students to get specific information on applications and sites (i.e. content, quality, audience, etc.) for different purposes.

The only initiatives in this field are the ongoing campaigns of dissemination of the existing resources.

[1] There is no formal characterization of ICT usage in Higher Education due its heterogeneity.

Development of educational applications and sites

Comparing with other EU countries there is no considerable professional development and production of applications and sites in Portugal.

To foster the development and production, some competitions and calls for proposals are organized.

Now, the most relevant official ICT development includes the development of Internet systems to gather school and site statistics to inform the public about the educational system and to facilitate the filling of forms.

Official definition of students' and teachers' competencies in ICT

To define what should be students' and teachers' competencies in ICT is important regarding a clear understanding of educational and training goals as well as certification criteria.

Portuguese official definition of students' competencies in ICT includes:

- interest for learning with ICT (including self-learning and cooperative work);
- capacity to use ICT consistently and autonomously (i.e. handling applications and processing information with ICT);
- experimental, ethical and solidary attitude to the use of ICT;
- capacity to transfer acquired competencies in ICT.

Alongside, the official definition of teachers' competencies in ICT implies:

- openness and positive attitudes toward ICT use;
- capacity to adapt to a new role of a teacher (i.e. mediator and supervisor);
- dominance of teaching with ICT skills (including how to promote integration of ICT in the syllabus and how to use it for students with special needs);
- ability to evaluate and exploit existing applications and resources;
- ability to foster vital values in ICT usage (e.g. safety, vigilance of information, copyright, ethical issues).

School usage of ICT for learning and teaching

In most Portuguese schools ICT is still used by a minority of students and teachers. Furthermore, in those schools where ICT is used, it is more employed by students than by teachers. This evokes a question of where ICT is used.

In the 1st cycle ICT is mostly applied in the disciplinary context. In other than the 1st cycle, students exercise with ICT outside the classroom (in the context of free-time), in an informally supervised way (i.e. in libraries, resource centres and computer laboratories).

What is the intention of ICT usage in Portuguese schools? Inquires suggest that is to search, produce and recreate information (especially, at the levels higher than the 1st cycle). Other sideline applications of ICT include Internet-communication, managing of information and data processing. Teachers mostly employ ICT outside the classroom as a professional aid.

The aim of the ongoing curricular reorganization is to attach a more prominent role to ICT in Portuguese education. This includes integration of ICT in each subject and making ICT another optional subject, as well as a new secondary training area. The new area of studies involves the contents related to ICT applications, programming, management and maintenance. Moreover, the curricular reorganization implies launching ICT for teaching handicapped students and in distance education (i.e. "tele-classes" via the Internet), in specific situations (e.g. particular families; students with special needs; hospitalised children; students who study Portuguese abroad).

Teachers' training in ICT

Teachers' training in ICT can be accomplished, in Portugal, at two levels: pre-service and in-service courses.

Pre-service level of training is still incipient regarding the promotion of teachers' acquaintance with ICT. Nevertheless, there is an ongoing integration of ICT in pre-service training courses, which is the responsibility of higher education institutions.

At the in-service training level, development of ICT knowledge and competencies permeates the system through optional courses offered by training centres of school associations. The offers are not uniformly spread and still lack exemplary ICT teaching units, which seem essential for teachers to understand how ICT can be integrated in learning and teaching.

Authorities "aim" at the in-service self-training of all teachers in ICT. The official discourse proposes such training as an opportunity to transform teachers' needs and concerns into professional development processes. It also stresses that training shall promote mastery not only in ICT tools but in the ways these tools can be used to advance learning. For this reason it suggests the organization of networks to share good practices, distance training activities, action-research initiatives, curricular development projects and training workshops.

Research and evaluation of ICT usage

In Portugal, research and evaluation of learning and teaching with ICT is officially recognised as still very insufficient. The research goes mainly in the research centres and universities.

The analysis of presentations at the recent Portuguese Congress on New Technologies in Education (7) indicates that the national research in this field is oriented, first, to teacher training and, second, to teaching strategies with ICT. Other subjects are less represented: ICT social aspects, learning with ICT, ICT evaluation and production, ICT curricular integration and methodology of research.

Conclusion

We would like to complement this summary with our personal, critical comments on ICT usage, along with some recommendations, which we think can be somehow extrapolated in the global context.

Our general impression of ICT usage in Portuguese education is that it is at the beginning of its development. The analysis of the official discourse on this theme reflects that the new technologies are assumed to be an important area of investment. The global picture shows that the country has just begun to convert the assumption in practical policy, which is meritorious, and the investment should be carried on and spread in an aligned form and at all educational levels (with special attention to basic and higher education) according to seven previously pointed dimensions of ICT usage. Let us now reflect specifically on each dimension.

Most schools still lack hardware and applications, which they must be equipped with. It is most evident in elementary education, which deserves a particular attention. Furthermore, we think that, as far as equipment dimensions are concerned, there are asymmetries, which must be corrected, between rural and urban areas. We have the impression that some schools may have the equipment, which potential is not fully realized, which puts forward the issue of teacher training in ICT. Moreover, although ICT usage is important in different school places (e.g. library, resource centres, etc.) for a real integration of ICT in learning and teaching to occur, classrooms have to be more fully equipped with the new technologies. A computer per classroom, often in a corner, is not enough.

There is also a need of organising a systematic and scientifically grounded evaluation of educational applications and sites. This is necessary for two main reasons. First, teachers, educational technicians, parents and students require information in order to select applications for particular purposes. Second, although many ICT applications can potentially improve the quality of learning, others

impact the learning process neutrally and sometimes negatively (2, 8, 9). Specifically, we think that ICT evaluation should incorporate the criteria, which measure to what extent it dissuades the users from undertaking a "surface/passive" approach to learning, thus encouraging a "deep and successful" approach (see (4) Duarte for more detailed suggestions).

These criteria can also serve design guidelines to develop educational applications and sites (4). We think that this design should not be a direct product of programmer's naïve ideas about learning and teaching. Therefore, it is necessary to involve learning and teaching specialists in multidisciplinary teams responsible for the development of ICT applications and sites. Furthermore, the development can be encouraged not only by organising competitions and calls for proposals, but also by providing market financial benefits for the sale of ICT applications.

Regarding the formulation of the desired students' and teacher's competencies in ICT, we would like to add the ability to use ICT to improve the quality of learning and teaching to the official definition. It seems loss making to apply ICT supporting traditional forms of learning (e.g. rote learning) or teaching (e.g. authoritarian).

Nevertheless, we are anxious that in many situations that is how ICT is really employed. Actually, we suspect that ICT can be used in the framework of learning as a mechanic process of information acquisition (see (5) for some empirical support) and – teaching as information delivery. In this way, ICT is meant to feed students with more information. However, in our view, the greatest advantage of ICT is that it can function as a "Trojan Horse" to bring a different kind of learning and teaching inside (and outside) school. We think of an intrinsically motivated learning, operated through deep learning strategies, and self-regulated in collaboration with others. At the same time we mean a scaffolding type of teaching, which supports student's autonomous explorations and construction of knowledge, the teacher being no longer an epistemological authority on a subject. Furthermore, ICT must be envisioned not as a means to study curricular contents, but as a good way to meta-learn about learning competencies (see (3) for more detailed view).

To use ICT in education to such extent teacher training becomes a key issue. Firstly, the training should be based on scientifically proved and tested curriculum. A good example is UNESCO curriculum *Multimedia in Education* (1), which is to be translated in Portuguese and implemented in Portuguese speaking countries. Secondly, in our view, the training must introduce teachers to the fact that learning with ICT can be done in the context of different conceptions of learning, through different approaches, with different results in terms of its quality. Our guess is that teachers will benefit when they familiarize with the examples of different approaches applied to learning and of pedagogical competencies in several situations of ICT usage, thus the application of successful approaches to learning with ICT will be encouraged (6).

However this hypothesis needs testing through research, which in its turn needs considerable investment. Here, we would like to focus on the necessity of more research on learning with ICT, namely, on students' conceptions and approaches to learning with new educational technologies. These variables are well investigated in learning in general, but not in this particular context (6). We should also bear in mind that their manifestation may vary according to ethnical culture, which suggests the need of cross-cultural research on learning with ICT. In our view, a global implementation of ICT should recognise and respect specific cultural values, conceptions and learning/educational practices to be able to adjust to world diversity and to reach efficiency in improving the quality of learning.

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Boris Kotsik
UNESCO Institute for Information
Technologies in Education
IITE

Education Quality in Information Society

I believe that motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely the use of textbooks. I should say that on average we get about two percent efficiency out of schoolbooks as they are written today. The education of the future, as I see it, will be conducted through the medium of the motion picture... where it should be possible to obtain one hundred percent efficiency.

Thomas Edison

There won't be schools in the future... I think the computer will blow up the school. The whole system is based on a set of structural concepts that are incompatible with the presence of the computer...

S. Papert

I used to think that technology could help education... But I've come to inevitable conclusion that the problem is not one the technology can hope to solve. What is wrong with education cannot be fixed with technology.

S. Jobs

Much has been recently said on the paramount advantages of information and communication technologies (ICTs) and their influence on education. Abundant attention has been attracted to the education quality and effectiveness. In both domains special consideration is required, although joint description is even more attention grabbing. Here we meet an interdependent influence of such issues as education context and content, standards and reasons for education quality evaluation; models to organize education environment for effective teaching – learning; benefits and drawbacks of ICT application in education; methods of evaluation of ICT integration in education.

Based on the results of research and implemented projects the UNESCO Institute for Information Technologies in Education has developed and continues the elaboration of an integral approach and systematic vision of this problem area.

The paper presents the experience in research, development of methodological materials, formulation of policy guidelines, instruction and training, implementation of international and national pilot projects on quality evaluation of ICT usage in education.

Quality evaluation of IT usage in education

Global economic competition has brought to the fore the critical importance of the quality of human resources, as well as the demand for new competencies in today's information society. The educational system, schools and students are under increasing pressure of the reform. In a society, which is becoming more dependent on information and knowledge processing, an individual is required to have solid and broad education. Educational policy in the information society must ensure that:

- IT qualifications are developed by means of their integration in all activities in the education sector; and
- an individual citizen has an active and critical attitude to technological developments without passive recognition that they set the pace.

Key features of the educational system of the knowledge society are assumed to be geographically and temporally independent from knowledge production and application.

For this reason an IT educational policy must ensure:

- equal and mobile access to education and information facilities;
- effective and flexible structure and organization of teaching – learning processes;

- integration of broad educational opportunities;
- up-to-date qualifications of the personnel in information society.

Sensible choices of ICT usage policy in education cannot be made without the analysis of the present situation, definition of the specific goals, identified means to attain them, and monitoring of the accomplished results. Planners and administrators have become more aware of the importance of ICT implementation strategies and the role of different regulatory mechanisms: choice of financing methods to create infrastructure, examination and certification procedures and other regulative and incentive structures. The concern of planners is twofold: to reach a better understanding of the validity of ICT application in education development, and to help in defining appropriate strategies to develop it further and to improve its quality.

In the endless contemporary discourse the education quality is frequently mentioned, although it is rarely defined. In the absence of an agreed formal definition, it may be inferred from normal usage that relates to the adequacy or appropriateness of objects or processes for the purposes they were intended for. Furthermore, quality implies a scale, and often standards. An object can be of good or poor quality, or it can meet, or fail to meet a standard.

A problem in defining the quality of education arises when one chooses the aspect of education that will be the focus of attention. Since education has many purposes, components, and competences, questions regarding quality may be reasonably posed about any important aspect of a system: infrastructure, school buildings, administration, teacher training, education materials, teaching, or student achievements. These elements are interrelated, and serious deficit in one is likely to have implications for quality of others.

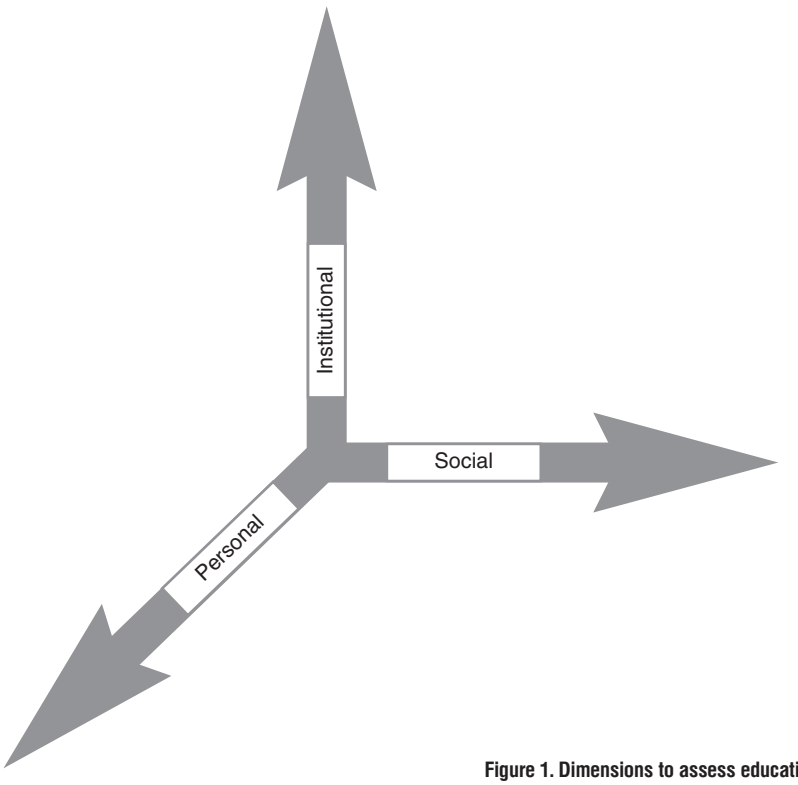


Figure 1. Dimensions to assess education quality

If the focus is on the outcomes of education, a further problem arises since there is no general agreement on what the purposes of schooling should be. Objectives are matters of choice and are based on value judgments. For some, the role of education is fostering students' cognitive, moral, and social development; for others, education is a means of promoting social cohesion and nation building; some think it is a preparation for the world of work. In this case it seems appropriate not to try to describe an overall problem in all dimensions simultaneously, but reduce the dimension of

research describing the influence of different variables, one by one, independently and later in groups of the most common sets.

