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The Impact of Computing in Education in Europe

Betty Collis
Contributing Editor

Introduction

Computers and computer related media are well established in the educational institutions of the twelve countries of the European Community: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom. Extensive experience related to computer use has accumulated within the school systems, in institutes of higher education, in training situations, and in situations involving more open and flexible learning occurring inside and outside of traditional educational institutions.

In this article, decades of experience in 12 countries cannot be adequately summarized. Instead, we will look selectively at a few aspects of the European experience with computing in education that may particularly highlight its characteristics, both those shared with many other settings with regard to the implementation of computer-related resources in education, and those which may be unique to the European Community setting. First, we need to establish some basic terminology and frames of reference for the article.

Information Technology in European Education: The Frame of Reference

In this article, when we speak of Europe, we will restrict ourselves to the 12 member countries of the European Community (EC). This will exclude the Scandinavian countries (other than Denmark) as well as other countries with extensive educational computing experience, such as Austria, Switzerland, Malta, and to a lesser degree Turkey and Cyprus. We similarly exclude the countries related to the former Soviet Union. Also, we will not speak about "computing" in education, but rather "information technology" (IT), as

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this is the designation most commonly used in the EC to refer to the broad category of environments in which a computer is an integrated part, used for mediating direct interaction between the user and some target.

Computer hardware and software environments in European countries are, in general, nationality based. Most countries have their own companies making MS-DOS-based computers and these are the kinds of computers that are, for the most part, found in schools. There is a shift from the XT- to the AT- type, following general shifts in the market. Generally, 286 processors are common. There are, of course, exceptional cases where powerful educational computing environments exist. At the University of Twente, for instance, networked PC's with Windows, Apple Macintosh II's, and Unix workstations are plentiful.

Information Technology can be more specifically defined as information processing technology combined with other technologies, such as video technology and telecommunication technology. Given the technological convergence of computers with other media, with information sources, and with communications media, the term "computer" is not used synonymously with this broader domain of IT.

The term technology, as used in Europe, refers not only to hardware and software, but also to processes and approaches. Thus, information technology in the European educational context refers as much to the strategies, processes, and understandings needed to work with information in a learning context, as it does to the channels and equipment through which this work is mediated.

Informatics is the label used for an area of study defined as the science concerned with information processing, similar but broader than that of "computer science" in North America schools. Telematics is the term used in some (but not all) of the EC countries to describe the intersection of informatics and telecommunications. The term "education" is also very broad. Within these definitions, therefore, what are some of the significant aspects of IT in education in the European Community?

In this article, we will comment on the following: (1) To what extent is IT part of the curriculum in EC elementary and secondary schools? (2) What are some of the major EC-level initiatives relating to IT in schools? (3) What are the highlights of policy and practice in selected EC countries with respect to IT in schools? (4) What are the major initiatives relating to IT use in post-secondary education and training? and (5) What are seen as major European challenges and opportunities with respect to IT in education? Selected references related to these questions are cited at the end of this article.

1. To what extent is IT part of the curriculum in EC elementary and secondary schools?

The educational systems in the EC countries are organized in different ways. Typically the term 'primary' education is used to refer to schooling for students 6 to 12 years of age, and 'general' or 'secondary' education to refer to schooling for students 12 to 18 years. We will use this designation, although it does not always fit a particular country. Also, vocational education is much more broadly developed in Europe than it is in North America and often begins early in the secondary education period. However, the relationships among vocationally oriented secondary education, vocational training, higher vocational education, and training are very difficult to describe and vary considerably among the EC countries. Thus, here in Questions 1, 2, and 3 we do not refer to the many secondary schools specialized for vocational education in Europe but only to the "general" secondary schools.

Primary Education

In all the EC countries, activities using IT are taking place in schools with students in the age range of 6 to 12 years old. However, there are differences in the type of activities, their compulsory or optional nature, and their presence in national or regional curricula (when these exist) or within curriculum projects of the individual school. Only in the UK and Denmark is IT compulsory in some way in primary education. In the UK, particular emphasis is given to IT among the "attainment targets" for the subject of Technology and also within the attainment targets for other subjects. In Denmark, IT is a compulsory subject for all primary students as well as being integrated into the context of other subject areas. In The Netherlands and Ireland, schools have a high degree of autonomy in establishing their curricula and practice; thus while IT cannot be compulsory, it is extensively being utilized by individual schools. In many of the EC countries, IT-related activities are highly recommended by the ministries or inspectorates of education. Most EC countries have had large-scale pilot studies investigating IT use in primary education. In Germany, however, the government has declared that IT should not be systematically offered in primary (basic) education, "at least not for the time being" (policy from 1987).

