COMPUTER-MEDIATED LEARNING

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ABSTRACT: This study points out the route of implementing scientific terms in order to clarify meaningful concepts of 'educational technology' and 'instructional technology'. The final target is that of finding a good theoretical frame for introducing computers in an educational curriculum on the basis of coherent theses.
KEYWORDS: curriculum, computers, educational technology, instructional technology, Finn, Coulson, Carroll, USDLA.

Background on integrating technology in education

When Marconi discovered radio, he called it "the wireless telegraph" – the communicator between two different points. But the importance of 'wirelessness' was to be revealed only later, when the unbelievable power to transmit messages from a single source to many listeners became a social force.

Likewise, people nowadays are still in process of discovering what roles computers may play in our lives. At the beginning experts predicted their military role and scientific need. Years later computers are present in business and schools, politics and economics … everywhere, educating, informing and entertaining. The World Wide Web has turned them into extraordinary communication tools.

In 2015 it is rather difficult to find the best definitions for a domain which has a history of more than 20 years: computers working for schools. It was almost overnight that blackboards have become 'active' and that textbooks or student books, manuals or guides have been transformed into 'interactive' tools. A huge industry of 'soft' and 'hard' has been trying for at least 10 years to cover each and every need of the educational market.

The competence-centered curriculum places the students in the centre of the educational policy. The educational paradigm shifted from objective-centered teaching to the process of learning and evaluation, and it has as a final target the students' competences of written/oral comprehension and written/oral production. Competences contribute to the competent personality of the students who apply their knowledge in new and various situations in the real life, analyse and have decisions, work as members in a group, prove their abilities of constructive collaborators, prove their responsible attitude towards the environment and the natural resources, possess self-development capacities, are highly motivated, and can apply a systemic thinking way in the process of adaptation to a permanently changing world.

Technology changes each and every aspect of the human life. The digital culture determined educational reactions: teachers and learners demand the implementation of the digital competence.

Nevertheless, curricular approaches including special 'technological' chapters have been especially designed in order to select the best or the proper ways of teaching/learning with the computer support. Children born today have access to media and computer since the first seconds of their lives so adapting teaching style to their needs is an imperative target of the new century.

Two fields (still under debate) have been defined by the curriculum researchers in order to clarify the educational 'paths': 'the educational technology' and 'the instructional technology'.

EDUCATIONAL TECHNOLOGY

Three major ideas contributed to the final definition of an 'educational technology': 'engineering', 'science', and 'audiovisual education'. (Januszewski 2001, 1).

Munroe (1912) was the first theoretician of 'educational engineers" who should study this 'huge business of preparing youth for life, to find out where it is good, where it is wasteful, where it is out of touch with modern requirements, where and why its output fails'. (Januszewski 3) Viewed from an industrial perspective, education was offered as a model of infrastructure and cost. W.W.Charters (1945) focused on means and methods of instruction, refining the engineering model. He identified the basic characteristics of engineering and assumed that only these can be applied in curricular models: the systematic nature, scientific applications, the efficient utilization of resources, and the production goals. Charters is the first researcher who develops a new curricular chapter: that of 'educational technology'. In his opinion, educational engineering, like industrial engineering, should derive its methods based on research in a step-by-step and thorough process through a science designed to standardize processes and outcomes.

Kliebard (1987) is one of the first theoreticians of the learners' environment. The author propels the idea that children should be 'analised' in their natural environment before any curricular objective should be designed. By collecting and refining data about children, the prescribed activities for their education become scientifically meaningful. The scientific contribution to education was precisely measured by laboratory and experimentally derived methods in order to screen and place students, establish the curriculum, deriving the proper instructional methods, and test students. New theories about 'efficiency' and 'effectiveness', 'prediction' and 'control' will derive from these studies. Other specific examples from the field include: the systems models, behavioural objectives, task analysis, mastery learning techniques, quantitative/qualitative nature of referenced testing.

Finn (1960) was the first who announced a new educational field: that of educational instruction. The initial research was based on hardware and equipment. One of his disciples, Ely, wrote that: 'this analysis must begin with a consideration of the audiovisual field since it was here that the initial developments in the technology of instruction were largely concentrated. Audiovisual personnel were the first technologist in education.'

Saettler (1990) will reinterpret the effect of the audiovisual education into a new context. The author shifts the emphasis from the machine-based concept of education to a systematic approach for improving instruction. It is with this author that a distinction appears between educational technology and instructional technology.

