ICT-supported teaching and learning
Some priorities and objectives for the future

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Abstract: The aim of this paper is to contribute to the debate on future research activity in the area of technology-supported learning. Some aspects that emerged as crucial in the recent Open Consultation process launched in 2001 by the Multimedia Applications for Education and Training services of the European Commission will be briefly analysed and discussed on the basis of the author's personal involvement and role played in the consultation process as researcher in the field and as current PROMETEUS chair.

Key words: ICT-supported learning and teaching, e-learning, research, recommendations, priorities, pedagogy

1. INTRODUCTION

PROMETEUS (PROmoting Multimedia access to Education and Training in EUropean Society) is an open initiative launched in March 1999 under the sponsorship of the European Commission to encourage effective use, take-up, research and development in the field of technology-supported learning. The PROMETEUS initiative is bound to a Memorandum of Understanding (MoU) which has to be signed when becoming a member of PROMETEUS. Such a MoU is open to all, and can be signed either on an individual basis or on behalf of an organisation (for further information on PROMETEUS and to consult and sign the MoU, see www.prometeus.org).

PROMETEUS can be defined as an association of enterprises, universities, research institutions, and individuals sharing a common interest in employing information and communication technologies (ICT) for education and training. PROMETEUS is a community of experts working

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through its Special Interest Groups and, as a virtual community, through the PROMETEUS web service.

"The main goal of PROMETEUS is to build a European forum and a global knowledge resource dedicated to identifying, sharing, and disseminating knowledge and best practices relating to all significant activities in the field of ICT-supported learning, and to identifying gaps in knowledge, experience, capability and tools, across Europe" (cited from the MoU). This means there is a need to face the challenges put forward by the evolving needs of society, the new economic demands, and the technological evolution, taking into consideration European specific needs and cultural aspects. PROMETEUS's quite ambitious aim is to attract a critical mass of actors, promoting collaboration between different sectors and across national borders, and providing a channel for conveying the needs and opportunities identified within Europe to PROMETEUS members, the European Commission, member states, standardisation bodies, and other relevant organisations (Bottino, 2001).

According to these aims PROMETEUS has recently played an important role in the Open Consultation process launched by the European Commission to obtain recommendations for future research actions on technology-supported learning and inputs to prepare the Sixth Framework Programme for Information Society Technologies.

Hence several actions were carried out, and facilities were set up on the PROMETEUS web site, to ensure contribution from a number of experts from different backgrounds and expertise. All PROMETEUS subscribers and PROMETEUS SIG members, together with other interested parties and experts, were invited to contribute to the process of identifying the research and policy challenges and priorities in the area of technology-supported learning and in particular in the three themes identified by the Commission: pedagogical and organisational aspects; new applications for ubiquitous learning; technology and infrastructure.

Contributions were made in the form of an idea, a vision or a recommendation with clear identification of the target groups and expected benefits arising from the proposed actions. Three working groups based around each theme were also set up with the aim of commenting and analysing the contributions received on the website. A report for each working group was then edited by the co-ordinators of the groups and became part of the final PROMETEUS position paper which was produced a result of the whole activity and submitted to the European Commission (PROMETEUS Position Paper, 2001).

Desk research was also carried out to determine whether work relating to the proposed recommendations had already been initiated. Important

reference for that desk research were the outputs from major international conferences such as IFIP conferences, EdMedia, etc.

2. RESEARCH CHALLENGES FOR TECHNOLOGY-SUPPORTED LEARNING

In the PROMETEUS position paper an effort has been made to group all the contributions received according to general areas or directions, which are briefly analysed and from which key recommendations have then been extracted. On the basis of the recommendations pointed out, and from the outputs of the Open Consultation meeting (Evans, 2001), in this paper I consider some of the aspects that emerged as crucial in respect of giving some indications to the debate on future research activity and trends in the field of technology-supported learning. Within this general field, I consider, in particular, aspects related to ICT-supported teaching and learning in schools, and some indications for educational computing as a research discipline.

