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Information technology, support for innovation in education sciences

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Abstract

Nowadays it is recognized that information technology has a powerful impact on learning. The central idea of the current e-learning technologies is to provide to the users ability of using and reusing learning objects. These must be compatible with the learning management systems and any other future technology in the education area.
New informatics technologies like the components-oriented programming or services-oriented architecture enable easily handling and composing of learning objects even by non- specialists, teachers who make up their lessons according to their vision, or students who can practice the knowledge acquired through solving the variants of problems studied.

Keywords: information technology; ICT; e-learning; LO; LOM; SOA.

1. Introduction

The innovation process is decisive in knowledge society. This is explained by the fact that, this society is based on the knowledge management, new technological knowledge production and their dissemination through more efficient electronic means, including e-learning.

EU promotes the adoption of information and communications technology (ICT) in different ways (for example in E-learning Programme) and Lifelong Learning Programme 2007-2013, also includes e-learning. Thus, education must adapt itself to the society demands and each person must be able to learn during their lives. The permanent education principle offers the possibility of reaching an individualized education, in relation with the rhythm, needs and each person's aspirations.

The training design introduces Internet technologies in the learning process, in order to make it effective. The ICT means used in education represent an important support in the learning process, but do not eliminate teacher assisted learning traditional methods or the self-instruction (Vasilache, 2008). The use of technologies in the educational process has resulted in the formation of an active and responsible attitude, with multiple advantages, including: reducing the time in the training process, the possibility to adapt programs to the learners' needs,

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interdisciplinarity promoting, and the possibility of easily adaptation to changes in different areas and essential reducing costs of continuous education.

Continuous improvement of ICT, increasing the use and continuous adaptation to the requirements for the development of society, turn these technologies into an optimal environment to spread information, a necessary condition but insufficient for the educational process success. The training effectiveness depends on the chosen environment for communicating the content and its choice should be influenced by content, not by technology, each environment having advantages and disadvantages.

2. Computer- assisted learning

As for the e-learning understanding it is necessary an overview both of the system components and the interaction between them. In attempting to define the architecture of a computer-assisted instruction system extensive studies were regarding on the intersection between education sciences and informatics (Figure 1).

Starting from the prevailing pedagogical aspects and the technological involved level, there was an attempt to define the computer-assisted training. Not incidentally, today we find different names for this learning process.

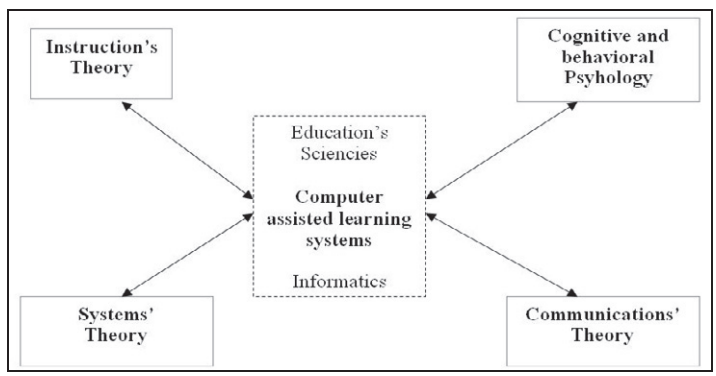

Figure1. Theoretical basis of computer-assisted learning

In computer-assisted learning the possibilities of rendering information are more numerous, compared with traditional training. The didactic means have been diversified so far: from printed course to interactive multimedia information in real time via Internet. The teaching method required by the information society is the computer assisted training, which leverages the principles of programmed instruction (Figure 2), in the context of new ICT.