Strategies to introduce substantial development and improve quality have been a concern of educational planners for many years. The issue of quality has progressively shifted its focus from infrastructure development at the beginning to learning achievements at the end. It is a need, which is to be articulated in the country with a well-developed educational system in the industrialized world, as well as in a developing country that has not reached the goal of universal primary education yet.

Considering the changes and proposals to be implemented, education policy-makers, planners and managers face two major decisions. The first is if the resources should be invested in ICT activities (either to improve the existing or to introduce new ones) or better results would be achieved, if they were invested in some other aspect of education system like school buildings, textbooks, teacher training or number of teachers. Given the contemporary worldwide emphasis on ICTs and its current leading role in setting the goals and standards for national policy development, it is unlikely that in the nearest decade it will be dismissed as an area that does not merit further consideration and investment. In this case another question arises – what kind of ICTs and application and under what conditions are likely to impact the quality of education at schools.

There are no simple answers to these questions. The answers can be found only when all relevant factors have been taken into account. Conceptual analysis of related issues and the available information on the practice in other education systems can also assist in evaluating options and anticipating the effects of proposed actions.

It is the purpose of research, which collects the experience from all over the world, to provide educational planners, administrators, and managers with such analysis and information. Since the aim of the research is not to describe the experience only, but to use it as a lever to change education systems and improve the quality and high standards of learning, the effects of ICT usage on curricula, teaching and learning need a special consideration.

ICT usage indicators in secondary education (IITE experience)

The creation of knowledge societies depends on the joint process of knowledge usage and the way, the educational systems and institutions master the known and upgraded methods of generating, analyzing and spreading knowledge and information. This poses the challenges of adaptation and renewal of the system of education to be continuously monitored and reported about in the view of the state of education in the world.

Reaching these objectives implies:

- use of information and communication technologies; national, sub-regional and regional potentials in the fields of policy, planning and simulation, budget formation and cost evaluation of education programme;
- acquisition, analysis and dissemination of upgraded data and statistical information on educational status-quo in the states participating in the project attracting various data sources and specialized studies, which add to the regular systems of data collection;
- circulation of scientific and research results, information on effective policy, innovations and advanced experience, as well as securing access to such data.

Project history

Almost since its foundation in 1998 the UNESCO Institute for Information Technologies in Education has onset this activity. In 1999-2000 with IITE participation the *Report on Information and Communication Technologies in Education of the G-8 states (OrbIt 2000)* was published. In March 2000 the Institute organized and held the *International Expert Meeting on ICT Indicators in Education*. IITE conducted a statistical study on information and communication technologies in secondary education of the Baltic and CIS states in 2001. The experience gained and the results of the project were

shared at the Consultative Workshop on developing the performance indicators for ICTs in Education, which was jointly organized by UNESCO Asia and Pacific Regional Bureau for Education and the Southeast Asian Ministers of Education Organization Regional Center for Education Innovation and Technology in August 2002. The results were presented at the International Conference *Information Technologies in Education ITE-2002* held on November 5–7 in Moscow. Based on the results of this project IITE conveyed the proposals for sub-regional project for South East Europe, National project for the Russian Federation and National pilot project for Belarus.

Main objective of the project was to strengthen ICT application potential for national education capacity building on the base of its evaluation and monitoring with the system of indicators.

The statistical study was conducted in two stages.

At the first stage of the IITE preliminary developments, the questionnaire was compiled and expertise was made by foreign specialists with the subsequent changes, which considered the experts' recommendations. The questionnaire was faxed and e-mailed to the addresses given by the Ministries. Upon familiarizing with the questionnaire and obtaining preliminary data, the working meeting *Indicators of ICT Usage in Secondary Education of the Baltic and CIS States* was held. At the meeting the specific features and details of the information submitted on certain sections of the questionnaire, as well as the methods of unification and simplification for data collection were discussed.

At the second stage according to the recommendations of the working meeting on filling-in the questionnaire, the specialists for data submission at their locations collected and transferred the specified information on the indicators of ICT usage in education. The information was grouped in the table and illustrated with diagrams as it can be seen in the published *Statistical Report*. During the work the latent uncertainties were revealed. In some cases the specialists changed the initial data three or four times. As a result, additional proposals on modifying the content of the questionnaire and recommendations to fill it in were prepared.

Thus, the next line of activities was worked out:
- questionnaire development;
- questionnaire expertise and amendment;
- establishment of contacts with official administration;
- appointment of experts in charge of data provision;
- a workshop on data provision;
- data collection and assessment;
- adjustment and primary processing of data;
- secondary adjustment and processing of data;
- composition and dissemination of statistical report.

The questionnaire was based on the most relevant indicators reflecting the main factors, which determine the efficiency of ICT usage in education. These are the following:
- Indicator group 1. Official documents on ICT usage in education.
- Indicator group 2. ICTs in curricula.
- Indicator group 3. Hardware.
- Indicator group 4. Software.
- Indicator group 5. Global communication means.
- Indicator group 6. Personnel development.

Detailed description of indicators

Overall set of indicators included about 30 parameters and was disaggregated by various categories:
- **Indicator group 1. Official documents**
  - ➤ Official documents in IT/ICTs in secondary education valid till 2002
  - ➤ Official documents in IT/ICTs in secondary education currently in force

- **Indicator group 2. ICTs in curricula**
  - Available state curriculum on Informatics and/or Information Technologies
  - Informatics and/or Information Technologies as a separate subject
  - ICT usage to support other subjects implied in curricula on these subjects

- **Indicator group 3. Hardware**
  - Computer classrooms in educational institutions (EI)
  - Average number of students per one computer in EI equipped with computer classrooms
  - Percentage of IBM- and Apple-compatible computers to total number of EI computers
  - Percentage of EI equipped with one or more multimedia systems to total number of EI equipped with computer classrooms
  - Percentage of EI equipped with local network to total number of EI equipped with computer classrooms

- **Indicator group 4. Software**
  - Percentage of computers with installed OS DOS™ to total number of computers in computer classes
  - Percentage of computers with OS Windows™ or Apple Macintosh to total number of computers in computer classes
  - Percentage of computers with other OS to total number of computers in computer classes
  - Percentage of EI with any educational software for teaching the corresponding subjects to total number of EI with computer classes:
    - elementary school subjects
    - science subjects
    - humanities
    - informatics or information technologies
  - Percentage of educational software designed by the specialists within the country to total number of educational software used in EI for teaching of the corresponding subject curriculum (elementary school, science subjects, humanities, informatics/information technologies)
  - Percentage of educational software designed by foreign specialists to total number of educational software used in EI for teaching of the corresponding curriculum (elementary school, science subjects, humanities, informatics/ information technologies)

- **Indicator group 5. Global communication means**
  - Percentage of EI without Internet access
  - Percentage of EI with limited Internet access – only e-mail
  - Percentage of EI with access via dial-up channel
  - Percentage of EI with access via dedicated line
  - Percentage of EI with own web pages

- **Indicator group 6. Personnel development**
  - Percentage of elementary school teachers, subject teachers (except teachers of Informatics and/or Information Technologies), teachers of Informatics and EI administration who have undertaken the computer literacy course from 1 September 1999 till present:
    - less than 50 hours
    - 50-100 hours
    - over 100 hours
  - Computer skills of elementary school teachers, subject teachers, teachers of informatics and administration
    - elementary computer literacy
    - proficiency in ICT field

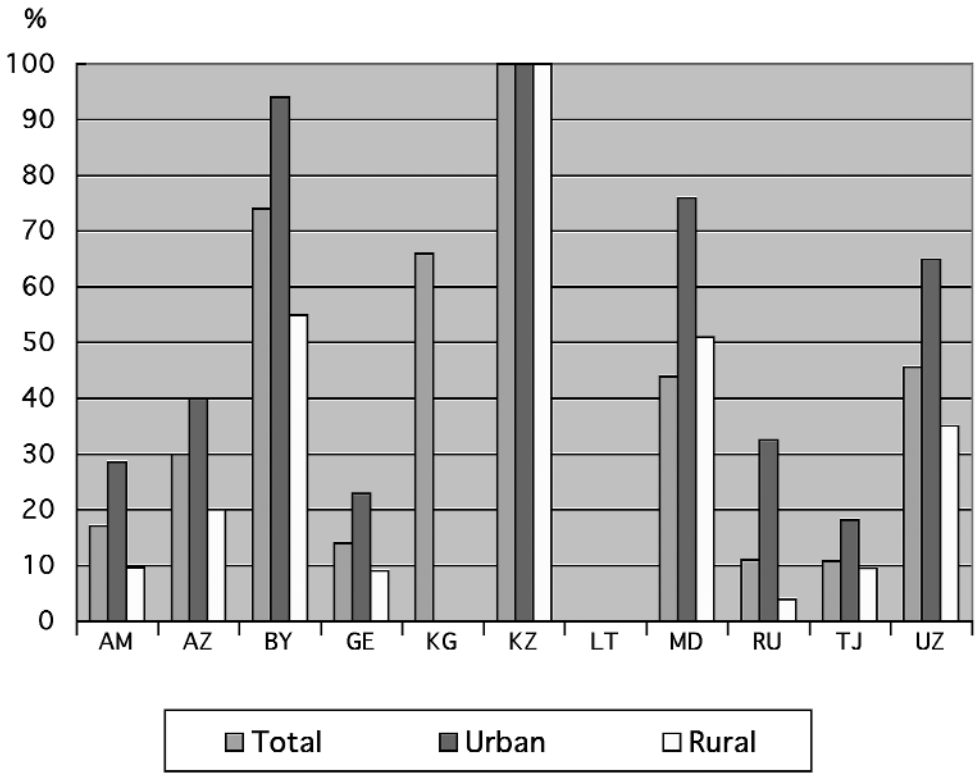
Data performance and utilization

Data on indicators were collected in the form of a filled-in questionnaire and converted in an MS Excel table. The table consisted of separate worksheets for each indicator groups; appropriate diagrams were built on the data of each worksheet to present the data for each indicator group.

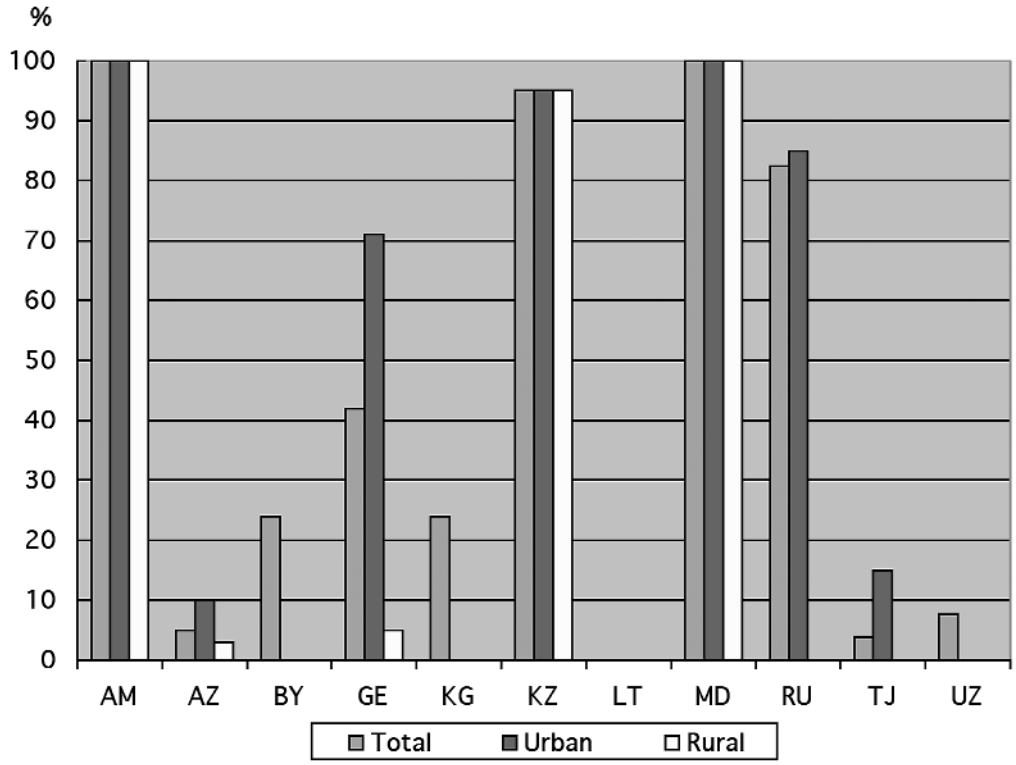
International abbreviations for states – participants of the project

AM	Republic of Armenia
AZ	Azerbaijani Republic
BY	Republic of Belarus
GE	Georgia
KG	Kyrgyz Republic
KZ	Republic of Kazakhstan
LT	Republic of Lithuania
MD	Republic of Moldova
RU	Russian Federation
TJ	Republic of Tajikistan
UA	Ukraine
UZ	Republic of Uzbekistan

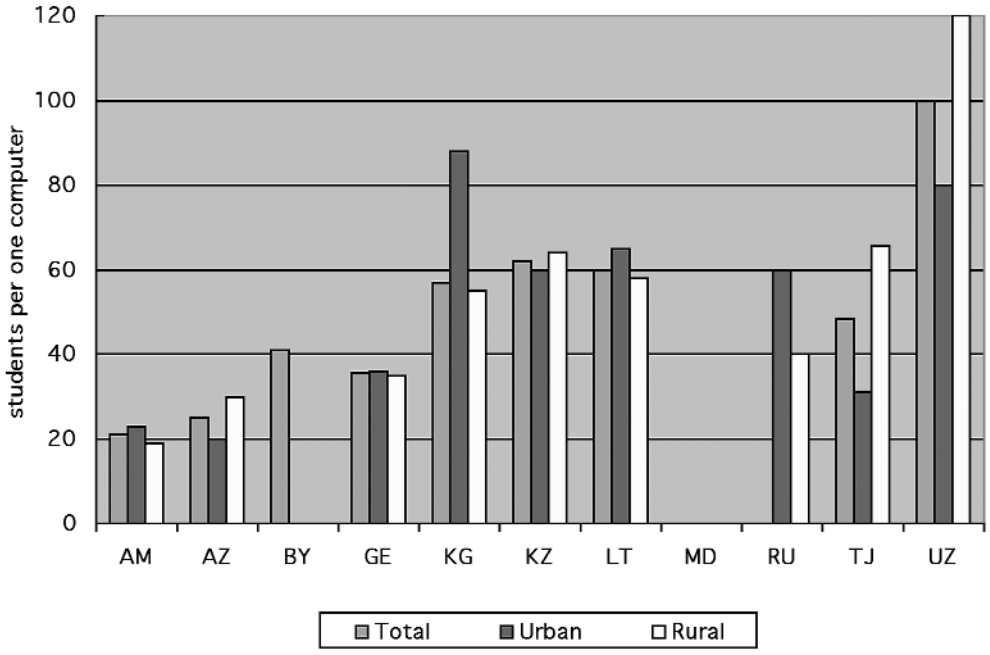
Percentage of schools equipped with computer classrooms