The majority of experiences with IT with 6–12 year-old students occur relative to basic language and mathematics skills. All EC countries have developed activities relating to IT and basic language and mathematics skills, either experimentally or on a compulsory basis (in the UK). Ministries establish methodological guidance and materials and send them

to the schools as examples of good practice. The types of activities which are most frequent are familiar and include exercises to improve written communication and comprehension; drill and practices activities, particularly to improve spelling; and the use of LOGO in the context of geometry (particularly in Luxembourg, Belgium, and Ireland). Word processing software is commonly used. Most activities take place with computers clustered in a separate room, although in some countries a computer may be found in the occasional primary classroom or the school library.

Interesting innovative work also occurs with IT use within geography, history, environmental studies, and science education in primary schools, but on a scattered and experimental scale in most countries. Luxembourg has particularly interesting examples, with many of its primary schools connected to the national telematics network and making use of it for science and geography assignments. Only in the UK is IT included within compulsory programs of study for science in primary schools. Some of the activities in which primary students are required to engage in are: the use of computers and simple electronic devices in their experimental work; the capture, transmission, storage, and retrieval of information using computers and sensors; the investigation of simple electronic circuits for measuring, switching, and control; and the construction of circuits which illustrate AND OR and NOT gates.

Secondary Education

In most of the EC countries there is a subject dedicated to the teaching of informatics during general secondary education. In some countries this subject is compulsory (Denmark, Dutch-speaking Belgium, the UK, Luxembourg, Greece, and The Netherlands); in other countries it is optional. In Germany "basic education in IT" for all students of ages 13–15 is called for, but through integration of IT into existing subjects. The most frequent age for a specific IT course is 14 years. In all cases, informatics includes the study of the computer as a tool, and general-purpose programs (mostly word processors and data bases) are studied. Programming in higher-level languages is often compulsory. Integration within subjects other than informatics also takes place in all the EC countries, although in most cases only on a recommended basis. Mathematics is the subject area in secondary education with the most frequent application of IT, with particularly strong recommendations for its use in France. Most EC countries indicate some use of IT in secondary science subjects, with compulsory applications in various subjects in the UK, Denmark, and The Netherlands. Methodological references are made to IT use with respect to language study in a number of the EC countries. IT is less used within geography and the social sciences, with the exception of Denmark, although various projects can be cited in a number of the countries, often involving databases and telematics. In general, IT use in secondary schools, as in primary, occurs in a separate computer room.

In summary, although IT is taught as a secondary-school subject in all the EC countries, its integration in other subject areas is not uniform. As an overall trend, there is an increasing focus on the instrumental use of IT in education and less interest in programming than had been the case in a number of the EC countries in the past.

2. What are some of the major EC-level initiatives relating to IT in schools?

The Commission of the European Communities, although not having any direct influence on the educational policy and practice of its member states, sponsors many activities to help the introduction of IT in European education. These activities often have to do with information exchange and dissemination. The Commission arranges for national policy coordinators (NPCs) for "New Information Technology" in education, and other senior policy-makers and their advisors, to meet frequently. Besides this human network, a network of information centers, called the EURYCLEE network, was set up in the 12 EC countries. This network links existing centers, nominated by the Minister of Education in each EC country. Its role is to provide and exchange information about each country's strategies concerning the introduction of new technologies into education. Organizational and financial difficulties have prevented the EURYCLEE network from functioning as intended, but in the period 1986–1989 a considerable amount of information exchange occurred. The problem of multiple-language translation for Europe-wide exchange of information remains significant in the 1990s.

The Commission has sponsored a number of seminars and other activities bringing together persons from each of the EC countries in relation to a specialized topic relating to IT in schools. There has been a series of "Summer Universities," often aimed at policy-makers and focused on problems and practice in introducing IT into schools of various types. Seminars have also focused on the potential impact of IT on schools, including specific seminars on word processing, interactive video systems, and electronic databases. Also, the Commission has stimulated the sharing of techniques for the evaluation of the effects of IT. Teacher training has received particular attention at the Commission level, and a number of seminars and publications have focused on dissemination of ideas for effective teacher training.

