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# ADVANCED LEARNING TECHNOLOGIES IN THE NEW INSTRUCTIONAL PARADIGM

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## ABSTRACT

There is a trend towards the introduction of computer networks and related technologies into the educational and training process in order to enrich the latter by providing alternative means to the students for learning, communicating and collaborating. The need to shift from the conventional instructional paradigm to the new networked model is becoming eminent and the attempt of taming these technologies in order to make them functional and at the same time achieving pedagogical efficiency remains a great challenge. In this paper we present the technologies of computer networks that are used to support the instructional process, namely advanced learning technologies. After defining these technologies we describe the ways they can be used in the context of the learning process by categorizing them according to the services they provide. Next we present a brief literature review, outlining the major players that are conducting considerable research in the field of advanced learning technologies and are attempting to standardize the various aspects of these technologies. Finally we conclude with some remarks about the present situation in the application of advanced learning technologies.

**KEYWORDS:** advanced learning technologies, distance learning, hypermedia, courseware, web-based education and training.

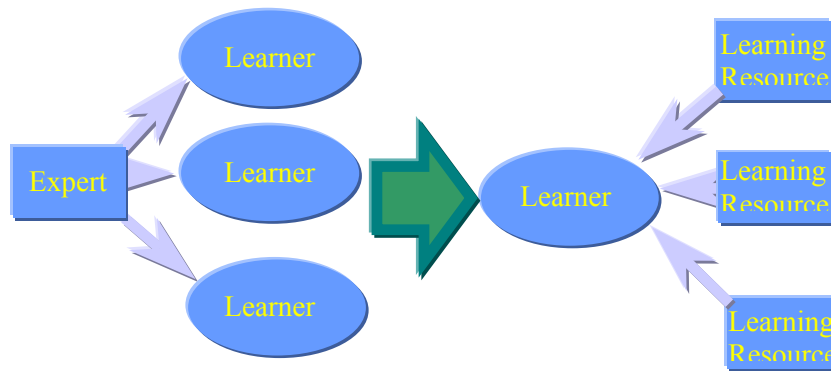
## 1. INTRODUCTION

Over the past decades, the world of education has often witnessed the introduction of new revolutionary technologies that promised to radically alter the way people teach and learn. Most of these proved to be rather over-estimated, mainly ending to have a narrow adoption and short life-cycle. Even when computers became affordable and available to the large public, some claimed that they would be the perfect tools for almost every instructional activity but that also turned out to be another great hyperbole. The last grand milestone in educational technology was the introduction of the Internet and the World Wide Web, where the prophecies claimed that the whole educational system would have to be re-engineered in order to be based upon them. Did the Internet and the Web actually revolutionize education? Not exactly, but there are strong indications that this is not far from happening [Vella & Vella 1998].

The Web represents information that can be disseminated to the world and accessed in minimum time, and this cannot be disregarded by the educational community. The technologies of computer networks, namely intranets and the Internet, and the WWW together with its content, i.e. the hypermedia, constitute the **Advanced Learning Technologies (ALT)** [<http://csalt.lancs.ac.uk/alt/>, Center for Studies in Advanced Learning technologies, Lancaster university].

The technology is already available, hence the next question is whether there is actually a need for changing the traditional instructional model. The fact is that the transition from the industrial society to the information society causes the traditional instructional model to be obsolete and unable to cover the instructional needs of modern societies. The world is confronted with a quantum leap, stemming from globalization and the new knowledge-driven economy, directly necessitating a new instructional paradigm, more open and knowledge-based. The stepping up of the education and training is essential in order to successfully assimilate the digital technologies and use them to best effect. A new learning environment needs to be created which will provide autonomy and flexibility, establish contacts between centers of culture and knowledge and will facilitate access for all the citizens of a knowledge-based society [European Commission 2000].

The new instructional paradigm is going to be an open one, or to put it in other words it is going to be learner-centered [Wasson 1997]. The learner will be placed in the center of the learning environment and the learning resources will be offered to him in a flexible manner with respect to the place, the time and the way he will learn about a subject. The learning resources include educators, learning material (e.g. on-line book) and other tools that facilitate learning. The fact that education and training are taking place, on a learner-based concept is the reason that the term educational technology is tending to be replaced by the term learning technology to describe the application of technology to the support of learning. To be more precise, learning technology endorses instructional systems where the learners have a high level of control over their learning. Figure 1 depicts the shift from the traditional instructional paradigm to the new open one.