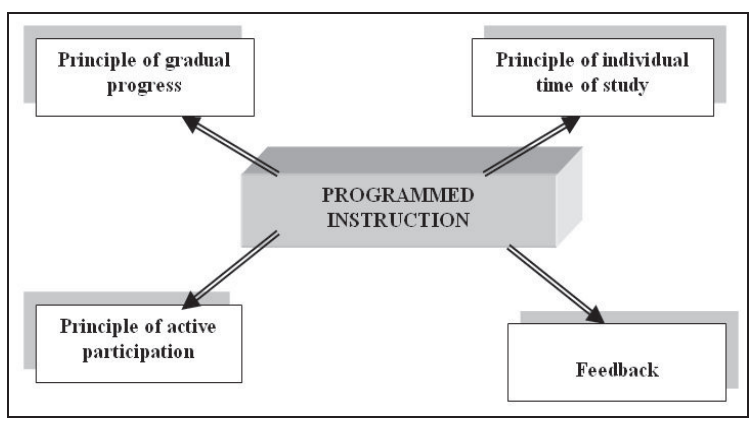

Figure 2. Principles of programmed instruction

- The principle of small steps and gradual progress, which refers to the fragmentation of the learning material in units of content, elementary, accessible, simple and logically linked to ensure continuity and success in teaching - learning – evaluation;
- The principle of active behavior or active participation which aimed at directing the student's endeavor towards the selection of answers, understanding and application of information needed to make a right answer;
- The principle of personal rhythm of study or self-paced learning, when each student manages the necessary time for the given tasks relatively independently;
- The principle of immediate evaluation of response or feedback which provides a positive or negative response of the student's behavior, according to the success or failure of the learning task (Cucoş, 2006).

2.1. Properties of learning objects

The educational objects, as informational entities which can be used, reused or referred to during the educational process sustained by information technology may take the lesson form, questionnaire or case study.

Among the specific properties of learning objects (LO), with implications for the practical implementation of computer assisted learning the following ones mentioned:

- LO are self-contained, comprising information about itself (also includes metadata), and can be taken and transported elsewhere;

- Granularity - reflects the objects complexity, in terms of the way they can be divided into smaller objects and the possibility of their coupling to transmit more complex knowledge;

- Composability and decomposability (consequences of granularity), meaning the possibility of a complex object to be decomposed into elementary objects and recomposed, possibly by different rules.

Composability is based on the possibility of LO to be coupled to form larger objects. Choosing the most appropriate learning object to learn a thing and how to combine elementary objects for more efficient training, are related to the teacher's creativity.

Finding the most suggestive elements, their personalized way of coupling, individualizes each teacher in terms of creativity. On the other hand, the effect of learning allows improvement, based on the feed-back and adapting lessons to the classroom training level (Smeureanu, Reveiu, & Dârdală, 2006).

2.2. E-Learning Standards

E-learning is the expression of use ICT to transfer encapsulated knowledge in standard formats known as objects. The effective form of electronic learning is accomplished by using e-learning tools in order to create learning content and its distribution, without theoretical restrictions of time and space. The standards need to be implemented by the producers of educational content and also developers of computer assisted learning systems.

The establishment and compliance with e-learning standards is important to ensure the compatibility and portability of materials from one system to another going to reduce their time and cost development.

In literature we find the following e-learning standards: IEEE LOM, SCORM, IMS, AICC, Prometheus, Dublin Core Metadata Initiative, Ariadne, ISO / IEC JTC1 SC36, Microsoft LRN, CEN / ISSS WS-LT. The purpose of the LOM standard is to facilitate search, evaluation, use and reuse learning objects by users or online learning environments. All LOM elements can be directly associated with the elements in Dublin Core Metadata Initiative through an association table.

2.3. Limits of assisted learning

The use of new technologies in education a set of knowledge skills and attitudes requires from teachers which enable them to use and to harness new technologies in teaching. Teachers must be able to identify pedagogical situations as well as appropriate IT solutions, with beneficial effects for education and training.

As to educational objects properties (i.e., the composability and decomposability) when a professor prepares the learning material, he reuses other lessons and through decomposing and their recomposing creates a new lesson,

according to the new objective. Thus, the teacher becomes creator of digital content and he has the possibility to combine learning objects in prefabricated lessons to obtain a new lesson, adapted to pursued objective.

3. New programming technologies

The teaching-learning-examination process acquires new dimensions and characteristics using e-learning technologies (Vlada & Jugureanu, 2007). These are a direct consequence of development psycho-pedagogical methods in education and new technologies ITC (Web technologies, multimedia, and communication technologies). Supporting the continuous learning process in a society and a knowledge-based economy requires the development and application of standards in educational technology, in order to enhance interoperability and improve the working experience on the Web.