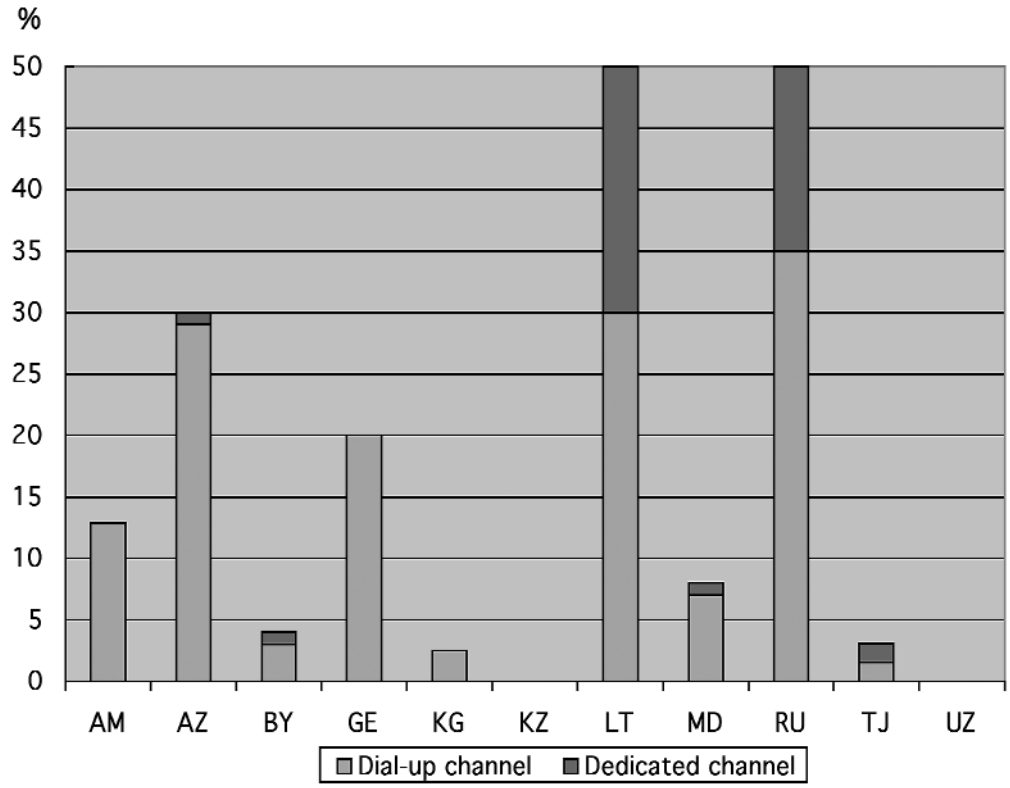
Percentage computers compatible with IBM and Apple models to total number of computers in school



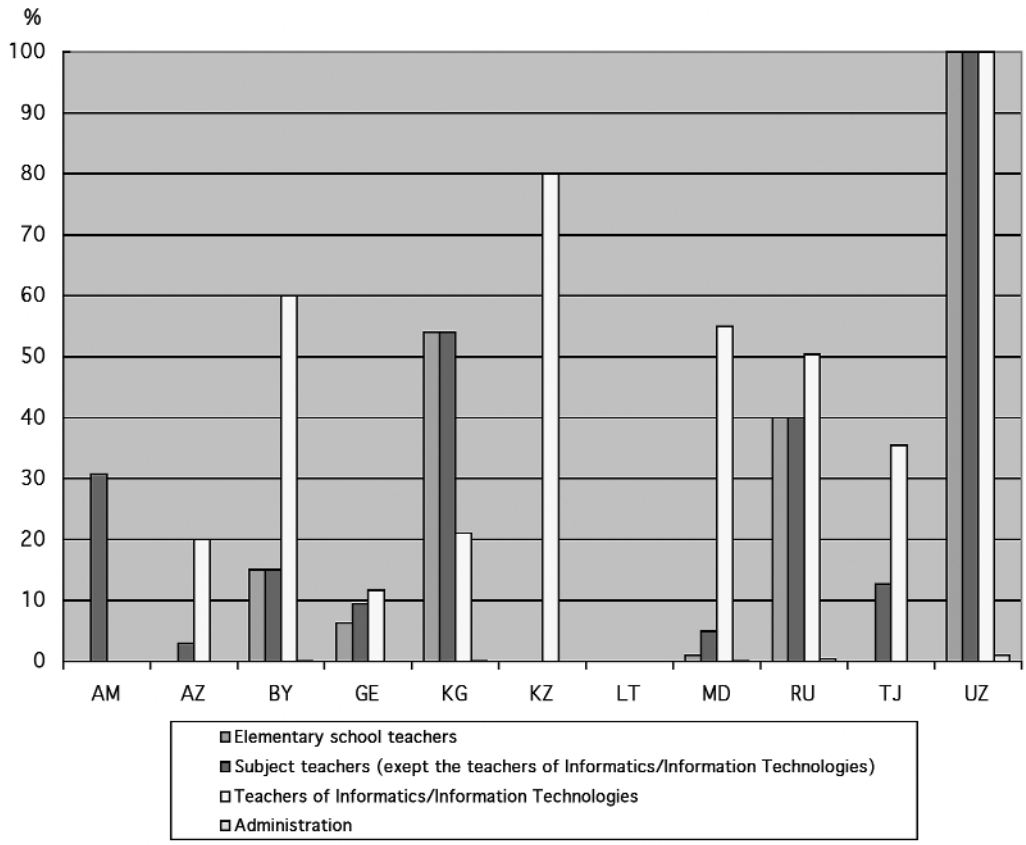
Average number of students per one computer in schools offering computer classes



Access to the Internet. School percentage with Internet access via dial-up or dedicated channel



School staff development in the field of computer literacy. Percentage of teachers trained

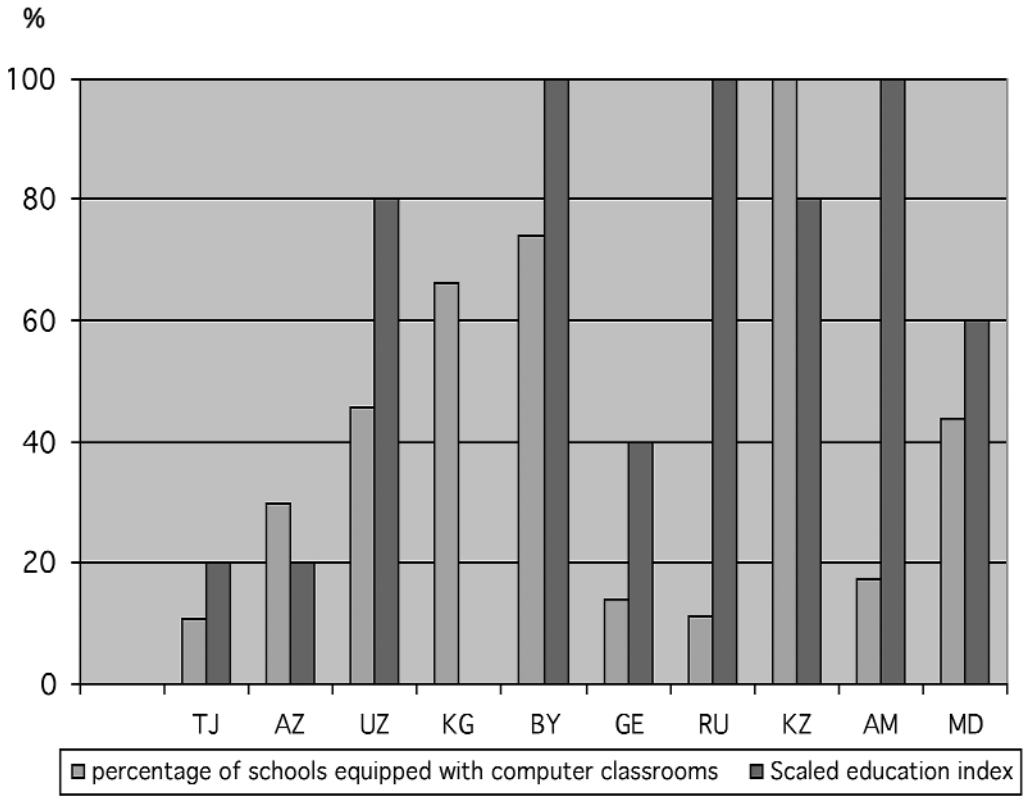


Based on the results of the survey the statistical report *Basic ICT Usage Indicators in Secondary Education of Baltic and CIS States* was published by IITE in English and Russian. The statistical report described the project, processed statistical data and diagrams, presented supplementary material. Some data from 1999 EU reports were also included in the report for reference. The report was distributed among the Ministries of Education of participating countries and was mailed to UNESCO Headquarters and National Commissions of all UNESCO Member States.

Results of the statistical survey were compared with other statistical data gathered from various UN projects and with the data of international measurement of ICT usage in education.

In the diagrams (pp. 46-47) the complementary data were taken from the *UNDP 2000 Human Development Report*.

Comparison of scaled education index with the percentage of schools equipped with computer classroom

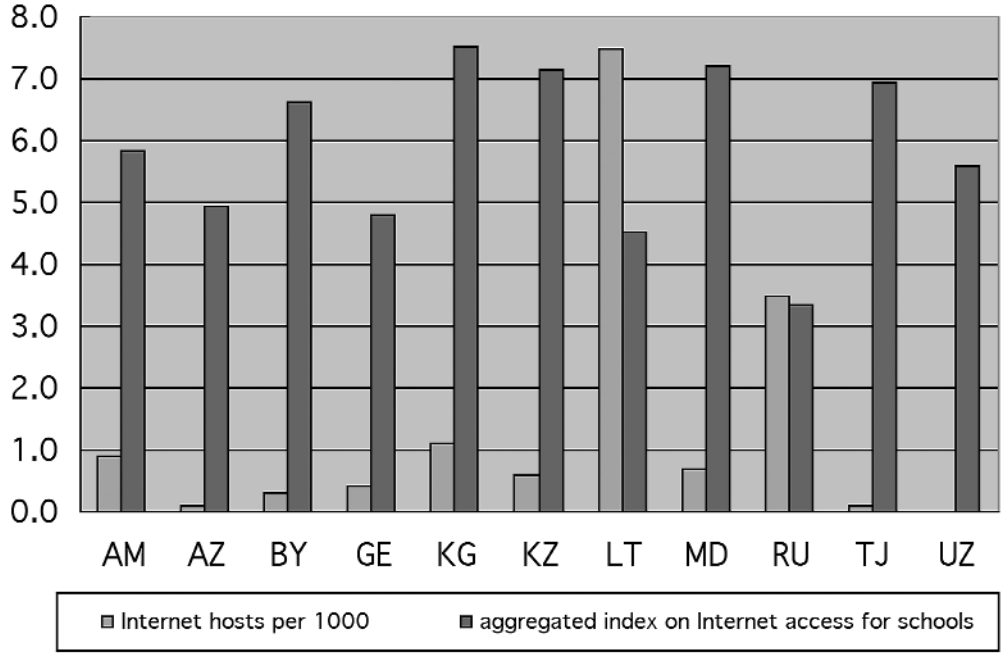


Though, quick conclusions are hard to draw, this experience set forth new directions of IITE research on ICT applications in education and their influence on education quality. Some considerations are shown below.

International experience on ICT influence on the education quality

Despite a wider access to technology and accumulation of a critical mass of equipment, even in the most developed countries ICT usage in schools remains limited. For the countries of different historical roots and traditions of education organization, in spite of various differences in objectives, organization and education philosophy, similarities regarding situation of ICTs for schools are of major significance.

Relationship between Internet availability in the country and schools Internet access

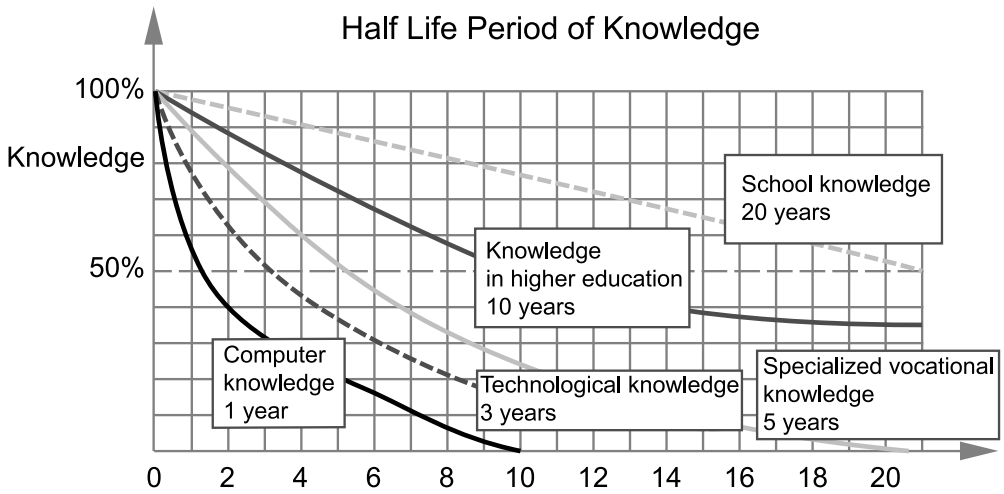


Number of students per computer	**1997**	**1998**	**1999**	**2000**
American school	13	6	6	5
French high school	12	7.9	7	6
French middle school	26	17.5	15.3	14
French primary school		30.9	25	23
Internet connections (%)				
American school	78	89	95	98
French high school	80	85	96	98
French middle school	40	53	84	91
French primary school	5	10	25	50

Based on the aggregated official data it was estimated that 20% of US teachers were frequent users, 30–40% occasional users and the remaining were non-users. Other data confirm these estimates. Only 53% of US teachers are multimedia users. Among the users of specially designed educational software 17% of teachers said it was a primary source, 77% – a supplementary source, 6% – a leisure timer activity.