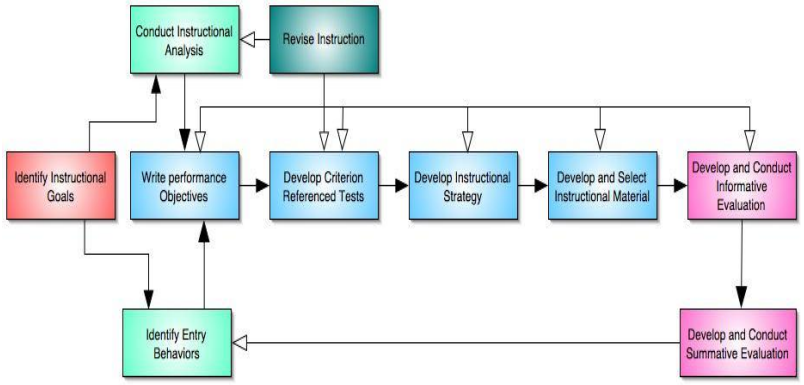
In 2004 the Association for Educational Communications and Technology (AECT), the Definition and Terminology Committee, specified that the concept of 'educational technology' has been evolving 'as long as the field has', but offered a 'temporary' definition, as a 'snapshot in time': "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources. [1]

The main postmodernist trends in the interpretation of 'educational technology 'concept are: study means research, including reflective practice; ethical values are collected into a 'Code of Ethics'; learning is 'facilitated' instead of being controlled or caused; centrality of learning instead of teaching; performance is improved on the basis of quality criterion, leading to usable skills, not just inert knowledge; an eclectic view of the design process; it makes the attribute of "technological" explicit, with the rationale that tools and methods that are not technological fall outside the boundaries of the field.'

In 2015 'educational technology' is generally referred to as 'instructional design' (in opposition with 'instructional media' – translated as 'learning objects'.)

The most common models of 'instructional design' are:

- ADDIE: 'Analyse (learners' characteristics, tasks to be learned), Design (learning objectives inside an instructional approach), Develop (training materials), Implement (instructional materials), Evaluate (the desired goals)'.
- DICK AND CARRIE (1978)[2]: SYSTEMS APPROACH MODEL



Dick and Carey Instructional Design Model

[1] *The Definition of Educational Technology* **,** by the Association for Educational Communications and Technology (AECT), Definition and Terminology Committee, June 1, 2004 at the website address: http://ocw.metu.edu.tr/file.php/118/molenda_definition.pdf (extracted 20 July 2012).

[2] The model was downloaded from the website address: http://www.nwlink.com/~donclark/history_isd/carey.html (extracted 20 July 2012).

➢ IDSL (INSTRUCTIONAL DEVELOPMENT LEARNING SYSTEM**:** originally published in 1970 by Peter and Mary Esseff. The components of this system are: 1. Design a task analysis; 2. Develop criterion tests and Performance Measures; 3. Develop interactive instructional materials; 4. Validate the interactive instructional materials.

INSTRUCTIONAL TECHNOLOGY

'Instructional technology' derived as a specific domain from the educational technology field. Two types of definition interchanged starting 1990s:

a. instructional technology as systemic and systematic approach;
b. in terms of audiovisual devices.

The association of this term with the 'learning object' theory started in 1600 (Comenius). The new approaches about 'learning objects' exclude almost entirely the previous conceptions about the 'teaching' tools used in the classroom, in addition to textbooks: maps, crayons, photos, dictionaries, pictures, dolls… The simple physical presence of such 'variables' in the teaching/learning process has completely changed its place and importance.

The Audiovisual Movement (1910-1923) brought forward instructional films and the growth and popularity of visual education. In 1930 the first organizations started to establish rules for creating slides, radio broadcasting, and motion pictures associated with the visual instruction. (the first movies which showed the effects of the World Depression).

Starting 1950 interest has focused upon communication theories and media research on the background of television programmes for schools. The name of the field changed from audio-visual media to instructional technology in order to include the design and use of messages. Debates upon the description of the field are divided between a. application of scientific principles, particularly theories of learning and b. the use of equipment for presenting instructional materials.

Finn played a major role in defining and establishing the field of instructional technology. He promoted technology as a way of thinking ('educational technology' – the term was used for the first time by Finn), and how to use machines to assist in this process and make learning more efficient (anticipating the field of instructional technology). The author criticizes the literary-oriented educational administrators who applied censorship in 1960 over the audio-visual methods, considered 'second-class unwanted twin'. (Finn 2004, 11) Finn pleads for audio-visual communication against 'Conversation' (knowledge resulted from books) on the basis of eliminating the hard effort of reading long pages in books ('Puritan Theory of Linguistic Perception') and also destroying the theory of the elite (reading is individual and, by reading books, Conversation becomes supreme) in favour of mass communication. In a world hidden behind 'iron masks', Finn opens the door to the new 'variables' of the educational system.