Multi-state working groups have been sponsored for the production of various resource manuals for distribution throughout the EC in order to "distill the experience of Member States and make it available to

decision makers and practitioners in all Member States." Translation and dissemination problems remain barriers. However, a very popular program to support teacher exchange visits among countries (the ARION program) is an example of information exchange through grass-roots contact.

Particular attention has been paid to the issue of portability of educational software across EC countries, through a variety of studies, reports, workshops, prototype programs, and other strategies. However, no real progress seems to have been made with respect to broadening the European market for educational software produced in any one of the EC countries. Thus, educational software remains relatively expensive and restricted to local areas in Europe; an economically attractive market for commercial educational software has not really developed.

3. What are highlights of policy and practice in selected EC countries with respect to IT in schools?

Many aspects of policy and practice could be mentioned, as innovative practice can be found in every EC country. An extensive article, for example, could be written about special IT projects in Dutch schools and, in fact, books about the projects are available. We will mention here only two broad areas: (a) national projects involving new interactive multimedia, and (b) national projects involving telematics.

After the well-known "Domesday Project" in the UK, where students contributed extensively to the development of an interactive multimedia database about regional history and characteristics, many similar projects have emerged in Europe. In Denmark, the SIULLEQ Project about Greenland, its country, people, culture, and wildlife, is one example. The Norden '90 Project involves Denmark as well as the other Scandinavian countries in the development of a multimedia database to document daily life in 15 local areas in the participating countries. The "500 Anos Despues" Project, a multimedia database marking the fifth centenary of the discovery of America by Columbus, involves partners from Spain, Italy, Portugal, and Denmark and receives funding from the Commission. The "Proefschool Nieuwe Media" Project in The Netherlands involves teacher participation in the development and implementation of various instructional materials involving interactive video, compact discs, and on-line databases for use in the study of geography.

The Education Innovation Office of the Ministry of National Education in France supports each year a variety of projects for educational applications of IT. Among those supported in 1991 were "imageware" in mathematics (interactive image manipulation) and the contribution of new technologies to the school training of top-level athletes. In particular, CD-ROM is stimulating much attention in France, where the Ministry of Education is supporting the use of many different CD-ROM titles in schools. In return, this public support for CD-ROM publishers is stimulating a strong local industry. A CD-ROM pilot project is also underway in the UK which involves a government-funded scheme to assist local education authorities in purchasing CD-ROM resources and in supporting the development of CD-ROM resources. Thirteen CD-ROM applications are under development through this scheme, including titles relating to chemistry, industrialization of Britain 1750–1900, theater, 20th-century art, medieval history 1066–1500, special education resources, and sex education.

With respect to networking, interconnectivity, and telematics, innovative projects are underway in many EC countries. Particular examples can be found in Luxembourg (making use of its RESTENA educational network), France, and Denmark.

4. What are major initiatives relating to IT use in European post-secondary education and training?

This topic could fill up several articles, but only two items will be mentioned here: (a) Commission initiatives at the post-secondary level, and (b) open and distance education and training. The Commission of European Communities has invested considerable amounts of money in the stimulation of IT research and development for applications in higher education and training. The COMETT Program supports cooperation between industry and universities for innovations relating to training in the field of technology. The EUROTECNET initiative stimulates innovation in the field of vocational training resulting from technological change in the European community. The PETRA Program is an action program for the vocational qualification of young people and their preparation for adult and working life. Implicit in this program is the intention to raise the standards and quality of technical and vocational education and training throughout Europe. IT plays an important part in all these initiatives.

Perhaps most well-known of these projects is the DELTA initiative (Developing European Learning through Technological Advance). This initiative has had a pre-pilot phase and an exploratory action and is now in a new round of activity. DELTA has involved hundreds of participants from throughout the EC countries, all involved in different investigations relative to the issues of "harnessing technology" with regard to the problems of life-long learning. The Exploratory Action phase focused on an analysis of the European market for flexible and distance learning, the design and production of learning materials, remote course delivery systems, and methodologies for the delivery of distance learning. The current initiative generally

focuses on R & D initiatives in telematics systems for flexible and distance learning and involves implementation studies and evaluations.

More generally in Europe, open and flexible approaches to training, life-long learning, and on-going professional education are of high interest. IT figures strongly in these approaches. The EuroPACE initiative, for example, utilizes satellite transmissions, teleconferencing, and other computer-mediated communication and print materials to bring high-level professional education to senior European engineers and managers. European distance education is sophisticated and well developed, with, for example, 14 members participating in EADTU, the European Association of Distance Teaching Universities.