Probably, the critical mass of equipment enabling the pervasive use seems to have been reached in every developed country, but the wider access does not lead to wider use in a classroom. Despite the evident interesting signs, absolute scientific proof of how efficient the technologies are is still to be shown. Educational technologies look inevitable in terms of socialization of schools. This introduction is an absolute necessity if we wish to avoid a division between schools and the rest of society. The school has a double mission: first, in education and training students; second – preparing them for living in tomorrow's world.

Even more excessively than the hardware component, the contextual aspect of information technology is burdened with a tremendous rate of change. The scope of this problem becomes visible when we consider the rate of change in different types of information, which we have to deal with.



The adjustment of training to the rate of technological change is a paramount problem. The globalization, which characterizes today's technological development, is also valid for the training programmes, which are designed to cope with technological changes around us. To determine where the problem of a limited ICT usage in education roots, a more in-depth analysis appears necessary to sort out different categories of obstacles that limit the usage. Distinction is made between the first order barriers (extrinsic to teachers, dealing with logistics and secured additional resources) and the second order barriers (intrinsic, challenging teacher's fears and beliefs). The first ones make the best of adjusting current practices and institutional solutions. The second ones refer to new goals and challenge teachers' beliefs, reformulating basic school culture.

Usually, determining education development policies the decision-makers tend to privilege a linear and sequential approach, trying to address the first order barriers before tackling with the second ones, once enough resources and equipment have been gathered fostering the creation of enabling infrastructure. Only in a due course come qualitative issues like research and evaluation based on the lessons from the past suggesting that the two barriers should be addressed simultaneously as it is a multifaceted challenge. The problem becomes even deeper, because the technology itself changes substantially causing the necessity to provide new solutions that usually repeat the previous mistakes.

If school is supposed to change, then what is the new pedagogic model? There happens to be a consensus among the researchers that the model for a change is of constructivist character. In terms of models behaviorism is outdated, cognitivism is in the process of being so, and only constructivism is not worked out yet.

The instructional principles associated with constructivism require the learners to:
- solve complex and realistic problems;
- work together to solve these problems;
- examine the problems from multiple perspectives;
- take ownership of the learning process (rather than being passive recipients of the instruction); and
- become aware of their own role in the process of knowledge construction.

This vision of the constructivist paradigm insists on socialization, marking a shift from teaching to learning.

It is much easier to declare the objectives like "learning to learn", than to implement practical strategies to achieve them. 40% US teachers describe themselves as constructivists, but only 23%

can be such. At the same time, 64% of the teachers surveyed feel more comfortable with traditional methods. The 23% constructivist self-declared teachers can be expected to share constructivist exemplary practices. Compared to 23% of US teachers that could be constructivists, only 16% exchange e-mail with colleagues, 7% make their students use e-mail in the classroom and 4% encourage their students to publish on the Web.

In the past century the history of educational technologies was characterized by a succession of cycles that mark the development of educational technology:

- still pictures,
- broadcasting,
- movies,
- television,
- teaching machines,
- videos,
- computers.

During each cycle the forecasters and salesmen eulogized the merits of the new technological miracle in announcing it the next educational revolution. At regular intervals almost identical arguments were applied to different technological systems. These never-changing arguments cover the opening up of the school to life, the improvement of the efficiency of teachers, the possibility of working by oneself, the new role of teachers.

Now we have the Internet. However this time the context looks different. It seems that that the digital convergence of informatics, telecommunication, and multimedia technologies radically differs from anything we have seen before. It is more than the matter of the changed scale. For the first time in history, pedagogical tools are the main tools our society use to produce wealth, and structure activities. When an innovation has such a wide-ranging effect, there is a natural tendency to overestimate a short impact, and to underestimate dramatically the importance of long-term effects.

Cinema and TV did not cause such changes in education, but they were important innovations that deeply affected our societies and shaped our way of thinking. They were as ubiquitous as the new information technologies, which are in the process of becoming as generic as electricity. The stake, therefore, seems higher now.

Due to digital unification, education technologies allow teachers to access and manipulate any kind of information resources (text, data, sound, graphics and video) and to adapt them easier to specific needs and strategies every day. They can accommodate any pedagogical style and enable each teacher to adapt resources to specific needs. Therefore, the conditions have been created to make a qualitative step in practices. This craftsman approach to teaching as to tailoring resources and methods in an educational situation, which is always unique, is deeply embedded in teachers' professional culture.

Despite the rapidly developing context of educational technologies the situation remains fragile, because the evolution of content is slow and time for integration of these technologies into educational practice is extremely long.

Nearly 50 years had passed before the overhead projector was practically available in every US classroom. Experiments with Apple Class of Tomorrow (ACOT) showed how practices of teachers working with technological environment evolved over a period of ten years. It also demonstrated that the results of the project would have been much different and more disappointing if the project had lasted only one or two years. In the course of five stages – entry, adoption, adaptation, appropriation, and innovation – only the last two manifest the real change. Fortunately, some hints exist that the pace of change has been accelerating.

There seems to be little doubt that pedagogical design principles will be severely challenged by technology-facilitated change.

We must remember that teachers are gatekeepers for technology at school. The beauty of ICTs now – and tomorrow it will be even better – is that it fits all types of teaching, past and present paradigms of education.

Policy-makers need fast returns of investment. If they want to build a successful strategy they will need to accommodate the cultural clash between the rapid change of technology and long time of education. If it occurs, it will be not a revolution but a progressive evolution that takes time.

Dainius Numgaudis
Ministry of Education and Science of the Republic of Lithuania
Lithuania

Eugenijus Kurilovas
Centre for Information Technologies in Education (ITC)
Lithuania

Computerization of Lithuanian Schools: History and Problems

Information and communication technology (ICT) is gaining ground in all areas of life. Its introduction into the school plays an important role in the process of restructuring of the educational system of the country. Moreover, the results of this work will affect the educational reform and the social and economic progress of the state. Computerization of schools is quite a lengthy process, which was launched fifteen years ago. This article is an attempt to describe the current processes and to evaluate the accomplished work.

ICT was first introduced into Lithuanian secondary schools **in 1986.** Then, following the order of the USSR's government, the basics of computing were introduced to all secondary schools. **Up to 1989** Lithuania followed the USSR's way of computerization of education. Trying to keep abreast with the rapid spread of information technology in Western countries, a compulsory discipline of computing was introduced in the higher grades of the secondary school, and the authorities approved special public programmes intended for the equipment of schools with computers. Following the USA standard of 1985 (1 computer for 72 pupils at least for grades 9-11), the "Nuklonas" factory in Šiauliai was obligated to start manufacturing cheap home computers for schools, and as a result, in 1989, a secondary school in Lithuania could offer one computer to 286 pupils.

Since 1990, the Ministry of Culture and Education of the Republic of Lithuania has taken care of the equipment of schools with computers. The Ministry for that purpose has established the Centre of Informatics and Forecasts. The years **1990–1995** saw the centralized supply of IBM computers to educational institutions of all levels. In 1991 so-called pilot school project was launched. Under this project, the IBM Corporation provided Lithuania with eleven computer classes, which were evenly spread all over the country. Apart from that, schools received constant technical and methodological support. In five years more than 1,100 IBM computers were installed in two hundred secondary schools (85 of which were equipped with computer classes with six or more workplaces). Approximately half of computers were purchased from the governmental budget, the rest were provided by the Open Society Fund of Lithuania or acquired by schools themselves. About 600 second-hand home computers also came from Canada, and the majority of them were distributed among rural schools.

It is worth mentioning that the Open Society Fund of Lithuania (OSFL) has paid particular attention to education. The Fund has implemented the project *Transformation of Education for Lithuania's Future*. It has also worked on various projects in cooperation with the Ministry of Education and Science (MES), and the most important work for us has been the work carried out within the framework of the programme *Introduction of New Technologies Into Lithuanian Schools*.

However, due to the absence of a long-term and thorough strategy for the introduction of ICT and permanent shortage of public funds, the publicly declared general regulations on the integration of IT differed from the actual work performed by lower administrative bodies. As in **1996** almost no funding was provided for the computerization of schools, Lithuanian schools had only 3,894 computers, including 1,500 of the IBM family. Only 200 out of 696 secondary schools had at least one IBM computer. About 18 per cent of school computers were not being used, as most of them were broken. 32 per cent of school computers were Soviet computers, which were morally and physically outdated.

Searching for ways how to essentially improve the process of computerising of educational institutions, the MES drafted a project of computerising of Lithuanian secondary schools, vocational and high schools, the overall value of which amounted to LTL 24 million. The IBM Corporation won the tender for the implementation of this project. The aim of the project was:

1) to provide all secondary schools with computer equipment at the basic level, i.e. to install a computer with a modem in every secondary school, and to set up a computer class in each district;
2) to create the basis for the Lithuanian educational information network;
3) to create a network for teachers in-service training in information and technology skills – to establish regional computer centres in all counties;

4) to organize computer literacy courses to all teachers of informatics and to headmasters, and to work out diverse methodological-teaching materials.

Within this project Lithuanian educational institutions received 2815 computers, and 143 computer classes were set up. However, not all the ideas of the project have been implemented or have proved to be effective. Due to legal and financial problems, the educational information network provided for in the project has not been established, and the regional computer centres that were supposed to improve the teachers' informational qualification, today are either working very poorly or are not working at all.

The OSFL has also played an important role in the implementation of the project. In **1997**, computer dial-up service centres were established in Šiauliai and Panevėžys. The Internet reading-rooms were opened in four centres provided the educational, scientific and cultural institutions of these counties with free access to the Internet, and the hardware was upgraded. Certain schools were supported within the framework of particular projects. As part of different projects, the development of electronic informational-methodological publications, curricula, organizing of seminars and conferences have received funding.

In **1998**, the investment project *Information System of Lithuanian Education* was formulated and was put into practice. It was aimed at creating of the infrastructure for spreading and exchange of educational information: installing of hardware, designing of databases and the procedures for the installation and functioning of the system. The information system was intended for the management of education, for teaching and learning. The project specification was approved in 1999, and its value amounted to LTL 27 million. Unfortunately, as up to 2001 only LTL 6,85 million were appropriated for the project, its implementation has exceeded all deadlines, and the finishing touches, which will be made this year, will allow to achieve the objectives of the projects only in part.

If we want to create information society, we need to train all its members, how to use IT tools. It is particularly important that pupils have such skills after they graduate from the school. However, in **1999** it was difficult to talk about a real possibility to train all Lithuanian pupils to use IT tools in practice, as only about 90 per cent of Lithuanian secondary schools and 15 per cent of basic schools had at least one computer for training purposes. Primary schools had practically no computers for teaching and learning. On average, 76 pupils of a secondary school had one computer for training purposes. E-mail or WWW were available at approximately 90 per cent of the secondary schools equipped with computers, but in most of them the Internet access was available only from one computer and only using dial-up connection. Schools were short of special software intended for teaching different subjects. Very few secondary school teachers had at least basic skills of work with a computer.

In **2000**, the main document – *The Strategy for Introducing of ICT into Lithuanian Education* – was worked out. The document defined the trends and prospects in integration of ICT into Lithuanian general education. Today the steps in the introduction of ICT are being designed according to this strategy. The work of different institutions is being coordinated and the funding is being planned on the base of this strategy either. The strategy claims that it is necessary to use IT in education because:

I. **The economic welfare of the country** and its opportunities to compete in the global and European markets depend on the computer literacy of the country's population. All students and pupils can acquire such skills already at school. Moreover, many of today's pupils will work in the IT sector, so it is important to attract their interest to computing, its application and to start developing their professional skills already at school.
II. **Social changes** are related to the abundance of information, to the expansion of communication network that opens new possibilities to exchange information, communicate and express one's opinion and to play an active part in the social and political life. The ability to use computer tools is becoming a condition for a normal social life – computer literacy conditions the opportunities of an individual to get information and to enjoy his/her rights and social guarantees. Unequal opportunities for pupils to learn using a computer and to acquire informational skills may cause social inequality and alienation.

III. **Changes in educational methodologies** are related to the possibility to acquire knowledge in different subjects faster and in a more appropriate way, to acquire skills of a higher level by using information technologies. Computers facilitate the creation of a new learning environment, enriched by the diversity of information sources and communication tools, which makes it easier to develop the critical thinking skills, to integrate topics from different fields, to apply active teaching methods, to highlight and develop the personal abilities of a child, and to teach children to work independently and in a team. The specialists of educational development consider ICT as a catalyst, which may speed up the development of modern educational reforms and didactics.

Realizing that it is impossible to accomplish everything at once, the strategy plans to manage the whole work within following stages:

1. The objective in the first – preparatory – stage is to establish the financial and legal basis, to create technical conditions and to provide the staff of the educational system with an opportunity to get basic technological knowledge, guaranteeing successful further integration of IT.
2. The major work in the second stage – modernizing of libraries and the expansion of computer centres for teachers – is intended for the introduction of ICT into school libraries.
3. The essence of the third stage – integration of into education – is to foster computer literacy among pupils, teachers and the whole population, and to integrate IT into teaching and learning of different subjects.
4. The main work in the fourth stage – the expansion of educational networks – should be intended for the expansion of the infrastructure of the networks and for the use of the potential of telecommunications at school in the widest possible way.

When introducing ICT into education, it is important to realize clearly the mission of different educational institutions and the principles of their work, to follow their general goals and coordinate actions. For that purpose, the following principles of implementation have been established:

- The objectives, tasks, tactics and means of the introduction of ICT into education must comply with the general trends of the educational reform in Lithuania, as well as with its aims and main principles.
- ICT must be introduced to the educational system based on the principle of equal opportunities – proper technological and informational literacy and a possibility to use modern tools should be available to students from the families of different social and economic status, from different types of schools, and of different gender and nationality. Permanent care is taken of the equality of rights of the socially neglected children, the pupils of rural schools and girls.
- Particular attention must be paid to the special needs of disabled children – to the integration of disabled pupils into the social environment and information society.
- The introduction and use of IT must foster respect to traditional human values and those of the country, and follow ethical standards.
- A safe and harmless working environment must be guaranteed. Computer classes and rooms with computerised workplaces must be equipped following the requirements of hygiene and ergonomics and must be subject to permanent observation.
- The process of introduction of ICT into education is revised and evaluated on a yearly basis. The strategy and the programmes of its implementation are reviewed and modified depending on the progress in ICT and the changes in the educational system.