2.1 Bridge the gap between technology and pedagogy

In the field of ICT-supported learning, pedagogy and technology have usually been treated separately, pedagogy often being based around what the technology appears to permit, rather than fully integrated as a basis for technological design. It often seems that the hidden assumption of the technologist is that the technology is so useful and good that it will automatically be successfully adopted for educational advantages. To give only one example in this regard, the interest that educational software developers have shown recently for 3D interfaces and applications can be cited. Since 3D is a promising technological development and has proven successful in some applications (for example, games and virtual reality applications) there is an increasing interest in applying it in the educational field, without a real consideration of its educational potentials and possible drawbacks.

Technology and pedagogy should be considered together, as it is pointless, from a pedagogical point of view, to make ICT-based tools available if the educational strategies, and the activities the learners engage in, are not suitably revised. Technology can influence learning by fundamentally changing the content of a subject and the way in which it can be taught and learnt.

Technology cannot refer only to pedagogical assumptions and to the organisational structure of existing educational institutions. New models and

roles for teaching and learning, also in non-institutional or non-formal settings, need to be studied.

When reflecting on the design and use of technology for education we need to consider the whole teaching and learning situation, not only how technology can be applied but also the needs of the teachers who will use it, the ways in which it will be used, the curriculum objectives, the social context and the way in which learning is organised. This means that consideration needs to be given not only to the software design but also to the definition of meaningful practices through which technology can be used effectively (Bottino and Cox, 2001). The design of educational technology itself should include examples of meaningful pedagogical processes based on a widespread consensus derived from appropriate pedagogical research.

There is the need to address research questions regarding what teaching and learning practices are successful and how it is possible to map effective teaching and learning in order to be able to reproduce the processes involved.

As far as technology-based advanced learning environments go, issues that deserve further investigation are related to the cognitive functions that need to be considered when investigating their impact on teaching and learning processes, and the type of tools that need to be integrated to support such cognitive functions. Other issues that need further analysis are related to the most appropriate and effective ways of evaluating ICT-based learning environments and on how such environments affect learning through collaboration and communication.

2.2   The need for theoretical frameworks

A non-superficial analysis of ICT-based learning and teaching processes is needed since this is the only way to provide a more complete and less anecdotal understanding.

The possibility of relying on solid theoretical frameworks is one of the key factors that can enable conception of the many positive experiences already taking place in order to arrive at the definition of reliable innovative reference models. Pseudo-references to theoretical frameworks are often used to support the provision of technology-based learning. Often such frameworks are assumed with little critical review and are not based on a widespread concensus derived from pertinent research activity. Let us think, for example, of the reference often made to learning styles theory and to the way in which it is used to justify the provision of an interface or of quite 'trivial' educational programs or environments.

There is the need to explore new approaches that can take advantage of the potential benefit of e-learning and turn it into a discipline in its own

right, rather than a technology-enhanced extension of traditional models of education. A clear commitment to new paradigms such as life-long learning, ubiquitous learning, self-organising groups and communities must be made.

At a theoretical level, we have made a progressive move from cognitive theories that emphasise individual thinkers and their isolated minds to theories that emphasise the social nature of cognition and meaning (Resnick, 1987). An increasing importance is ascribed to theories that highlight the importance of studying the relations among individuals, mediating tools, and the social group (reference can be made to theories such as Activity theory, Situated Action Models, and Distributed Cognition - for a short account on these theories, see, for example, Nardi, 1997). These theories suggest a reformulation of learning in which practice is not conceived of as independent of learning and in which meaning is not conceived of as separate from the practices and contexts in which it is negotiated.

In relation to the use of technology, the reference to such theories requires that learning is looked at not only as an individual construction developed during the interaction with the computer but also as a social construction developed within the whole learning environment.

The concept itself of learning environment has undergone a deep transformation in the course of time and its evolution has substantially contributed to change in the way in which the mediation offered by technology to educational processes is considered. At the beginning, as witnessed by the terminology frequently adopted in the literature, educational software applications are often referred to as learning environments, thus focusing attention on the fact that it was the software itself, through interaction with the student, that was to form the environment where learning can be developed. Progressively the term learning environment is applied to the learning situation as a whole, where technology is ascribed an important mediating role but does not cover the whole environment.

Consequently there is a mounting interest in aspects related not only to software design but also in the definition of ways of use suited for exploiting software features in order to accomplish meaningful teaching and learning activities.

