THE INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION

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Abstract

In the majority of the advanced countries there are many educational school networks and even more and more schools are getting equipped with multimedia computers and connected to the Internet. Through the advancements of the personal computer and the Internet, the school of the future will find new strengths in both personalised and community learning environments. The prevailing perspective for the introduction of the Information and Communication Technologies can be characterised as the "computer as a tool". However, as with all tools, effective use of the technology is embedded within practices and activities that realise its functionality for specific purposes and situations. On the other hand, the investigation of the relationship between practices, purposes, and situations and computer-based learning technologies is a major topic on pedagogic research.

Introduction

The expression "Information and Communication Technologies" refers to a series of technologies that usually include the computer and which, when combined or interconnected, are characterised by their power to memorise, process or make accessible (on screen or other support) and to transmit, in principle to any place at all, a virtually unlimited and extremely diversified quantity of data. Since these technologies are by definition new, it is not possible to take stock of their "contribution" in education. In the vast majority of cases, the application of these technologies in the school system are part of pilot projects or experiments.

The most important reason for the rapid penetration of the ICT in modern society is the great advancement of the computer technology, which results in the tremendous increment of computers' capacity and the reduction of their cost. This fact gives everyone the ability to obtain a high-performance computer at reasonable cost. In addition to this, the progress in the field of software has led to the disposal of friendly, easy-to-use and powerful applications, including general (e.g. word processors, worksheets) as well as specific programs (e.g. multimedia and virtual reality authoring tools). Hence, today is much easier to equip a school with a computer laboratory and the available software and most countries in the world are moving toward this objective.

Another accelerating factor in the use of ICT is the recent advances in the fields of multimedia and telematics applications. Multimedia and telematics comprise the hard core of the ICT. Multimedia can be considered as the combination of any two or more different media types (text, graphics, images, audio, video) and the modern multimedia PC's have shown great potential for enriched communication, bringing images and spoken words directly to the user's eyes and ears. Furthermore, hypertext and hypermedia technology uses hyperlinks in order to represent in a structured way information that could be in various media types. This technology gives the user the ability to explore the information in a non-linear format

that changes dynamically according to the user's choices. Additionally, virtual reality applications offer 3D interactive environments that can simulate real-life events and have great potential for educational purposes.

At the same time, the evolution in network technologies and telematics applications has enabled users to share information easily and efficiently across local and wide areas, using such vehicles as the Internet and the WWW. Network technologies such as SMDS, Frame Relay, DQDB, ATM and ISDN, as well as communications protocols such as RTP, RTCP and IP Multicast have been well established giving ground for interactive real-time telematics applications. Moreover, several new technologies could provide low cost broadband access in the low Mbps performance range. These technologies obviate the need to install new fibre access links to the customer's premises, either by exploiting existing analogue communications infrastructures or by using wireless access, and therefore significantly reduce the cost of provision. These new technologies include Digital Subscriber Line (DSL), Asymmetric Digital Subscriber Line (ADSL), Very high bit-rate Digital Subscriber Line (VDSL), High data-rate Digital Subscriber Line (HDSL), cable modems, electricity supply modems, mobile telephone networks, Low Earth Orbit (LEO) satellites and others.

As a result, ICT are seen to many educational authorities as a way of raising educational standards to improve the quality of education at affordable and stable costs, while addressing the new literacy targets deemed necessary in the up-coming knowledge society. Creating an environment based on these technologies in the educational sector is in itself necessary in order to educate and train a competitive work force because both pupils and adults will have to be able to function in a world and in a labour market penetrated by ICT.

The educational role of multimedia and telematics

The primary motivation for using ICT in education is the belief that they will support superior forms of learning. For this reason, theory and research in learning provide an extremely important source of ideas. Advances in cognitive psychology have sharpened the understanding of the nature of skilled intellectual performance and provide a basis for designing environments conducive to learning.

Especially, multimedia and telematics can contribute in several ways to the development of various skills and attitudes. The use of them in the learning process can actually teach students how to access and productively use information which is presented in a new and very attractive way. Multimedia communications and information retrieval skills will be necessary for the minimum level of business and professional communication. When working with multimedia and telematics applications, students are engaged in activities which develop higher order thinking skills such as problem solving, reflecting, recognising relationships, analysing and creatively synthesising information, as they deal with complex, realistic information. These tools can give students the experiences they need to be informed, intelligent decision-makers, producers and problem solving adult members of twenty-first century society.