**Figure 1 – The shift of the instructional paradigm**

## 2. ALT IN EDUCATION AND TRAINING

The Advanced Learning Technologies in the modern instructional paradigm are considered to be, as aforementioned, computer networks, the Internet and the Web. Of course these technologies comprise several other more specialized technologies like interactive hypermedia courseware, synchronous and asynchronous communication tools, on-line study guides and learning object databases. The term “advanced” is used in this context to differentiate these technologies, that support networked learning, from conventional resources like lecture slides or text books that support the traditional paradigm.

Advanced Learning Technologies can be used in education and training, following various instructional models. These models can be categorized according to the services they provide as following [McCormack and Jones 1997]:

- information based model (WWW is used for retrieving information, like in Virtual Museums, digital libraries, etc.)
- teaching media based model (WWW is used only for dissemination of educational material to distance students, i.e. course descriptions, educational software, etc.)
- enriched classroom model (web-based courseware is developed to be used complementary to traditional classroom-based teaching material)
- virtual classroom model (WWW is used with emphasis on collaboration and computer mediated human interaction)

The first model is restricted to disseminating information to learners in the form of web pages, which is more or less the well-known “web surfing” activity. The learners do nothing more than navigate through the Web in search of information, which is usually structured in some specific manner, like in a digital library, and collect information that is of use to them. The non-linear way in which the web is deployed is a huge advantage as the learners can follow certain paths to reach the desired information and are not confined in a single resource like a book.

The second model extends the first in the sense that the information being distributed is specialized educational resources for a course, a seminar or some other educational module. This is a model that is often used in open and distance learning programs, for example in the courses of open universities. Distant learners may receive through the Web, information about a course (registration information, course schedule, deadlines, project assignments, grades etc.), or learning material about the course (on-line books, case studies, software tools, past exam papers etc.). The learning resources that are accessed by learners must be pedagogically efficient and of high quality. One of the greatest open issues for research today is to develop a systematic approach for the construction of high quality learning resources [Bourdeau & Bates 1996].

The third model is similar to the second, with the difference that it is not applied to distance learning models but to traditional classrooms as an extra source of virtual learning activities. Information about a course is not only given inside the classroom but it is also published to the Web. For example, announcements that are made in the classrooms can also be posted in a special web page for announcements, so that students that are not present during course hours can read those announcements that are of interest to them. Also the material that is being taught in the classroom can be accessed through the Web, thus providing certain facilities to assist the learners. For instance, course notes can be offered from the course’s web site, so that students can pay attention to the lecture rather than being busy taking notes. Case studies from traditional classroom courses supported by networked learning of this type have shown encouraging results mainly by proving that they can help to remove

some of the traditional model constraints, such as low classroom attendance, difficulty of acquiring information about a course and rapid change of courseware material.

Finally the fourth model of the use of advanced learning technologies aims to transform the Web into a virtual classroom not only containing information about a course and learning resources but also providing all the necessary communication and collaboration mechanisms to fully replace the student-teacher interaction that takes place inside a classroom. These mechanisms include e-mail, text-based chat, audio-video conferencing, and discussion fora, whiteboard, file and desktop sharing. The enrichment of the learning process with communication and collaboration services is of paramount importance as it reflects the need to change the archetypal educational system where collaboration is not at all encouraged, into a high-level collaboration model, catalyzed by ALT [Harding and Zierbath 2000].

### 3. RELEVANT WORK OF RESEARCH AND STANDARDIZATION

There is currently a significant amount of work taking place towards the application of ALT from international organizations, projects and research groups, some of them being European and some US-driven. A great part of this work involves pure research about the development of systems that take advantage of ALT while other work aims to suggest and develop standards and specifications related to ALT. Also there is work being done towards the evaluation of ALT systems in schools so that proper feedback can be provided to the working groups. The following list, although not exhaustive, highlights the most important of these groups:

- **CEN/ISSS** (Comité Européen de Normalisation / Information Society Standardisation System) [<http://www.cenorm.be/iss/>] has been requested by the European Commission to draw up a work programme, in support of the development of Europe's Learning Society. This report is the prime task of the **CEN/ISSS Learning Technology Workshop**. The Workshop 's objectives are to encourage the effective development and use of relevant and appropriate standards for learning technologies for Europe and to directly respond to the European Commission Standardization mandate in the domain of "Learning and Training Technologies & Educational Multimedia Software".
- The IEEE, has constituted the **Learning Technology Standards Committee** [<http://ltsc.ieee.org>], the mission of which is to develop technical standards, recommended practices and guides for software components, tools, technologies and design methods that facilitate the development, deployment, maintenance and interoperation of computer implementations of education and training components and systems. Currently LTSC is comprised of several working groups, each working on a specific domain. Many of the standards developed by LTSC will be advanced as international standards by ISO/IEC JTC1/SC36 - Learning Technology.
- **PROMETEUS** (PROmoting Multimedia access to Education and Training in EUROpean Society) [<http://prometeus.org>] members have been divided in several working groups (SIGs) and undertaken discussions to reach a common understanding and promote knowledge in the field. These discussions provide both input and feedback to the work of CEN/ISSS Learning Technology Workshop and other related standardisation activities.
- Educom's **Instructional Management Systems (IMS)** [<http://www.imsproject.org/>] Project is developing and promoting open specifications for facilitating online distributed learning activities. IMS aims to define the technical standards for interoperability of applications and services in distributed learning, and to support the incorporation of the IMS specifications into products and services worldwide. IMS endeavors to promote the widespread adoption of specifications that will allow distributed learning environments and content from multiple authors to work together (in technical parlance, "interoperate"). IMS develops the technology as a consortium and submits the specifications to the formal standardization process of IEEE LTSC working groups.
- The **ARIADNE** project [<http://ariadne.unil.ch/>] focuses on the development of tools and methodologies for producing, managing and reusing computer-based pedagogical elements and telematics supported training curricula. Validation of the project's concepts is currently taking place in various academic and corporate sites across Europe.
- The **Advanced Distributed Learning (ADL)** initiative [<http://www.adlnet.org/>] was launched by the White House Office of Science and Technology Policy (OSTP). The purpose of ADL is to ensure access to high-quality education and training materials that can be tailored to individual learner needs and made available whenever and wherever they are required. This initiative is designed to accelerate large-scale development of dynamic and cost-effective learning software and to stimulate an efficient market for these products in order to meet the education and training needs of the US military and workforce in the 21st century.

- The **European Schoolnet (EUN)** [<http://www.en.eun.org>] has set up the European Network of Innovative Schools - ENIS - with the aim of bringing together schools in Europe at the forefront of using ICT to improve teaching and learning in order to further innovation, development and change.
- The **Education Coalition (TEC)** [<http://www.tecweb.org/>] is a not-for-profit educational organization, created in 1993 to serve the needs of the business and education communities. It is comprised of diverse agencies from across the USA working together to promote systemic educational reform through the use of multiple technologies. It serves as a focus for development, dissemination, research, advocacy and funding related to educational change and the use of technologies.
- The **Virtual European School (VES)** [<http://www.ves.eu.org/>] is a European research project, with the aim to develop a comprehensive resource of teaching material for secondary school education. Pedagogically, the VES project aims to reduce instructors' hesitation towards using computers as teaching assistants, by offering an innovative delivery system containing a large variety of material, supporting various pedagogical concepts. All material will be adapted specifically for school use by publishers having a know-how of the educational sector.

#### 4. CONCLUDING REMARKS

Advanced Learning Technologies have arrived and the impact they will have on education and training is expected to be immense on all stages as new models of networked learning are emerging. The paradigm of open and distance learning is already changing due to the employment of ALT from educational institutes such as open universities. The field of corporate training also seems to catch up quickly on these technologies as they seem to be more cost-efficient than traditional training methods, such as seminars. Moreover there seems to be a small but steady adoption of ALT in schools and universities where virtual classrooms are being constructed to enhance the learning process and alleviate the restrictions imposed by traditional classrooms. It is important to notice that virtual classrooms and web-based learning environments are not aimed to substitute the conventional educational model as the role of educators and in-person interaction is irreplaceable. The new technologies will simply but efficiently supplement the instructional process by providing additional information, learning resources and communication mechanisms.

In order though to use ALT in a cost-efficient and pedagogically correct manner and ensure that the learning resources constructed will be of high quality, a structured, disciplined development process has to be followed. A process that involves an engineering methodology like Web Engineering [Retalis et al 2000] or Courseware Engineering [Bostock 1998]. Regretfully most courseware material is developed today in an arbitrary, ad-hoc manner, resulting in poor quality material. To make matters worse, there are not yet well-established methodologies for the engineering of hypermedia resources [Lowe & Hall 1999]. The bright side is that there is an enormous amount of research taking place as described in the previous section and some of it is already starting to pay off. Working standards and specifications for all aspects of the use of ALT are rapidly developed and it is not too optimistic to expect the results, in the next years or so.

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