The concept of learning communities is an especially important area in this regard and is strictly linked to a new paradigm for ICT-based tools which appear to be particularly promising for future research and applications: that of situated multi-environment learning tools (Bottino, 2001). Such a new generation of open-learning systems seems to be more suited to mediate the new ways of looking at teaching and learning processes that are now progressively affirming themselves. These systems should make available tools able to support not only the relationship of the student with the learning object but also all the relationships that are established

between participants during a teaching and learning activity. Research studies and applications in this new generation of systems seem to be of particular importance in the near future. They should explore how to promote a strict integration of visualisation, communication and re-elaboration tools with the aim of supporting both the creative exploration of problems and the representation and justification of knowledge.

2.3   The need for large-scale involvement of teachers and learners

The large-scale involvement of teachers and learners appears to be of particular importance, as does the necessity to develop tools to support the creation of communities of practice. Users, that is learners, teachers, trainers, etc., have to assert themselves as a driving force rather than only as consumers. It is necessary to maintain the focus on the social dimension of education related activities which cannot be reduced only to business and market issues.

There is a need for researching ways of encouraging the large-scale involvement of teachers and learners and removing the obstacles that hinder their participation. For example, many teachers and learners lack the time and expertise to find out the answers to quite simple technical questions; without those answers, they may be unable to connect to the internet and participate in on-line discussions, etc. Moreover the time they spend in such activities should be considered within their current job timetable and not as an additional activity. Such problems may seem trivially simple to experts, who therefore conclude that no problem exists. There are many subtle variations on this theme of a mismatch between the assumptions made by people on either side of the boundary of a community of practice; experts inside the community may forget any difficulties they had in joining the community. It is therefore not enough to establish collections of best practice, or to codify knowledge about e-learning; that knowledge will only be of use to teachers and learners who are new to e-learning, if it is made suitable for people in their position, rather than experts. Moreover the study of models for effective dissemination of successful pilot projects is needed to ensure teachers are aware of the potential of technology-supported learning.

Developing teachers' communities of practice using ICT is a valuable possibility for fostering a greater involvement of teachers at all school levels. Such communities would also work as a network for dissemination of good practice and promote the development of new role models for the teachers. It is necessary to study which are the problems related to the development of such teachers' communities. As experience had shown, it is not enough to make technology available and to provide some formation to use it.

Motivations, roles, and content issues are more crucial, as well as the redefinition of training in a life-long learning perspective.

2.4   The opportunity for open initiatives and the issue of interoperability

There is much discussion of the need for interoperability, reuse and durable solutions. What is feasible in terms of technology continues to drive developments in technology-supported learning. Even if problems of interoperability are familiar for technologists and for people who are at the forefront of the e-learning sector, they are still insufficiently appreciated and taken into account at the wider user level.

There is a lack of provision of information on such matters, and the necessity to consider critical success factors for adoption of technology-supported learning particularly for people (both users and developers) who are not expert in the field.

The opportunity for open source and open standards initiatives is another crucial aspect to be considered (open in the sense that the developers publish the sources applying an open source model). On the one hand there is the need to carry out in-depth analysis about promising technologies and developments (for example, infrastructures, software tools, open source systems, metadata, etc.), which need to be monitored and need to have their significance explained. On the other hand studies are needed on how to take account of existing requirements, contexts and resources (for example, to share ways to be culturally sensitive, to meet the needs of currently excluded groups of users, and to make innovative use of simple, readily available technologies).

3.   CONCLUSIONS

The development of ICT-based education and training processes is a growing reality in Europe. Evidence of this can be seen by progress made in distance educational and training systems, the development of some virtual universities, the development of a variety of learning environments, and in the drive towards the definition of standards for the field of e-learning. Corporate training and professional re-skilling systems are another area in which important developments have taken place. E-learning is a growing market, and this is recognised by the e-learning initiatives and decisions taken recently by the European Community.

Despite the positive developments in the field so far, there is therefore a need to continue research work on the development of these technologies and their applications. As the Open Consultation process has shown, a certain realignment of research priorities is necessary. The aspects briefly analysed in this paper give suggestions in terms of broad trends and some possible research objectives.

It is also possible to observe that there is the necessity to have less fragmented work in the ICT-supported learning field and some nexus for the wide variety of programmes, initiatives and organisations that are active, as well as the promotion of the validation of research, theories and methodologies.

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BIOGRAPHY

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