The potential of computers in the educational instructional process was anticipated by Coulson (Coulson 1971, 161) who wrote in 1970: 'A modern computer has characteristics that closely parallel those needed in any educational system that wishes to provide highly individualized instruction'. He also noted that the specific benefits that the computer could offer are: a very large memory capacity that can be used to store instructional content material or to generate such material; can perform complex analyses

of student responses; can make decisions based on the assessment of student performance, matching resources to individual student needs'.

The convenience the home computer started to offer was accelerated with the proliferation of the Internet in late 1990s. Starting as an extension of computer-based instruction, online education became increasingly popular and systematically researched starting 2000.

Reiser (Reiser 2001) specifically describes what he calls:

- 'instructional media' (1960-1970): 'the physical means via which instruction is presented to the learners'. This includes textbooks, videos, computers, and having an instructor physically instructing a group in a classroom. The author anticipated the Total Physical Response method of teaching which was defined only later in 2005.

- 'instructional design' (1970-1990): 'systematic process that is employed to develop education and training programs in a consistent and reliable fashion'.

Since the moment Reiser specifically defined the difference between 'educational technology' and 'instructional technology', the path to studying 'instructional devices' as 'objects of learning' was wide open. Specialists started to organize and structure the main modern technological means of education in order to understand the benefits, but also the bad effects of these upon the young generation.

In 1994 CARROLL'S minimalist theory is based upon studies of people learning a wide range of computer applications including world processors and databases. This theory suggests that: all learning activities should be meaningful and self-contained; activities should exploit the learner's prior experience and knowledge; learners should be given realistic projects as quickly as possible; instruction should permit self-directed reasoning and improvising; training materials and activities should provide the error-recognition and use errors as learning opportunities; there should be a close linkage between training and the actual system because 'new users are always learning computer methods in the context of specific preexisting goals and expectations'.(Carroll, 1998) With Carroll educational technology becomes closely related to instructional technology. In his view it is impossible to design new teaching methods without considering computers as means of instruction. These new instruments ('resources', 'variables' in older theories) are the ones which require adequate methods. Starting with Carroll teaching theories have become dependent on computer science and pedagogical practices and practical web-design strategies have invaded the educational field: 'Keep important information at the top of the page'; 'Keep frames simple and be consistent in design of text, graphics and sound to limit cognitive overload'; 'keep pages short so learners don't have to scroll'; 'keep pages uncluttered by extracting unnecessary element'; 'pages should download in 30 seconds or less with 14.4 modem'; 'screen excess information'; 'Structure materials as topical modules'; 'strive for quality not quantity'; 'design small'; 'test any outside links regularly'; 'get feedback from users'.

Instructional technology concept is generally associated with the 'learning object'. Wiley is one of the first postmodern theoreticians who has tried to define the boundaries of this term. (Wiley, 2000) In the author's perspective: 'Technology is an agent of change, and major technological innovations can result in entire paradigm shifts' so, consequently, "Learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science."(Wiley, 2000) The

fundamental idea is that learning objects nowadays are characterized by general access and usage through the Internet (i.e. traditional video tapes used as part of a lesson could be accessed and used in only place by only one teacher and a group of learners). As 'digital entities', the new learning objects have also become collaborative and can be improved by new versions. Instructional development is characterized by 'reusable chunks of instructional media': this means that teachers and learners have also the possibility to break the materials and reassemble the parts so that they should support their individual goals and thus 'potentially increasing the speed and efficiency'.

Instructional technologies are interoperable. Different institutions all around the world have developed and promoted instructional technology standards so that learners and teachers all around the world could become part of the new curricular approaches which use technology: the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE) formed in 1996 in USA, the Alliance of Remote Instructional Authoring and Distribution Networks for Europe in 2000 (ARIADNE), the Instructional Management Systems (IMS) Project in USA in 2000. In this perspective there is a working definition which stipulates that:

> *Learning Objects are defined as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. Examples of technology-supported learning include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments. Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning (LOM, 2000).*