3.1. Component-oriented approach

The principles underlying the component-oriented programming, namely: interface separation of implementation, binary compatibility between server and client, language independence, location transparency, competitive implementation, security, explain the advantages of component-oriented approach. These are:

- Reusing of modules or software components;
- Actuality of this type approach, especially by imposing the concept of "service" and “service-oriented programming”, SOA (Service Oriented Architecture). A service is implemented and provided by one or more software components. The access to services is usually through a network, generally Internet (web services). The service can be atomic or composite, and in this case, it is composed by the interconnection of existing services as a logical flow (workflow) called "orchestration."
- The great granularity simplifies the problem of adjustment; the components can be considered software objects of great granularity. While the granularity increases, the representation of application becomes simpler.

Component-oriented programming offers better reuse possibilities and more flexibility than object-oriented programming. Gradually the component-oriented programming became the prevailing methodology in software development.

3.2. SOA (Service Oriented Architecture)

SOA promotes the reuse of services and the service-oriented system evolves by adding new services. SOA is not related to a particular technology, can be implemented using a wide variety of technologies, programming languages and communications protocols (e.g. HTTP, RMI, DCOM, CORBA, etc.). The services can communicate with customers or other services using standard methods, with reduced dependency, based on the change of XML documents. This feature is called "loose coupling" and requires that each software entity, that communicates, minimizes information about its pair. Web services facilitate communication between different applications. Also, they make it possible to reuse existing Web services and create new opportunities in many fields because provide an easy way to distribute information to a large number of consumers. The aim of Web services is to provide components that can communicate each other regardless of the language they were written or the operating system.

The conversion of new technologies in education and training strategies has already proved as reality that characterizes education systems, having a great impact in increase of the educational activities efficiency by: development of visual perception; structure of material; increased self-confidence (Vlada & Jugureanu, 2007).

4. The use of components technology in achieving the applications

The educational objects, as educational components are stored and accessed independently and create new courses or sequences of individual learning through reassembly. Each learning object is characterized by a set of attributes that allow the location, management and their evaluation. The existence of a consensus on metadata schemes, for learning objects shouldn’t be an obstacle for digital content developers. The components technology discusses the problem of integration and implementation of complex applications. In terms of their use, the components are characterized by: (Smeureanu, Reveiu & Dârdală, 2006)

- These are pieces which are seeing and complement each other, adding the properties which connect them and enable their coupling;
- Are running even from the creating stage of application that incorporates them, automating some of the teacher's work for composing a lesson;
- Some properties can be changed without writing code, with minimum effort and even by non-IT teachers;
- They benefit from abstracting through interfaces for standardize the communication and oblige the components to respect the communication rules;
- Running on the virtual machine, ensures the independence of running platform;
- Automatically adapts to new versions through removing incompatibilities between versions and can be reused.

An example, in this case, can be for learning mathematics by persons with visual disabilities, using voice synthesis. Thus, the objects for mathematics learning are available as components. These components are designed to be coupled into interconnected environment of components and have linking properties of components, generally by references. The properties can be accessed to achieve interconnection using "drag and drop" operation or at execution time with right clicking the mouse, from contextual menu. Thus, Function component is dragged over MathTTS component, overtaking the analytical expression of function and sending it to vocal synthesizer (Figure 3). This is an example of using the objects for mathematics learning by people with visual disabilities.

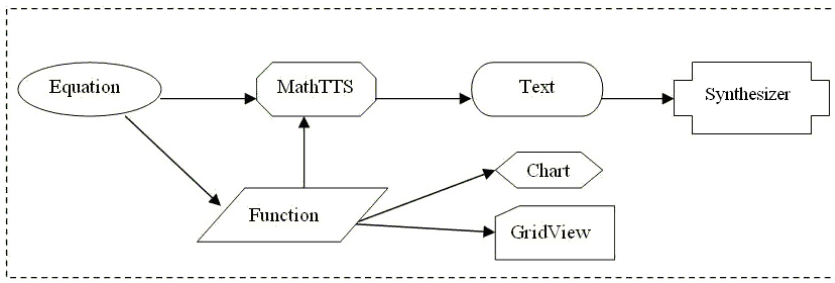

Figure 3. Interconnection components

The use of components technology allows the definition, management and interconnection of specific objects to mathematical domain to achieve the instruction.

5. Conclusions

The technologies are at beginning, but they will revolutionize the educational sciences. In the trend of globalization and Internet development, the innovations must be present in all areas and a good organization and management of information and knowledge enables better management of change. ICT will become the universal utility tools, being necessary to develop this new way of thinking and behavior that allows to teachers to meet every new requirement.

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