5. What are seen as major European challenges and opportunities with respect to IT in education?

Many answers could, of course, be given to this question. Two major problems—better teacher/instructor preparation for the integration of IT in education and training, and better strategies for efficient, cost-effective dissemination of information and experience—are problems throughout the world. However, the European setting adds a dimension to these problems, *viz.*, the dimension of linguistic and cultural diversity. This dimension adds considerable difficulties to initiatives requiring cooperation or information exchange. It is, of course, not unique to Europe, as many political regions of the world consist of culturally and linguistically diverse groups. A special motivation exists in Europe, in the context of the post-1992 maturation of the European Community, to stimulate inter-country cooperation. Education will be one of the last aspects of the European setting to move from a national orientation to an European context, if indeed it ever does. Thus, the Commission appears to seek as many strategies as it can to stimulate new approaches to education and training that can involve some aspect of inter-country involvement. Open and flexible distance learning, perhaps linking learners or trainees in a "virtual classroom" through the mediation of IT, is therefore of strategic importance in the European Community context. Mapping the interconnectiveness possible through "electronic universities," distance education, and multi-country professional education programs such as EuroPACE or that run by the Berlitz Language Schools, onto local standards for accreditation and acceptance or for local support, remains a great and long-term problem.

As one step in the direction of better dealing with this problem and with other problems relating to a European approach to IT in education and training, the Commission of European Communities is establishing an electronic network for education and training. This Trans-European Network will function as a meeting and communication place among people in or wanting to utilize European education and training systems, as an information access point for a broad range of users, and as a support channel for open and flexible learning and training and cooperative work among participants from all European countries. Clearly, such a network is more than a technical infrastructure, but also a conceptual and human affair. The imagination and cooperation needed to make it work will be one of the major challenges for European education and training during the upcoming years. The involvement of information technology as a mediator for this flow of information, communication, instructional materials, and interpersonal interaction will in turn increase the need for information processing and IT-handling skill development at every level of European schooling. □

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SPECIAL ISSUE ON BEHAVIORISM

The October issue of *Educational Technology* is a special issue on **Behaviorism Today**. Guest Editor is Dr. Donald A. Cook of the Cambridge Center for Behavioral Studies. The authors and their papers in the issue are as follows:

- William N. Schoenfeld: The Necessity of "Behaviorism."
- Carl V. Binder: Behavioral Fluency: A New Paradigm.
- Ian Spence and Wells Hively: What Makes Chris Practice?
- Richard W. Malott: The Three Contingency Model of Performance Management and Higher Education.
- Douglas W. Carnine: Effective Teaching for Higher Cognitive Functioning.
- John A. Nevin: Why Pigeons?
- Robert Epstein: Generativity Theory and Education.
- Ernest A. Vargas: From Behaviorism to Selectionism.
- Kenneth R. Stephens and William R. Hutchison: Behavior Analysis and the Quest for Machine Intelligence.
- Donald A. Cook: Behaviorism Evolves.

During 1994, Educational Technology Publications plans to reprint these papers, to appear with additional material, in a hardcover book. Watch these pages for details. Several other special issues are now in press.

The Impact of Computing in Education in Korea

Unna Huh

The Need for Educational Computing in Korea

There are two major needs for computing in education in Korea. First, as the use of computers in various parts of life has increased, the need for computer professionals has increased. In this climate, in 1970, the Ministry of Education (MOE) established a plan to teach computers at the high school level. In the same year, Soong-Jun University established the department of computer science. In 1971, business high schools decided to have "general computing" as a core course and four programming courses including COBOL were provided as elective courses. To support computer education for business high schools, KIST installed computer terminals at the Duck-Soo business high school in 1971, followed by a CDC 3100 in 1975.

It was only after the 1980s that computers were discussed not in the light of development of computer professionals but in regard to the computer's role in education. Predictions by futurists about the coming of information societies brought awareness to Korean educators that there was a need to revise the curriculum by integrating computers. Several research studies done in the early and middle 1980s under the leadership of MOE and Data Communication concluded that in the future, the information industry and the dependency on the computer in every aspect of human life will dramatically increase and that without knowledge and skill in the use of computers, many difficulties in life are to be expected. This assertion was reflected in the report of the Committee on Educational Innovation and MOE's "Policies on Strengthening Computer Education."

Another influential element was that several governmental agencies felt that school computing was a prerequisite to the preparation for an information society. In 1988, the Korea Computer Institute and the

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