The Programmes of Introduction of ICT into the Educational System are approved by the Ministry of Education and Science on a yearly basis and provide for concrete steps of the implementation of the strategy and its funding. By means of the programmes the MES aims to form at least the minimum hardware and software base, which would allow secondary schools to provide all the pupils with equal opportunities to acquire computer literacy. In the coming years, at least one modern computer lab should be installed for the pupils of higher level (grades 9-12) of the secondary school. Moreover, every school library and other teaching rooms will have several computers. At the same time, a local school network and the Intranet should be created, and pupils should have access to the World Wide Web information from each school computer. It is important that all Lithuanian secondary schools get centralized supply of multipurpose and training software package necessary for the main work

with IT. Pupils must be taught in their mother tongue; therefore Lithuanian systemic, multipurpose and training software must be installed into each computer. While until now certain educational software is also in foreign languages (English or Russian) the new initiatives on national level on introduction of training software to be used in the classroom, should follow the rule, that only educational software developed in Lithuanian or translated into Lithuanian are eligible.

The most important programme of the MES in **2001 – 2002** is *Education for Information Society* (hereinafter referred to as the E-school). According to the programme, within three years period all pupils graduating from a general education schools will have acquired the IT competence. The objective of the programme is to teach pupils how to use IT so that, graduating from school, pupils could get a relevant certificate or pass an examination. Another task of the programme is to achieve that 1 computer could be available for 10 pupils of 9-12 grades of a general education school. Moreover, the programme aims at training all teachers and acquiring tens of computer training tools. In three years, LTL 50 million will be appropriated from the governmental budget for the implementation of this programme.

In 2001, the funding of the E-school programme made up LTL 13.9 million. The acquisition of hardware made the largest part of expenses (360 computer classes were purchased).

The E-school comprised 40 per cent of the funds allocated for the computerising of schools (see Chart 1).

A part of the funding came from the LITNET programme. Thanks to this programme, the Internet is being developed not only in higher schools but also in secondary schools.

At the same time, the work with other state institutions was being coordinated. 341 computer classes (1,450 computers) reached schools under the *Information of Young People about Issues of Security and NATO* programme (together with the Ministry of Defence) and the *Introduction of Information Technologies in Basic Schools* programme (together with the Ministry of Economy and with the support from China).

Quite a lot of attention has been paid to the attempts to attract private capital and resources from certain funds. The support programme *School for Information Lithuania* is being implemented for the second year already. As part of this programme, about 1300 computers reached schools and more than 200 schools have been provided with permanent access to the Internet on favourable terms. The overall support amounted to LTL 8 million.

Training software is being stored and teachers are being advised on the possible ways of their use. Teachers can also make copies of the legal software (Table 1).

Among the surveys, which are being carried out, the most important one is the *Information Technologies at School SITES*.

Under the programmes of 2001, the Standard of Teachers' Computer Literacy has been elaborated, which set the requirements for the programmes on training and retraining of teachers of all levels and for the organization of such training. The Standard is based on the European Computer User Certificate Programme and the conception of application of ICT in education, didactic attitude to the teaching of teachers and their learning, and the requirements to the awareness, how to apply ICT in the process of education, to understand their social and ethical peculiarities and to be able to use training software by means of IT. More than 5 thousand teachers have been trained under the E-school programme, and public competitions for the in-service training have been already announced for that purpose.

The legislation that regulates the organization and management of the educational system fails to name explicitly the mission of the county education centres and local education authorities in the process of introduction of ICT into schools. Nevertheless, the influence of local authorities in solving the problems related to the computerising of schools is great and evident: county and municipal

Table 1

	Title of the product	Distribution
1.	*Art Encyclopaedia of Foreign Classical Works* (in Russian)	1 CD for secondary and basic schools
2.	*Encyclopedia of classic music* (in Russian)	1 CD for secondary and basic schools
3.	*Computer Digest of the Lithuanian Language* (in Lithuanian)	1 CD for secondary and basic schools, the state licence
4.	Encyclopaedia *Encarta Standard 2002Win32 EngBrit* (in English)	1 CD for secondary and basic schools
5.	Design-construction *Crocodile Chemistry* (in English)	5 licences for secondary schools
6.	Design-construction *Crocodile Technology* (in English)	5 licences for secondary schools
7.	Software for devising tests and testing IS INFOTESTAs	1 CD for secondary and basic schools, the state licence
8.	*Lithuania before Mindaugas* (in Lithuanian)	1 CD for secondary and basic schools
9.	Different software (Akis-M (An Eye), Grafikas (The Schedulle), Dangus (The Sky), Įvardink daiktą (Name the Thing), Chemija (Chemistry) 2000, Chemijos testai (Tests on Chemistry), Frazeologizmai (Phraseological Units), "ARS I dalis" (ARS part I), Dailės žanrai ir rūšys (Genres and kinds of Art), Veiksmai su teigiamais ir neigimais skaičiais 7 kl (Actions with positive and negative numbers 7 grade), ECDL distancinis kursas (ECDL distant learning course))	For all schools, the public licence
10.	*Dynamic Geometry* (in Lithuanian)	For all schools, the state licence
11.	*Komensky's Logo* (in Lithuanian)	For all schools, the state licence

educational and regional computer centres organize events that help teachers to improve their informational and technological skills; municipalities of many districts and cities have been and still are providing funding to schools in order to acquire hardware and software. Furthermore, we should emphasize the favourable attitude of local authorities and their strong motivation to take care of the introduction of ICT into schools. However, the extent of contribution varies from municipality to municipality.

The policy of the introduction of IT into education is shaped not only by the regulations of the managing institutions but also by school communities. It is the enthusiasm, principles and decisions of a school that determine the way how computers are being used in the teaching and learning process, how the information on modern technologies is being spread, what support a school succeeds in receiving for its projects. An important role in determining the priorities of the introduction of information technologies into school is played by teachers, school librarians and the management. School communities should draft projects on the application of IT at school, which should determine the objectives, primary tasks on the introduction of IT into the school, and the schedules of their completion, the areas and ways of the use of the equipment, and the tools for the improvement of informational and technological skills of teachers. School projects on the introduction of IT into school are reviewed and modified on a yearly basis.

The experience that we have acquired allows us to introduce technologies actively in 2002 and later on. A devised strategy, its consistent implementation and the positive attitude of politicians play an important part here. The school facilities are expected to be constantly improved, and the criteria set within the eEurope+ framework should be followed. Chart 2 shows the change in the ratio of pupils and computers and the results of the two closest stages (the expected period of time is one-two years)

Chart 1. Distribution of resources for computerizing in the year 2001

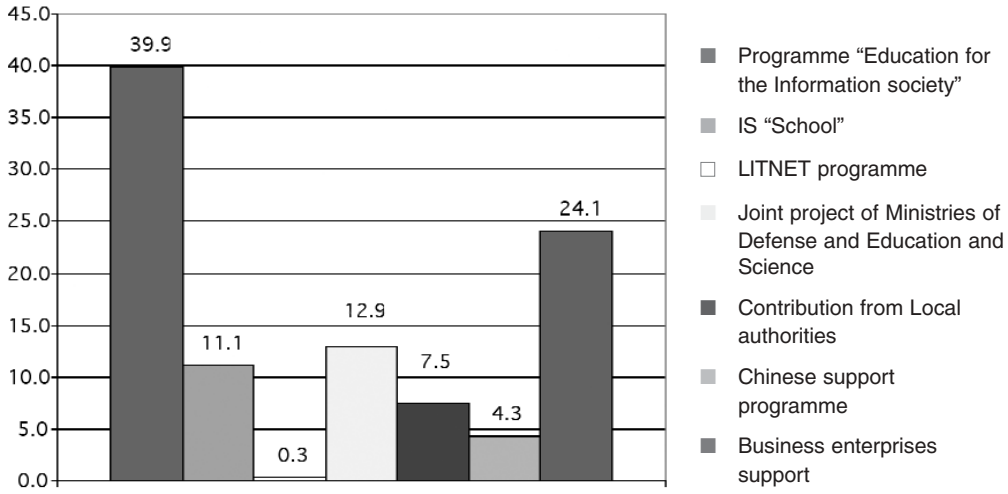
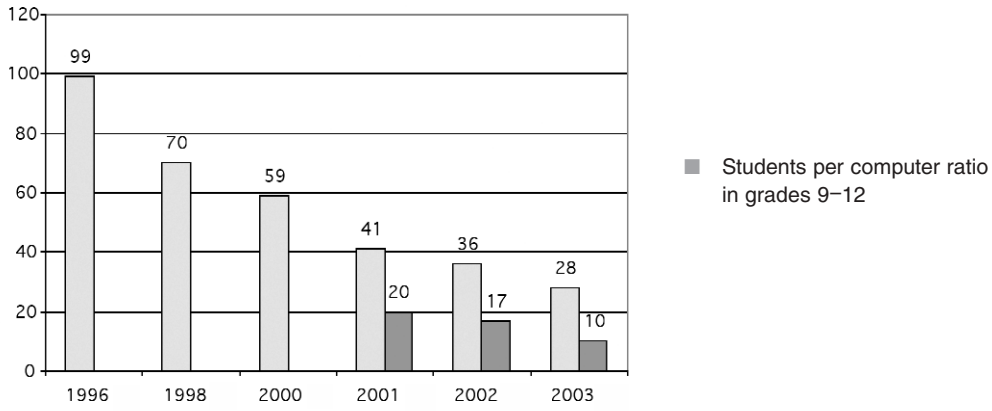


Chart 2. Number of students per computer



Terry Haydn
School of Education
University of East Anglia
United Kingdom

What Do They Do with the Information? Computers in the History Classroom: Some Lessons from the UK

Abstract

The paper examines the recent development of the use of computers in the teaching of history in schools in the UK, in the context of substantial government investment in new technology and political enthusiasm for the use of computers in education. As in other countries, there is to at least some extent a "rhetoric-reality gap" between the claims made for the use of computers in schools, and what is current practice. Consideration of the use of information and communications technology (ICT) in UK classrooms over the past ten years suggests that new technology is not an unproblematic tool in education, and that considerable thought needs to be given to the instructional design of materials for use with computers. In particular, it is argued, attention needs to be given to the subject discipline of history, and what we are trying to achieve in school history, if the potential of computers for enhancing teaching and learning in history is to be realised.

> "The computer can be a fabulous tool... But the dirty little secret is that no one really knows what to do with this stuff." (Warhaftig, quoted in Banks *et al, 1997*)

Context

Politicians and policymakers in the United Kingdom (UK) have invested great faith in the potential of information and communications technology (ICT) to improve educational standards in schools. Over two billion pounds have been invested in new technology in schools between 1997-2001 (DfEE, 1997; DfES, 2000) and the UK now has one of the highest computers to pupil ratios in schools of any country. (Abbott, 2001, OECD, 2000, Research Machines, 1997) Recent estimates are that there are now over a million computers in UK schools, with one computer for every 9 pupils in secondary schools. (DfES, 2000) Regulations for the training of teachers in the UK now state that trainees cannot be passed to enter the profession unless they are computer literate and able to use computers in their teaching, and the government has also funded a massive programme of training in ICT for in-service teachers.

Study of the statements of politicians (of all parties) about computers and education shows that they are unreservedly enthusiastic about new technology. In the words of Prime Minister Tony Blair, "the future lies in the marriage of education and technology. The knowledge race has begun. The pace of technological change means the task in urgent. Knowledge is power. Information is opportunity." (Blair, 1995) Charles Clarke, Minister of State for the Department for Education and Employment elevated new technology above even literacy and numeracy in declaring that "Familiarity with ICT is the most vital life skill for the generation now going through school." (Clarke, 1999) Minister of Education Estelle Morris described ICT as "our new DNA... our new internal combustion engine." (quoted in *The Guardian*, 18 October 2001)

This inchoate political enthusiasm for new technology in education did not pass unremarked by the educational establishment in the UK. As Professor Stephen Heppell (1995) cynically remarked,

> Ever since Harold Wilson spoke of the white heat of technology, politicians and decision makers have assumed that silicon offers a hot-wired short-cut to voters' hearts, especially when jobs, schools and national pride entered the equation. A succession of ministers, from Benn to Baker, embraced technology with photogenic relish; when did you last see an Education Minister in the media without a computer in the background?

The Great Computer Delusion

It is not possible to examine the recent history of computers in education without concluding that they have not had the transformational effects that were hoped for, either in the UK or elsewhere (see for instance, Abbott, 2001; McKenzie, 1995; Stevenson, 1997; Trend *et al*, 1999). Although some institutions, such as banks and newspapers, might find it difficult to function without their ICT networks, it is difficult to think of many schools or history departments who would be unable to function, or who would have to send all the children home, because "the network was down".

It should be emphasised that the "rhetoric-reality gap" (Trend *et al*, 1999) is not limited to the UK. Strommen (2000) claims that even in the United States, with one of the highest computer to pupil ratios in the world (Research Machines, 1997), "the technological changes that have swept through society have left the educational system largely unchanged." This would suggest that although access to ICT in schools might be part of the problem, there is more to it than simply whether there are enough computers to go round. One of the most recent surveys of the use of ICT in English schools (DfEE, 1998) found that in spite of the substantial increase in the number of computers in schools, a declining percentage of head teachers reported them as having made a substantial contribution to teaching and learning; the figure falling to well under 20% of schools surveyed. If computers are so wonderful, why aren't teachers using them?

Recent research findings suggest that the belief that simply putting more computers into schools will in itself in some way improve educational outcomes is a misguided one. The general enthusiasm for new technology in some quarters has perhaps led to the assumption that because ICT is good for booking holidays, sending messages, and formulating accounts, it is equally good for teaching and learning (in all subjects), without looking closely at what it has to offer, both for learning in general, and in relation to particular subject disciplines. One of the reasons for the "rhetoric-reality gap" is that politicians and policy makers have radically different ideas about what computers are *for* in education.