Educational technology ('technological design') and instructional technology ('technological media') have added new theoretical and practical background upon which new modern theories and programmes have been structured. Many acronyms encipher various educational experiments under the umbrella of new curricula. The 'voices' do not form a 'choir' but the best advantage of this is the continuous research in the theoretical and practical aspects of the educational field. By demoting a previous conception, researchers build new other ways of dealing with terms, clarify the concepts, open new perspectives, and release imagination. Among the most famous educational and instructional 'lab-experiments' nowadays we should mention:

a. Strauss and Frost (1999) – identify nine key factors that should influence media selection: institutional resource constraints, course content appropriateness, learner characteristics, professor attitudes and skill levels, course learning objectives, the learning relationships, learning location, time (synchronous versus asynchronous), and media richness level. (Strauss, 2012)

b. Dick, Carey, & Carey (2001) specify three major constraints operating on media selection, each of which may impede the selection process. These constraints include the following:

- (Un)availability of Materials: Using existing instructional materials can facilitate the creation of instructional units; however, if no appropriate materials exist, then the instructor must create the materials. This usually leads to a production constraint.
- Production Constraints: Creating quality instructional media can be a costly, in both time and money, enterprise. A central question to answer is what level of media quality is acceptable, that is, both time and cost efficient as well as instructionally effective.
- Instructor Facilitation: Most forms of instructional media involve teacher modeling, demonstration, implementation, or more broadly, facilitation. The amount or difficulty of this processes of media facilitation may inhibit a teacher's ability to effectively utilize the particular media.

c. In 2006 the USDLA (United States Distance Learning Association) edited an 'Instructional Media Selection Guide for Distance Learning' with 'Implications for blended learning' and 'featuring an introduction to virtual worlds'. (Holden 2010) From the very beginning it is stated that: 'Media selection is an integral part of the Instructional Systems Design process. In that role, media selection ensures that a specific instructional medium can support the attainment of a given learning objective'. The theory about distance learning is integrated into 'blended learning' concept which is 'hybrid learning'. The new concept derived from various experiments which in time had become regular methods of teaching/learning: Correspondence (1883) joined Technology – enabled concept (1950-1990) into the complex Distance Learning method. Technology-enabled developed into e-learning and TV (satellite and cable), audio tape, audio graphics and audio conferencing techniques. E-Learning derived into Computer Mediated Learning, Electronically Assisted Learning and Web 2.0 e-Learning.

d. In 2010 a lot of discussions bring forward Web 2.0 in teaching and learning. Web 2.0 refers to "web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web" (Wikipedia, 2010). Blogs, wikis, podcasting, social bookmarking, and social networking sites are some examples of Web 2.0 applications. These new technologies have allowed users to easily publish content online and to connect and network with people who share similar interest without regard to physical location. The use of tags particularly enables students and teachers to collectively categorize and find content easily. In a nutshell, Web 2.0 could be characterized by openness, user participation, knowledge sharing, social networking and collaboration.

Year 2015 has come up with new suggestions for educational tech trends. Some of them are really unexpected and hardly recognizable as 'educational' but the word 'trend' explains only the present tendency without specialized theory or research for the moment: MOBILE PHONES: unexpected information which can become knowledge at request; BYOD ('bring your own device'): Students are asked to bring their own devices to school: IPod touches, tablets, laptops, mobile phones, e-readers, net books… Teachers will find new ways of using these devices as possible educational resources for their students; NATURAL USER INTERFACES: important innovation which can be used in the educational field: touch screens, voice-activation, motion-sensing; WEB APPS (HTML5): using Flash in order to access different web-based educational applications; DATA: standardized testing based on analytical tools which is supposed to be improved by the

new ‘data paces’ in the future. All of this information is already stocked in the Internet, but ‘data exhaust’ is to be counted and brought into discussion by the new taxonomy researchers; PRIVACY/SECURITY: government legislation in the USA especially dedicated to children and students’ interactions in the virtual space: COPPA (Children’s Online Privacy Protection Act), CIPA (the Children’s Internet Protection Act), and FERPA (The Family Educational Rights and Privacy Act). This major trend of the year 2012 is inspired by the negative effects of searching for random information on unprotected web sites: messages with violent, racist, implicitly sexual, xenophobic contents. Specialists haven’t delivered yet theoretical backgrounds for such virtual threats, but a number of laws are constituted on Teachers’ and Parents’ associations local case studies; OPEN LICENSING: open source technology, open source textbooks, open educational resources and open source data; PEER TO PEER: social learning virtual resources in order to offer teachers and students various practical ways to collaborate on safe platforms. It is meant to be applied either in pair work inside the lessons in the classroom but also with students miles away. Communication will be involved not only into a mere connection matter, but mainly as a method to create big opportunities for learners to help and teach each other; GAMING: new gaming applications for educational targets by using mobile technologies, data and analytics, new and engaging ways to move through lessons. Specialists are asked to theoretically introduce the concept of ‘educational games’ as a brand of learning objects.

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