In addition to this, the open-ended, non-linear, constructivist model of learning is very compatible with use of multimedia and telematics software. In particular, multimedia or hypermedia authoring software enables constructivist learning experiences by allowing teachers and students to create interactive lessons, multimedia reports or presentations. Furthermore, through the process of discovery, or guided discovery, the student learns facts, concepts, and procedures, in other words they learn by exploring. These applications also facilitate important educational and cognitive processes, including presentation of complex, authentic tasks, engagement in active problem solving and critical thinking, utilisation and synthesis of knowledge from a variety of domains and others. Multimedia authoring tools are inherently meta-cognitive: they help students think about thinking. In addition to this, multimedia software provides

a platform for interactive exploration, inquiry and creative application which is context-based. The context in which learning occurs (situated cognition), and the activities through it occurs have a direct and significant influence on what is learned.

Another significant point is that interactive multimedia and telematics services manage to develop students' interest in learning activities, at least for the time being. Moreover, it is not too surprising that they also increase their confidence in their abilities. In turn, this confidence of the students in themselves undoubtedly explains in part the spontaneously receptive attitude that a large number of them adopt in which technology plays a role and the perseverance that they show in accomplishing this activity. Among the reasons that contribute to student motivation there is the fact that these technologies can be as key vehicle for stimulating learning, primarily because they create environments and present content in ways that are more engaging and involve students more directly than do textbooks and more traditional teaching tools. They possess an interactive capacity and they allow students to take part in activities that invite them to create and share with others.

Furthermore, the use of these technologies don't isolate students from one another, but instead increases the relations and promotes co-operation among students in the same class and among students or classes in different schools. By participating in scientific experiments or other projects conducted jointly with students in other schools, using powerful telecommunications networks, students learn how to co-operate in order to get a job done. Consequently, they not only acquire the standards inherent in co-operation, they also actually acquire them through real situations. Furthermore, in situations where two students work on one computer can prove very positive, because it contributes in particular to developing the ability for social interaction, itself deemed indispensable for mastering certain intellectual skills and performing certain tasks. Thus, the use of ICT in the school system is likely to transform the current competitive social structure of the classroom into a more co-operative social structure.

In cases in which these technologies are used correctly in the classroom they do produce positive results and they have the potential to transform the classroom into a better and less boring environment for learning. Of all areas in which change could occur, the time students concentrate on a learning activity heads the list. The attention span or concentration that the majority of students are willing to devote to learning activities is greater when they use a new technology than they are in a traditional setting using traditional resources. Because they like working with a computer, because they can progress at their own pace and because they receive immediate feedback on what they are doing, the students remain engaged and they are willing to devote more time and energy to a learning activity on a computer.

Additionally, through these new offered technologies, teachers quickly obtain information on the availability and value of a very diverse selection of instructional resources, and also often benefit from support for their use. For example, a teacher can preview software to see if it is appropriate for students at a particular grade level or establish contact, sometimes instantly and simultaneously, between their students and experts or other students located anywhere in the world. Similarly, through advanced telematics applications teachers can gain immediate access to classes sharing a common interest in a particular topic or to educational resources which can provide them with help and ideas. Furthermore, educational projects can supply the focus and boundaries for interaction and can provide teachers with content, accompanying materials, organisational help, and technical assistance they may need to work multimedia and telematics into their curriculum and lesson plans.

Multimedia and telematics applications allow for a more individualised approach to learning. Much of the software lets students progress and learn at their own pace, and teachers become more like facilitators and coaches who tailor their assistance to the needs of the child. Part of the transfer of the information inherent in teaching is shifted from the teacher to the technological media, and the teacher has more time

to support each student in the individual process of discovery and mastery of knowledge, skills and attitudes. In addition to this, when teachers use the computer to teach, they tend to work with small groups of students or individual students rather than with the class as a whole at a given time. This allows them to develop a much more accurate and realistic impression of what the students do and do not understand and to concentrate more on students who need help.

In a context where new technologies play an important role, teachers begin to view knowledge less and less as a series of facts to be transferred and more and more as a process of continuous research in which they share the difficulties and results with their students. Successful computer-based learning technologies, such as multimedia and telematics, are a component of a larger pedagogical approach that warrants the use of technology. Viewing computer-based learning technologies as a tool or instrument implies that there exists a pedagogical approach which is well enough articulated so that the inputting, presentation, and communication facilities of the computer are realised as effective aids to student learning and performance. Just as teachers must be knowledgeable about the learning technologies they and their students are using, they must also be knowledgeable and experienced in the pedagogical approach to be taken in their classrooms. This would appear to be necessary if it is to determine how computer capabilities can be used to promote learning, and how to design computer-based learning environments.