ICT, learning and subject disciplines

ICT has massively increased the amount of information that can be transmitted across educational networks, but those involved directly in the process of teaching and learning are aware that there is no necessary correlation between the amount of information which is transferred, and the amount of genuine learning and understanding which takes place. The Information Revolution has taken place at a time when teachers in the UK are increasingly moving away from behaviourist and "transmission" understandings of learning, and becoming increasingly aware of its limitations. In the words of John Naughton (1998), "It's not every day that you encounter a member of the government who appears to understand the net. Most politicians (Clinton, Blair, Blunkett to name just three) see it as a kind of pipe for pumping things into schools and schoolchildren." As Bonnet (1997: 155) notes,

> Volume of content does not equate with richness of experience.... One of the chief dangers of information overload is that it can, at one and the same time, inhibit authentic thinking, and seduce us into believing that all we need to solve problems is yet more information.

Much of what has been written about learning and ICT over the past 30 years has been 'generic' rather than related to specific subject disciplines, in spite of the fact that particular ICT applications offer different advantages to different subjects. Integrated Learning Systems (ILS), or "drill and skill" exercises, for example, where pupils repeat similar tasks before moving to the next level, appear to offer opportunities for modern foreign language and maths teaching, but do not appear to work for teaching history. Data logging software is very useful to teachers of physics, but is of no interest to history teachers. The vast majority of history teachers make regular use of television and video, but very few maths teachers use television and video in their teaching. (Sharp, 1995)

If we are to maximise the potential of new technology for improving teaching and learning in schools, we need to take account of the ways in which children learn when working with computers, and the nature of the subject discipline being taught. What does it mean "to get better at history", and what specific advantages do particular ICT applications offer which will help pupils to make progress in *history*? How "useful computers are to a teacher" depends on what we are trying to achieve in a subject. (Haydn, 2002)

Changing views on the nature and purpose of school history in the UK

There has been a (contested) revolution in the way that history is taught in schools in the UK over the past 20 years (see, for example, Aldrich, 1991; Sylvester, 1994; Haydn, 2000). There is still a

conservative lobby which wants to use school history to pass on a received version of the national past which celebrates British heroes, victories, and political institutions – exemplified by the lament of Member of Parliament John Stokes: "Why cannot we go back to the good old days when we learnt by heart the names of the kings and queens of England, the feats of our warriors, and our battles and the glorious deeds of our past?" (Stokes, 1990)

Amongst teachers of history in schools however, it is now generally accepted that there is more to progression in history than the aggregation of substantive or "subject content" knowledge (simply "knowing more stuff" about the past). It is also widely felt that part of the purpose of school history is to develop the "information literacy" of young people- to teach them to think for themselves, rather than to teach them what to think; to cultivate skills of critical and informed judgement in contexts where there is not a provably right answer. In the words of Norman Longworth (1981: 19), to teach young people "to sort out the differences between essential and non-essential information, raw fact, prejudice, half truth and untruth, so that they know when they are being manipulated, by whom, and for what purpose." Helping young people to make intelligent judgements on the reliability of information from a range of media sources, in an era where they are faced with sophisticated techniques for the manipulation and distortion of information, is an important part of a historical education, and education for citizenship.

In addition to developing an understanding of history as a body of knowledge, school history is about a *form of knowledge* approach which attempts to pick out the central features of a discipline and find ways of developing children's understanding of those features. (Lee, 1994) A key part of this is helping to develop pupils' ability to compare, analyse and evaluate historical sources, representations and interpretations of the past. This involves handling the difficulties involved "intelligently", in the sense of learning to use some of the procedures which historians would use to "make sense" of the differing accounts or explanations of the past. (Britt et al, 2000, Lee and Ashby, 2000)

Examining competing claims about the past and making comparisons between the past and the present is seen as a way of making history powerful, rigorous, relevant and interesting to pupils. Arnold (2000: 13) reminds us that the Greek word for history meant "to enquire", and more specifically, "indicated a person who was able to choose wisely between conflicting accounts", and goes on to note that:

> If the past came without gaps and problems, there would be no task for the historian to complete. And if the past always spoke plainly, truthfully and clearly to us, not only would historians have no work to do, we would have no opportunity to argue with each other. History is above all else an argument.

In the English National Curriculum for history, this is represented by the requirement that pupils should be taught "how and why historical events, people, situations and changes have been interpreted in different ways", "to evaluate interpretations", and "to consider the significance of the main events, people and changes studied." They are also required to "organize historical information" (DfEE, 1999: 20).

These changes in the nature and purpose of school history have a profound effect on the ways in which new technology can be helpful to the history teacher. Given that there is more to "getting better at history" than simply accumulating more facts about the past, ICT's power to increase the amount of information about the past which is available to teachers and learners of history is of only limited value. A key question is what they do with the information when they have accessed it. As Dede (1995: 12) points out:

> We have found that learner investigation and collaboration and construction of knowledge are vital, and these things don't follow teaching by telling, and learning by listening. It isn't that assimilation of knowledge isn't a good place to start, because it is hard to investigate something unless you know a bit about it. But assimilation is a terrible place to stop. The excitement about access to information is that it is the first step to expertise, to knowledge construction. Only if access to data is seen as a first step – rather than as an end in itself, will it be useful.

As Christine Counsell (1999) has pointed out, for many pupils, "more stuff" is the last thing they need. One of the things which many pupils find difficult about history is that it is so vast and unmanageable. Some pupils are already confused by the volume of information they are having to cope with; giving them access to even more information may be the last thing they need.

Another of the "myths" about learning with computers is that it is "interactive" learning. Computers do offer colour, movement, sound and pictures to learners. This can make learning materials look much more attractive to pupils. Moreover, as Bill Gates (1995) points out, interactivity means that "the person controls what he or she sees or hears"; using hypertext links, learners can negotiate their own, individual pathways through learning materials.

The problem with this is that in terms of their interaction with the materials, learners sometimes do fairly low-level, meretricious or even pointless things with the information given, either uncritically accumulating information, or using hyperlinks to browse "pinball" fashion around a topic, often using them to avoid going near screens which have too much text on them. Josie Taylor (1996) from the Open University cites the avoidance of challenge and difficulty as a potential hazard of hypermedia interactivity:

> We certainly need to keep their attention and keep them going when they're learning, but if they think it's all to do with trial and error, pressing this button, that button, that's not learning, that's not getting the knowledge into their minds in an integrated way, in a way they can make use of, that's just mucking about.

The real potential of ICT lies not in the "bells and whistles" of multimedia, to provide "sugar-coating" for learning, but in its ability to access resources which would otherwise be inaccessible, and to manipulate and process those resources much more efficiently. Even these assets are only worth much if we can think of historically valid activities for pupils to do with these resources and processes.

What do they do with the information? Working towards genuine interactivity with history and ICT

In spite of Warhaftig's assertion that we haven't really worked out what to do with computers in schools, there is some evidence to suggest that teachers are gradually working out how to use computers to improve teaching and learning in history. Recent inspection of secondary schools in the UK suggests that although not all schools have worked out how to make best use of new technology, some teachers are finding ways to deploy computers in a way which enhances pupils' knowledge and understanding of the past, and enables them to make progress in their ability to communicate that knowledge and understanding. (Harrison, 2002) Whereas early attempts at interactivity in history and ICT showed a limited understanding of the nature of historical knowledge, and insight into what history teachers are trying to do, the last few years have seen some more thoughtful approaches to getting ICT to do what history teachers need, and to providing more genuinely interactive experiences for pupils. Does the activity force the learner to think, rather than simply remember, does it put the seeds of a new idea in learners' minds? Does it go beyond "low order" tasks such as retention and comprehension? Does it make them think about "connections" (either temporal or geo-political) that had not occurred to them before – including links to present day problems and dilemmas? Does the question posed intrigue the learner in a way that encourages them to read in more depth, and persevere in a difficult enquiry? Does it disturb their preconceptions? (Schick, 1995, 2000)

Part of this progress is learning from earlier mistakes and dead-ends in history and ICT. It is only over the past four to five years that word processing has been widely used in history classrooms to address high-order thinking and conceptual understanding, rather than to get pupils to "copy up in neat" handwritten work (see Appendix 2). Another "bad habit" in school history was the tendency for pupils to download and "cut and paste" large chunks of information from CD-ROMs or the Internet without actually reading them or doing anything with them beyond "pasting"; what Walsh (1998) terms "Encarta Syndrome".

For the teacher, the aim is to move pupils beyond the "hunter-gatherer" mentality (Counsell, 1999) and towards the marshalling and deployment of information to address a particular historical question. Part of the challenge for the teacher, is to select from the mountain of resources now available, materials which will enable them to exercise these information handling skills in the context of worthwhile historical enquiry. It also requires skilful judgement about the amount of information to make available, and the amount of support and guidance to give to pupils of differing abilities in their use of it. Word processing packages have several facilities which help pupils to sort, order, merge and discard information quickly, without laborious and time consuming transcription. In the words of Walsh (1998: 6):

> The word processor can search, annotate, organize, classify, draft, reorganize, redraft and save that fundamental of the historian, the written word. When we consider these processes and the difficulties they pose for so many of our students, the true power of the word processor becomes clear. It is not a typewriter, it is an awesome tool for handling information.

PowerPoint, with the limits on how much information can be inserted to each slide, can be a useful tool in helping pupils to delineate between essential and tangential information. In "The Information Society", learning to handle information intelligently is an important skill, and given the nature of history as a subject discipline, and the attributes of ICT, few, if any subjects are better placed to equip pupils with this skill.

Christine Counsell (2000: 2) makes the point that it is not just about technology replacing effort, but about getting the emancipatory facets of technology to persuade learners that difficult and challenging activities are worth persevering with:

> I do not want my Year 7s to spend an hour typing in data; I do want them to see the historical relationship between two ideas. I do not want them to search for yet more information: I do want them to select items, to convert them into causes or consequences, and to experiment with language for doing so. I don't want them to fuss over box size on a leaflet design: I do want them to choose or reject alternative field headings in a database. I don't want them to do low-level word matching or phrase-spotting: I do want them to be so motivated to read for meaning, that they pause, and think and ponder and reconsider – and ask *why*. I want to clear away the clutter and to get pupils to focus on the interesting historical puzzle. I want to slow them down.

Another crucial attribute of ICT that contributes to learning in history is the potential it offers for presenting multiple perspectives on the past. Given the constraints of space in conventional textbooks, the Internet has increased opportunities for incorporating different perspectives on the past, and presenting history as contested, problematic, and above all, in Arnold's words "an argument". (Arnold, 2000: 13) Almost any event or person in history can be "problematised" by presenting pupils with differing views as to how their contribution to history might be interpreted, and the significance which might be attached to their contribution to history.

In terms of advances in technology, the advent of the data projector may well be the "killer application" that revolutionises the use of ICT in history classrooms. Instead of marching pupils down to the specialist ICT room, with its suite of computers, for a whole lesson, to do a "set piece" special occasion lesson using computers, the facility for whole class projection means that ICT can be used routinely as a small "component" of a normal lesson, as the need arises, in the same way that history teachers use video and television to present or discuss a short extract.

Conclusion

Some of ICT's attributes can help history teachers to go beyond basic recall and comprehension interactivity. It can enable pupils to access materials, and undertake activities which enable them to make connections between substantive or "subject content" knowledge, and their knowledge and understanding of the nature of historical knowledge – to understand what "facts" are, the processes which are undertaken to establish the validity of claims, and how historians attempt to get at "the truth", or at least what Arnold (2000) terms, "true stories".

Communications technology has led to an increase in the speed at which resources develop and improve. Over the past few years, many museum sites have improved out of all recognition, the National Grid for Learning in the UK has gone from an embarrassment to a potentially useful resource. Sites, such as the Webby Awards (http://www.webbies.com) and the Public Record Office (http://www.pro.gov.uk), have provided models for better instructional design and purposeful interactivity, and online newspaper archives have gone from providing a text only service, to one which provides animations and cartoon/picture archives (it is now possible, for instance, to access high quality resources on September 11th), and other recent historical crises and events, on *The Guardian's* online site (http://www.guardian.org.uk).

Although we are not there yet, and very few history departments have fully harnessed the potential of ICT to improve teaching and learning in history, over the next few years, it seems likely that there will be a tendency for pupils to express a preference for history courses in which there is effective integration of ICT based resources and activities, and that departments which do not explore the potential of ICT will find that their courses are less popular.

Because the relationship between technology, learning and subject disciplines is a complex one, it takes time to assimilate ICT into pedagogical practice. In spite of Warhaftig's opening assertion, we *are* gradually working out "what to do with all this stuff". Given time, support and appropriate facilities, it is likely that over the next few years, nearly all history teachers will make increasing use of ICT, not because they feel under pressure to do so, but because they enjoy doing so, because it makes their job easier, and because they feel that it helps them to teach history more effectively.

The appendices attached are an attempt to show some of the ways in which ICT has been used in school history in the UK. They are not put forward as models of best practice, but as examples of the sort of instructional design that attempts to get pupils to do historically worthwhile activities with the historical sources they have accessed using ICT. In some cases the materials for the activities themselves have been attached, in others, examples of work deriving from the activities, and in others, simply a description of the activities.

Appendix 1. Using the Internet to access multiple perspectives on the past

The Internet has made it very easy for history teachers to get hold of differing interpretations of historical events and personalities. Reuben Moore (2000) provides a good example of the use of the Internet to set up a well structured interpretations exercise by selecting three contrasting reviews of the film *Michael Collins*, and then using the following simple table to structure the pupil activity that stems from the three sources. This activity demonstrates that effective "interactivity" is not about the volume of information which is "shifted", but about the selection of appropriate sources, and the quality of the questions asked of them.

Michael Collins 1

A review of the film *Michael Collins* by Roger Ebert, in the Chicago Sun Times
http://www.suntimes.com/ebert/ebert_reviews/1996/10/102509.html

"History will record the greatness of Michael Collins," the Irish President Eamon De Valera said, "and it will be recorded at my expense." Yes, and perhaps justly so, but even De Valera could hardly have imagined this film of Collins, which portrays De Valera as a weak, snivelling prima donna whose actions led to decades of unnecessary bloodshed in and over Ireland.

Michael Collins paints a heroic picture of the Irish military leader who signed a treaty saying it was the best we could hope for at this time.

Was De Valera really responsible for all these tragic consequences? Some argue so but others will find *Michael Collins* in need of an Irish villain to balance the British enemy. The film makes De Valera into

a much more devious man than he was. The film suggests that De Valera was aware of the plot that Collins was to be killed.

- **The film falters with the unnecessary character of Kitty Kiernan (Julia Roberts) who is in love with both men, but even though Kitty was a historical character, we never feel the scenes are necessary; they function to give the audience what they want, not as additional drama.**

Michael Collins 2

The summary of *Michael Collins* from the company who made the film
http://michaelcollins.warnerbros.com/cmp/welcome.html

- **Neil Jordan's epic portrayal of the life of Michael Collins has won the Venice Festival's Golden Lion award.**
- **In Ireland, where national pride is a passion close to religion and romantic love, one man became a legend for his fierce devotion to his land and its independence. Liam Neeson stars as Michael Collins in a story about the real life patriot whose bravery and dedication to the Irish people changed history as it made him into a legend. It would cost him his life but would make him a hero of the ages.**

Michael Collins 3

A perspective from a group of American politicians
http://www.geocities.com/CapitolHill/Lobby/5598

In 1996, the movie *Michael Collins* was released. A very fine picture in many respects, we believe it was seriously flawed by the inaccurate and unfair portrayal of the great Irish leader, Eamon De Valera.

- **De Valera was one of the greatest leaders of this century; a man who stuck to is faith, a man of principle, a man dedicated to peace and justice, a soldier who fought for freedom, a man who followed his conscience.**

Table 1

Interpretation number	Did the writer think the film was good?	Why did the writer think it was good/bad?	Why was each interpretation written?	In what ways has this affected how it was written?
1	–	–	–	–
2	–	–	–	–
3	–	–	–	–

Moore, R. (2000) Using the Internet to teach about interpretations in years 9 and 12, *Teaching History*, No. 101: 35-9.

Appendix 2. The use of the word processor to help pupils to organize and classify information

The *provisionality* of word-processed text allows the student to experiment, rearrange, reconsider and re-plan work without laborious and time-consuming transcription. Tables are a helpful mechanism for organising into categories. Bold, italic or underline can be used to differentiate between narrative and analysis, situation and event, fact and opinion, tangential or essential, long or

short term causes. Once organized into tabular form, information can be inserted into writing frames as a form of "scaffolding" which leads students into the art of essay writing in analytic and discursive mode. Work can also be differentiated for students of differing abilities, by providing graded versions of exercises. In the same way that data-logging software helps science students to spend more time focusing on the interpretation of data rather than spending time laboriously constructing graphs by hand, the word processor enables history learners to spend more time on "high order" thinking, and the *patterns and relationships* between pieces of information, as against laborious transcription of information.

Word processing and the causes of the English Civil War

The National Council for Educational Technology (NCET) and Historical Association project produced a set of activities and resources for teaching history topics through the use of word processing exercises. These included the events of 1066, the causes of the English Civil War, change agents in the Industrial Revolution, and a comparison of civilian experiences in England, France and Germany in World War Two. The package provided a set of disks containing the activities and resources for a range of word processing packages, and a teacher information booklet. (NCET/H/A, 1997)

The exercise on the causes of the English Civil War was an adaptation of a "card-sort exercise", where pupils had been asked to place various statements about the causes of the war into four columns according to whether they were irrelevant, not very important, fairly important or very important, as factors leading to the outbreak of war. (See Fig. 1)

Figure 1. The basic level text file

Charles' wife was French	Many people feared that Charles favoured the Catholics too much.	Charles spent a lot of money on paintings, his family and the expenses of the royal court.	In 1626, parliament refused to raise money for the king.
Charles' wife was a Catholic. He had children through this marriage.	Charles was very fond of dogs, particularly spaniels.	Charles was only 4 feet 7 inches tall.	In 1625, England fought an unsuccessful military expedition against Spain.
In 1634 Charles extended the use of an unpopular tax called "Ship Money."	In 1628, a military operation against France was a failure.	Ever since Henry VIII had been king there had been problems over religion in England. It would be difficult for any monarch to please everyone in England over religion.	In 1640, Charles fought a war against the Scots. He had to pay them money to maintain their armies while they occupied two counties in Northern England.
There were long term money problems in England which went back to the days of Elizabeth I. Anyone who was on the throne would have to raise more money in taxes.	Some textbooks suggest that Charles firmly believed he should keep all the real power of ruling the country to himself and that no-one had the right to question his decisions.	In 1642, Charles tried to arrest some of parliament's members and put them in prison. This caused riots and demonstrations in London. Charles left the city to raise an army to fight parliament.	Some textbooks suggest that over the previous 100 years, the power of the monarch declined (fell). These books also suggest that many people began to feel that parliament should have more power.

Pupils were also provided with a file which explained the rationale behind the exercise, and some contextual information. (See Fig. 2)

Figure 2. Rationale and contextual information

Why did a civil war break out in England in 1642?

If you look in history textbooks, more than one cause is usually given for the outbreak of the civil war in England in 1642. These are some of the causes which are often mentioned:

Charles I – The personality and beliefs of King Charles I
Money – Charles kept asking the English people to pay more taxes
Religion – There were serious disagreements over what should be done about religion at this time
Power – There were disagreements about how much power the king should have
War – Problems caused by wars with other countries

But which of these causes was most important?
Were there any connections between them?

To what extent was the outbreak of the civil war the fault of Charles I?

For nearly all the period between 1066 and 1642, the people of England accepted that they should be ruled by a king or queen. Why did this change in 1642?

Things to bear in mind:

Most people in England at this time did not like Catholics or people who might want to support or favour them.
Most people did not like having to pay higher taxes.
Wars cost a lot of money. Losing wars tends to make those who choose to fight them unpopular.

For less able pupils, a file providing a writing frame was provided (see Fig. 3). Having been previously asked to classify factors by using different text formats (bold, italic, underline, etc.); they then simply had to paste the sections of text into the appropriate paragraphs. The word processor thus provided "scaffolding" to help the pupils to organize their thoughts, and to move from a chronological to a thematic structure.

Figure 3. Writing frame for less able pupils

There were some long-term problems between king and parliament even before Charles came to the throne... (Insert text marked **bold**)

Many of these problems got worse during the course of Charles' reign. Religion was one such problem... (Insert text marked *italic*)

Money was also a problem... (Insert text marked underline)

Things were made worse by conflicts with other countries... (Insert text marked in CAPITALS)

How Charles was, as a person, also caused problems... (Insert text marked in Comic Sans font)

The last straw was when... (Insert text marked in Arial font)

In adapting the initial card-sort exercise for word-processing format, three levels of information were devised. The first level (see Fig. 1) was devised for use with younger high school pupils (in the UK, as part of the National Curriculum for History, pupils will study the causes of the English Civil War as 12 or 13 year olds). The intermediate level (see Fig. 4) adds to the complexity of the

exercise by providing pupils with 32 "boxes" of information about the causes of the Civil War, as against 16. The highest level was not in the form of text boxes, but a narrative of about 1,000 words, bringing out some of the historiographical debates and complexities surrounding the outbreak of the war, and was seen as being more appropriate as extension work for more able pupils, or for undergraduate work.

Figure 4. The intermediate level text file

In 1642, Charles went to the House of Commons with armed guards to try to arrest 5 M.P.s. They had already escaped.	In 1629, parliament criticised the king for allowing Catholics to sit at court, and for raising money without its permission.	Throughout his reign, Charles spent a lot of money on paintings, his family and the expenses of the royal court.	In 1626, parliament refused to grant the king more money for wars against Spain and France.
Charles' wife was a Catholic.	Charles was shy, quiet and had a bad stutter.	Charles was only 4 feet 7 inches tall.	Charles' wife was French.
In 1634 Charles imposed an unpopular new tax called "Ship Money."	Charles was sometimes indecisive, sometimes stubborn.	Charles was very fond of dogs, particularly spaniels.	In 1640, the Scots invaded England and refused to leave unless they were paid £850 pounds a day.
In 1638, Charles ordered the Scots to change the prayerbook they used in church services, and use the English prayerbook.	In 1637, Charles had some of the Puritans who opposed his religious policies mutilated (their ears were cut off).	In the summer of 1642, having gathered together his supporters, the king raised his standard at Not-tingham and declared war on parliament.	Some of Charles' main advisors, Buckingham, Strafford and Laud, were very unpopular with the people.
In 1628, Charles went to war with France and lost.	Throughout his reign Charles let Catholics attend his court.	Later in 1638, the Scots rioted and rebelled against Charles.	In 1639, the king raised an army to attack Scotland. It lost.
Later in 1629, Charles dissolved parliament and ruled without one for the next 11 years.	In 1640, there was a rebellion in Ireland. Some protestants were killed by Catholics. Charles has to think about raising an army to put down the rebellion.	In 1641, Charles had to go to parliament to ask for more money to pay the Scots and to raise an army to fight the Irish. He has to agree to give more power to parliament to get them to agree to this.	After the attempt to arrest the 5 M.Ps, there are riots and demonstrations against the king in London. He leaves for Oxford to gather support.
Some textbooks suggest that from about 1550 A.D, onwards, more and more people thought that parliament should have more say in the running of the country.	Charles' father, James Ist had been an unpopular king and many people thought of them as foreigners as they had come from Scotland.	There were big divisions over religion in England, between Catholics, the Church of England and the Puritans. No one could please them all.	There were long term money problems in England which meant that anyone who was on the throne would have to raise more money in taxes.
Charles made religious changes which were very unpopular with many people throughout England, Scotland and Wales.	Charles tried to rule without a parliament for 11 years, from 1629 to 1640, because they refused to raise extra taxes for him.	In 1625, when he came to the throne, Charles carried on a campaign against Spain. It was a disastrous defeat.	Some textbooks suggest that Charles firmly believed he should keep all the real power of ruling the country to himself.

Students were also given a range of "task files", which varied according to the level they were working at, where they had to copy and paste or drag and drop information into appropriate boxes or spaces. At the more basic level, this involved discerning between situations and events, classifying into financial, religious, foreign policy and "Charles as a person" factors; deciding which boxes were mistakes made by Charles, and which were factors beyond his control, and separating long and short term factors. Irrelevant statements could quickly be deleted, crucially important ones put in bold text and so on. In terms of the ease with which text can be manipulated and re-ordered, the word processor leaves more time for students to think about the history, rather than transcribing information. They are also obliged to do something with the information, beyond simply accessing and downloading it.

The thinking behind the activities was to try to ensure that students had to think about the information and process it in some way, usually in discussion with fellow students. The students had to do something with the information after they had accessed it, to make some decisions about each box in terms of its status and its position in the argument about what led to the war. Was it Charles' fault? Was it really about the divine right of kings? If there were more boxes or text about religion than other factors, did this mean that religion was the most important factor in the outbreak of war? Which boxes would a Marxist historian tend to prioritise, or a Whig Historian?

Another dimension for the exercise is for the teacher to "change the boxes" or provide additional information about historians' views on the causes of the war. More recent historiography in this area (see for instance, Cust and Hughes, 1997; Bennett, 1998; Coward and Durston, 1997) suggests that even the title "The English Civil War" is inappropriate, and might more accurately be referred to as "The War of the Three Kingdoms" or "The War of the Atlantic Archipelago". 13 The boxes which refer to the rise of the middle class and the king's belief in divine right would be regarded as quaint fiction by some modern historians, but run across most of the standard high school textbooks in the UK. This can help students to grasp that although there is little disagreement over the main sequence of events leading to the civil war, there are differing interpretations of what *caused* the war, and that these interpretations have changed over time.

Evaluation of the project suggests that the curriculum materials did provide at least a starting point for getting history teachers to explore the use of ICT in their teaching. Over 2,000 copies of the word processing materials have been sold (the total number of high schools in the UK is approximately 3,700). This is not to say that they are all in regular use, or that levels of knowledge and understanding of the causes of the civil war in UK schools have been radically transformed by this initiative. It has helped to move history teachers beyond using word processing for getting pupils to produce a neat version of work which they have already handwritten, and, as intended, it has led to the process of adaptation of the ideas in the examples provided to other historical contexts.

NCET/H/A (1997) History using IT: Improving students' writing in history using word processing, Coventry, NCET.

Appendix 3. Using the Internet and CD–ROMs to get pupils to think about which sources are helpful for answering particular historical questions

The Holocaust: what questions do we ask?

There are many ways of approaching this important and sensitive topic. We must not, however, make the assumptions that all our pupils either know about the Holocaust, or share adult perceptions of its importance. One danger is that it can be done in a way which leaves pupils thinking that it was something which happened many years ago, which has nothing much to do with their lives. Another is that pupils think that the Holocaust was just about the concentration camps, and was caused, fairly unproblematically, by the personal wickedness of Adolf Hitler. If teaching focuses mainly on the camps, and The Final Solution, some of the pertinent and relevant questions about the Holocaust may not be posed. Another problem about teaching the Holocaust is the limited amount of lesson time which can be devoted to what is a very broad and complex topic.

The aims of the following approach are to use the resources made accessible by ICT to get pupils to think about the Holocaust in broader terms, to challenge their ideas about its causes and the questions it raises, to get them to think about the issues raised outside the classroom, after they have finished the taught sessions, and to realise that many of the questions raised by the Holocaust are relevant to the lives they will lead.

The first part of the lessons is to ask pupils what they know about the Holocaust, and what images they think of when they close their eyes to think about it. How much and what they know will obviously very from group to group, but there will be few classes where none of the pupils have any knowledge of the Holocaust, and few where the camps and "The Final Solution" are not at the forefront of their thinking about the Holocaust. (An alternative approach is for the teacher to provide some of the more well known images of the camps – "Arbeit macht frei", the gates and railhead at Birkenau, on OHP or PowerPoint, before asking what pupils know. Images can be accessed from http://www.remember.org/image/index.htm.)

The next stage is to ask the pupils why they think that study of the Holocaust has been made a "compulsory" topic of study, why young people should know about it, and what questions we might ask of the Holocaust. The amount of teacher "prompting" will vary from group to group, but most groups should be able to come up with a list similar to the one in Table 1 (I am not suggesting that this list is definitive).

The next stage is to for the pupils to watch some video footage on the concentration camps. The last 30 minutes or so of *The World at War* is one possible option, containing as it does, a brief excerpt

Table 1. The Holocaust: what questions might we ask of it?