ICT foster a positive, close association of students with the assessment of their own learning. Given the potential of these technologies, students' work can easily take other forms than that of written text, or combine various forms, and can be transmitted at any time, virtually in an instant, to examiners in another location. These technologies also allow a student's work to be reviewed as often as necessary, and allow the student as well as other people or authorised organisations to keep a copy. Furthermore, these technologies can be used to build libraries or multimedia centres that bring together examples of students' work and instruments for interpretation. These locations may also have video editing and multimedia production equipment so teams of teachers can propose other approaches to assessment of student learning to their colleagues. Finally, these technologies make possible the dissemination over computer networks of the best assessment instruments prepared by teachers and the bet work produced by students.

Case study: WWW in the educational process

A relevant example of this situation is the use of World Wide Web (WWW) by the students. In particular, students have the opportunity not only to create their own complex learning environments, but also they have the ability to present that environment to other interested parties, such as students and teacher in the same classroom, parents and friends at home, or professors at a university on the other side of the globe. The notion of the student as publisher has traditionally been seen in more conventional forms, such as book reports or class presentations. Teachers have always asked students to research a subject and then present it in either a group or individualised form.

WWW offers a new twist to this time-honoured method of teaching. Instead of presenting information in a conventional, linear format, a student can use the web as a publishing tool to create in-depth "hyper-reports", on-line multimedia projects with links leading to numerous subtopics and network connections. For example, a high school student is asked to present a "hyper-report" on assisted suicide, a subject which is both complex and multi-sided. The student could design a project where the user would begin with a basic structure in which to explore, but within that structure links could lead to subtopics for which an interested reader could continue to study. Additionally, the student may add links which will take the reader to various bioethics departments at major universities, which in turn offers a wealth of materials that could not have been completed by one student in a short amount of time.

WWW may also play a significant role in the process of collaboration between dispersed teachers and students. Because many web browsers can now interpret gopher, ftp and news commands, as well as send e-mail, it is conceivable for someone to utilise all of these services to create a multimedia/hypermedia discussion on any given subject. For educators interested in hypermedia technology, the combination of the web and other Internet technologies can be used successfully in a variety of ways. For instance, a physics teacher may organise a web site which includes all class lectures, frequently asked questions, and multimedia presentations of experiments which may utilise text, graphics, even audio. With the inclusion of a list-server, students may automatically add information to that site, whether additional questions or project reports, essays, etc. This arrangement efficiently stores important class information and organises it to allow easy access.

Conclusion

The educational potential of ICT is due to relatively recognised facts. Efficient education and training based partly on these technologies can handle larger class sizes (taken as an average), reduce the number of "classical" teacher-based lessons and still offer a more individualised learning environment adapted to the single pupil's needs. These facts indicates that an increasing part of the total budget for education and training in the years to come will be spent on using multimedia and telematics in education and training. However, in order to create breakthroughs in the way these technologies are used, there is a need to adapt the classical educational structure in schools to allow much more flexible educational patterns and combine traditional lessons with flexible blocks where students are working together or alone with computers and networks.

As a result, in Europe and throughout the world many countries have already launched initiatives to equip schools with computers, connect them to communication networks, train teachers to use the new technologies in the learning process and develop software to meet pedagogical needs. On the other hand, in the European Union (EU) as well as in the USA it is noted that radical changes in the educational system are necessary, especially in elementary and secondary levels. The viewpoints converge to the necessity of reformatting the existing curricula with two main objectives:

- The new curricula should take advantage of the current pedagogic theories and learning methods in order to improve the quality of the offered education.

- The new curricula should prepare the students to live and work in the Information Society.

Today, most countries consider multimedia and telematics technologies as an educational tool and the are trying to incorporate them actively in their curricula. The main concept is that the use of these technologies can significantly contribute to the educational process, supporting in parallel the role of the teacher. For example, by participating in scientific experiments conducted jointly with students in other schools and by drawing their information from various sources on the network, students learn critical information-age skills and build higher-order thinking skills. Furthermore, they learn to use electronic tools to access information and develop research skills using the technologies they will face in the future.

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