- Is the Holocaust 'special' or different in some way from other events in history; if so, why, what is its significance?
- To what extent can a study of Hitler and his policies explain the Holocaust?
- When did the Holocaust start?
- To what extent is it about Germany and German history?
- To what extent is the Holocaust about the Jews?
- Why didn't other countries do more to stop it?
- Why did ordinary "educated" people do terrible things?
- To what extent was it unique or different from other twentieth century genocides?
- To what extent was it about eugenics and 'the efficient society' and what messages does that have for us today? Is it possible to value people differently and yet still treat them equally?
- How can people deny the Holocaust when there is so much evidence to support it?
- Should it be illegal to deny the Holocaust, as in Germany?
- What does the Holocaust tell us about human nature and the human spirit?
- Are some questions about the Holocaust more important than others?
- Could it happen again – in Germany or England, or elsewhere?

from a Nazi "public relations" documentary about the camps, but any programme which provides a substantial section on the camps would do.

The pupils are then referred back to the list of questions about the Holocaust, and asked "Which questions does this source (the video extract) help us to answer?" Most footage of the camps provides evidence of the reality of the Holocaust, and helps us to understand the scale of the camps, and what happened to the people in them, but is of little or no use in answering many of the other questions in Table 1. This helps to make the point to pupils that if we limit our study of the Holocaust to what happened in the concentration camps, it will limit our understanding of some of the important and relevant questions which the Holocaust poses.

The next step is to provide pupils with, or direct them to, a more wide-ranging collection of sources on the Holocaust (see Table 2), using the resources which can be accessed via the Internet (and CD-ROMs if available). The pupils are split into groups of between four and six pupils. Each pupil within the group is given an article to read, take notes on, and report back to the group as a whole. If you have eight articles/sources which address different facets of the Holocaust, give two different sets of four sources to adjacent tables and ask them to feed back to the adjacent table after the first round of feedback. The pupils are asked to consider which of our questions about the Holocaust their source is useful for, and what are the possible problems and limitations of the source as evidence. The reading and preparation of the summary of the article can be done either in class or as a homework. The articles offer a broader or more eclectic approach to the topic than it is possible within the constraints of most textbooks, and the aim is that the exercise will have disturbed their thinking about what the Holocaust is about, and that long after the taught sessions are over, pupils will think about some of the issues arising from the articles, including those which may seem "tangential" to the Holocaust itself, but which are relevant to the society they will grow up in.

Table 2. Dimensions of the Holocaust: what questions do we ask? ICT based resources

The following articles have been selected because they address aspects of the Holocaust which are not related specifically to the concentration camps, and because they address some of the questions in Table 1. They have been selected by using http://thepaperboy.com, http://www.remember.org, http://www.annefrank.ne, and http://vector.cshl.org/eugenics. You could obviously use many other Internet sources and CD-ROMs, such as *Lest we forget*, and *Anne Frank House*, and there is also a collection of quotes related to the Holocaust which can be accessed at http://www.uea.ac.uk/~m242/historypgce/hol.

- *The Scientific Origins of Eugenics*: http://vector.cshl.org/eugenics
- *Revealed: why evil lurks in us all* ("Study shows that crude loyalty to our social group and blind obedience make tyranny possible anywhere"). An *Observer* article by Martin Bright: http://www.guardian.co.uk/Archive/Article/0,4273,4106805,00.html.
- *We all have blood on our hands* ("The Holocaust Memorial day should remind us not only of German depravity, but of all genocidal campaigns everywhere.") *Will* Hutton, *Observer*, (21 January 2001): http://www.guardian.co.uk/Archive/Article/0,4273,4120705,00.html.
- *No way back* ("Europe is anxious about the rise of neo-nazism, but, argues Ian Kershaw, Hitler's biographer, history will not repeat itself, particularly in today's Germany"), Guardian, 30 September 2000.
- *Elderly neglected by NHS* ("Ministers told to act on health discrimination"), David Brindle, Guardian 8 November 1999.
- *Lipstick in Belsen*, (Lieutenant Colonel Mervin Willett Gonin) Guardian, 13 June 1998).

- *In the Stasi archives* (Matthew Reisz, review of Timothy Garton Ash, The File: A Personal History, Guardian, 3 July 1997).
- *Why history matters* (Reflections on the Irving Trial, D.D. Guttenplan, Guardian, 15 April 2000).
- *Survivor brings Holocaust home to roost* (Alex Duval Smith, French complicity in the Holocaust).
- *Two tribes go to war* (Peter Beaumont, review of *"We wish to inform you that tomorrow we will be killed with our families"*, Gourevitvch, P., Observer, 14 March 1999).
- *Let's pretend that life is beautiful* ("Why do we use the story of Anne Frank to tell a story about the essential decency of human beings?" Karpf, A., review of 3 Anne Frank biographies, Guardian, 3 April 1999).
- *Master race of the left* ("Forced sterilisations in Scandinavia have shocked the world...", Freedland, J. Guardian, 30 August 1997).
- *The everyday face of evil* ("It may be comforting to think that the Gestapo were hated and feared by most Germans, or that the Nazis were a short-lived phenomenon, but it is not the truth", Brown, M. Guardian, 9 September 1997).
- *Apocalypse then* (Lezard, N. review of "Exterminate all the brutes", Lindqvist, S., Guardian, 23 January 1999).
- *Myth and memory* ("Britain's first Holocaust Memorial Day – but why has such a laudable event stirred up anger and protest", Cesarani, D., Guardian, 24 January 2001).
- *The most dangerous man in the world* (Report on the controversial views of Australian philosopher Peter Singer, Guardian, 6 November 1999): a long article which might be appropriate for particularly able or well motivated students.
- *Couple jailed for neglect of 5 children* (The right to found a family is one of the articles of the UN charter of human rights, but should all adults have the right to have children, and in what circumstances might they forfeit the right to have children? Guardian, 21 March 2000).
- *Humanity among the horrors* (An interview with Tzvetan Todorov, author of *Facing the Extreme*, 2000, London, Phoenix, a book about the moral dilemmas of prisoners in the camps, Guardian, 26 February 2000).
- *Germany fears Superman's return* ("Philosopher unnerves nation with call to weed out the weakest", Observer, 10 October 1999).
- *Poland's willing executioners* (Account of anti-Semitic atrocities in Poland, Observer, 8 April 2001).
- *A chance dialogue with a contemporary Nazi* (Account of a 7 hour train conversation which a traveller had with a Neo-Nazi on a train journey from Berlin to Katowice in 1995, from the Cybrary of the Holocaust website, http://remember.org/educate/munn.html).
- *"Nobody was gassed at Auschwitz": 60 Rightist lies and how to counter them*; another source from the Cybrary of the Holocaust website, http://remember.org/ideas/kz.html.

The articles noted above are merely suggestions, and possible starting points. Another way of using The Paperboy site is to explore different newspapers' reactions to the same event – the decision to have a Holocaust Memorial Day, the events and reaction to the events of September 11th, the debate about whether there is such a thing as "The British Race."

The hope is that at the very least, the exposure to very different perspectives on the Holocaust will lead them to reappraise their ideas on what the Holocaust was about, its relation to the present, and to the lives they will lead.

From Haydn, T. and Counsell, C. (2002) History, ICT and Learning, London, RoutledgeFalmer

Appendix 4. The use of PowerPoint and the Internet to get pupils to problematise historical, events and personalities with regard to issues of interpretation, significance, and controversial issues

In the UK, there has recently been a national vote as to who have been the 100 greatest Britons of all time (figures in the top 10 include people as disparate as Oliver Cromwell, Charles Darwin, Isambard Kingdom Brunel, Princess Diana, William Shakespeare and Queen Elizabeth the First).

Pupils are given time to search for materials from books, newspapers, magazines, textbooks and the Internet and asked to "present a case" for either one of the 10, or their own choice, and make a PowerPoint presentation of it.

Either before or after pupils have presented their choice, they can be given Geoffrey Partington's criteria for "significance" (see below) in order to argue for their choice.

Alternatively, pupils can be given a list of events in World War Two (the dropping of the bomb on Hiroshima, the Battle of Britain, El Alamein, Stalingrad, the battle of the Atlantic, etc.) and asked to decide which of them was most significant, and why, using PowerPoint to frame their response.

Criteria for determining historical significance, Partington, G. (1980) the idea of an historical education, Slough, NFER: 112-116

1. Importance – to the people in the past.
2. Profundity – how deeply were people's lives affected?
3. Quantity – how many lives were affected?
4. Duration – for how long were people's lives affected?
5. Relevance – contribution to increased understanding of present life.

Alternatively, pupils focus on controversies of interpretations, or produce "polemics" to argue points of view from controversial issues and the help that historical procedures can play in resolving them.

Appendix 5. The use of datafiles to search for patterns in the past

In 1998, the National Council for Educational Technology, working with the Historical Association, put together a package of historical datafiles on topics which were part of the National Curriculum for History in the UK.

The package was subsidised by funds from the Department for Education and Employment, as part of an effort to get history teachers to make more use of computers in their teaching. (*History Using IT: Searching for patterns in the past using databases and spreadsheets*. It is available from BECTa, Milburn Hill Road, Science Park, Coventry, CV4 7JJ, price £15.) The package contained a teachers' booklet with supporting materials on how to use the datafiles, and disks with the datafiles, in a variety of software formats commonly used in UK schools (including the Microsoft package, Excel).

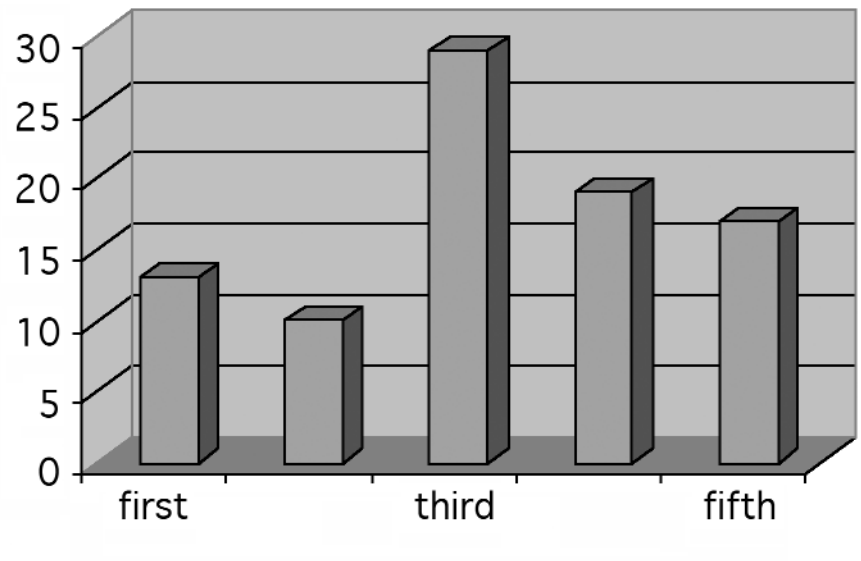
One of the datafiles provides a list of Roman emperors, with the duration of their rule, where they came from, and how they died. By interrogating the datafile, pupils can see that at certain points,

the Roman Empire was much stronger and stable than at others, and more or less prone to internal/external threat. The use of the datafile makes it much quicker and easier to discern such patterns than simply looking through the long list of emperors, and pupils can construct and present graphs and charts to present their findings. (See Figures 1 and 2)

Figure 1. The fate of Roman Emperors

Century	Cause of death			
	Natural Causes	Murdered	Suicide	Killed in battle
First	5	6	2	0
Second	5	4	1	0
Third	5	18	2	4
Fourth	9	7	1	2
Fifth	9	7	0	1

Figure 2. Number of Roman Emperors per century



Appendix 6. Using the Internet to develop pupils' information and media literacy

A recent (small scale) survey found that not all young people in the UK had a clear awareness of the reliability of the Internet as a source of information. Many of them saw "electronic" resources, such as CD-ROMs and the Internet, as more trustworthy than such sources as teachers (!), newspapers, television and radio.

The realization that many young people do not have a sophisticated understanding of the status of information on the Internet has led to the development of a number of sites which can be used to develop pupils' "Internet literacy." One example of this is a 'spoof' site, about Oliver Cromwell, which at first glance, appears to be a *bone fide* educational site on Cromwell (http://freespace.virgin.net/susan.inwards/index.htm). The site was designed to make a point about the integrity of information

on the Internet, and about the practice of uncritical downloading of information. The author was deluged with e-mail requests from students asking him to write their assignments for them.

Several sites have moved beyond simply teaching learners how to search for information on the Internet, and into educating them in evaluating the reliability of information on the Internet. See, for example:

- http://www.2learn.ca/mapset/tutorials/tutorial.html#evaluate
- http://www.ariadne.ac.uk/issue16/digital
- http://www.trinity.manchstr.sch.uk/curric/history/relnet/relianet.htm

There is also a site which explores the ethics of using resources on the Internet "Some advice and a lecture for those of you doing research, homework or whatever" – http://www.geocities.com/SoHo/Studios/1344/advice.html.

Appendix 7. The development of "depth" sites with improved instructional design

There has been a move towards devoting more time and thought to the instructional design of history Internet sites – thinking about what the learners can usefully do with the historical information once they have accessed it.

Whereas the history teacher, or department typically has a very limited budget and limited time to plan how to resource and teach particular topics, many history Internet sites are able to spend thousands of pounds, and hundreds of hours thinking about how to approach teaching a particular historical topic in depth, and about how to enable effective learning to take place. The key thing which these sites have in common is that at least some aspects of the design requires learners to think, and make decisions or "intelligent choices" in relation to the historical information presented.

- The Public Record Office Learning Curve site on The Cold War: http://www.learningcurve.pro.gov.uk/coldwar

A good example of the lessons that have been learned in the field of web design and learning over the past few years. Makes the point that the quality of the history is at least in part related to the questions posed of the content and the instructional design of the site. Based around six key enquiry questions and case studies of different events from the cold war. Much of the content could be printed off and used in class, or for homeworks, but the multimedia components are well chosen, for where facilities permit "hands on" use, or whole class demonstration using a data projector.

Appendix 8. Digital video editing of historical newsreel materials

Still in its infancy in the UK, but possibly an area for substantial development. Several news organizations in the UK now make collections of old history footage available to schools "online" as a subscription service. Pupils can therefore watch archive footage of major events in the twentieth century, and then use digital video editing software to choose which parts of the footage to keep in their own version, add their own commentary, captions and soundtrack, and experiment with changing the "bias" or 'position' of the constructed digitally edited film which they have made from the original sources.

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