An Educational Model for Asynchronous E-Learning. A case study in a Higher Technology Education

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Abstract—Nowadays, the use of Web based Education (WbE) in distance learning education is considered to be an innovative method of learning. Supportive parties argue that WbE renews the educational practice through the use of computers and their applied methodology, as well as the technologies provided by the use of the internet. These result to consciously renewing the educational material and to creating a flexible structure which promotes the individualization of learning. The proposed model aims at delivering technological classes through the internet, offering a flexible use of means and tools, allowing a synthetic presentation of selected bibliographic texts that cover the whole cognitional object, developing a cooperative spirit and individualising the learning procedure.

Index Terms—Web based Education, education model, higher technology education.

I. INTRODUCTION

There are quite a few pedagogic models and learning— instructive theories. The most popular of them are the following [1], [6], [15], [18], [19], [21], [24]:

The Behaviouristic model. Based on the idea that the learning procedure is a form of observed behavior and the outcome of a response to some kind of impulse. (Impulse→Reaction).

The Cognitive approach model. According to this model the internal cognitive processes performed within the student’s mind, during the learning procedure, are emphasized.

The model of Constructivism. Within this model the student should have or acquire the ability of managing the learning procedure applied. As a result the learning procedure is driven by and evolved through the social interaction effectuated during lectures. The tutor creates and uses this type of knowledge attained by actions adjusted to the class delivery content.

Models of established learning and learning communities. The model of established learning is based upon two principles: firstly the fact that knowledge can be found and acquired within authentic environments—frameworks that attain knowledge through empirical circumstances and secondly the presumption that new knowledge and learning can be found within social communities and demands social interaction and teamwork cooperation.

By comparing the most recent pedagogical models as studied by Merrill (2003) it appears that the most effective learning environments are those focusing on problem solution (problem-centered) and considering that there are distinctive phases within the learning procedure. Furthermore, Merrill suggests the following “Basic Teaching Principles” according to which the learning procedure is promoted (Figure 1): (a) students are focusing on solving substantial problems, (b) the student’s previous experience and knowledge are activated and used as the basis for new knowledge, (c) the new knowledge and skill is presented to the student, (d) the new knowledge and skill is applied by the student, and (e) the attained knowledge and skills are incorporated to the student’s learning environment.

Figure 1. Merrill’s basic teaching principles

It must be noted that according to Merrill’s analysis the dominant part is captured by the student as an individual rather than his participation to an educational group [11]. However, there are several other pedagogical models focusing more on learning communities & communities of practice and collaboration [17], [20], [23]. In addition, there is a new predisposition towards more social—constructivism learning approaches followed by the educational community [5], [7].

According to Bransford, Brown and Cocking, (2000) the educational procedure must focus on: the student, the assessment, the learning material and the learning community [4]. The information, data and facts provided can be rather effectuated and interpreted when the social framework is reconstructed through the learning procedure [10]. Nowadays, the non-linear model, mostly based on the model of constructivism, is widely used on designing educational systems [3], [9], [16], [18], [21], [22].
II. EDUCATION MODEL

The proposed model concerns the teaching of technological cognitive objects. The technological class or teaching material includes not only theory but concretisation skills too that presuppose the use of all senses, and aren’t only servile work. In addition the process of learning in such a cognitive object cannot be characterized from simple activities as memorization, rationalisation and rethinking but it should include also more composers processes as creation experimentation and feedback as well. At the following form (Figure 2) are presented the stages of creation of the WbE educational model according to their time of creation.

III. MODEL STRUCTURE

In Asynchronous Education of Technological Courses Model’s (AETCM) design, were used elements by relevant published theoretical models of asynchronous education. AETCM is constituted by two parts: the theoretical part includes the theoretical education of a technological course, and Laboratorial part that includes the laboratorial (practical) education of a technological course. For course design were used elements from relevant models of asynchronous education [2], [8], [12], [13], [14].

The offered courses will function as completely autonomous courses in the internet via web site that each candidate student can enter without been essential watching the corresponding conventional way of teaching courses. AETCM’s general structure is the following as it appears in the next form (Figure 3):

The TLP is constituted by three educational levels:

1. **Basic infrastructure level - BIL** (obligatory after unsuccessful test of knowledge level-diagnostic test). In this trainees cover the voids of knowledge that is required to watch the cognitive object. It is provided educational material and organisation of matter (progressive and linear structure) as to cover the voids.

2. **Education level - EL (obligatory)**. In this level trainees study the cognitive object. It is provided educational material of the technological course.

3. **Specialisation level - SL (optional)**. Trainees take this class provided that they have indication from the teacher for deepen studies if a training problem is realised (evaluation-feedback). It is provided educational material structured in units with detailed analysis and exercises.
Each educational level is separated in courses with linear order, and each course is divided in thematic educational units that follow a linear line in their educational presentation. The trainee should finish the first lesson to continue to the next one (typical procedure) and the same is followed for all units. At the end of each lesson the student can be tested and at the end of each level there is a required final test until to complete the course teaching material. At the specialization level are provided tutorial courses for deepen analysis and case studies. Each course includes the following characteristics:

**Educational Material.** In the case of distance learning material WbE does not depend on a single textbook but on many sources that includes the following (Holmberg, 2002): course material, course material of sources and self-assessment material.

**Tools.** The model uses as tools of presentation of educational material in the computer: educational software, animation, video, text, pictures all in digital form.

**Educational Methods.** In each course many educational methods are included according to the requirements of asynchronous education base of instructive frame of proposed model. More specifically, according to the subject of each course, are used the following: lecture (text, forms, and photographs, sound), demonstration (video, animation), individual work (use of email), group work (use email), discussion with a teacher (use email, telephone) and evaluation.

**Time of Education.** At the beginning of each course a briefing time is allowed to the student. The allocated time varies for each course depending on the object that includes studies, practice, and evaluation. This time is no obligatory for the student and can be increased or decreased according to the rhythm of learning (asynchronous dimension of proposed model) without however exceeding a concrete time limit that set the teacher for total evaluation of the level.

**Learning Theories.** Each course it is conditioned by the training frame of proposed model and more specifically by the content of educational material, from the model of cognitive approach and the constructive process of teaching material based on Blooms theory. Also in the instructive process is promoted student cooperation via group work or project.

The department Virtual Lab is proposed to have the following model (Figure 5):

Teaching-Learning Part contains the same structure as the theoretical part, Simulor Laboratorial educational software will be used for laboratorial practice in digital environment. The Practice department provides scripts of laboratorial exercises for Simulor use by the users. The department of Evaluation has the same structure in both sectors as it appears in the following form (Figure 6):

For the evaluation of the trainees there are course department Test and level department test. The course department Test is concerned with test that is based on the course material. While the level department. Test is concerned with tests based on the material for the whole level. The feedback department is involved with the communication between the teacher and the trainees and has the form of partial bidirectional communication and serves the following: (a) transport of evaluation test and results, (b) transport of questions, comments on the course, (c) educational evaluation of system from the trainees (transport of questionnaires from teacher to educate and on the contrary), and (d) depiction of educational directives in a forum by the teacher. The data is transferred by e-mail via internet since an asynchronous system and telephone communication model is used. A structure form is given which is the same for both parts (Figure 7):

Transfer Department is concerned with the collection of evaluation forms, texts with comments, indications, additional educational material from the teacher (it can be in electronic form from teacher or trainee or some web page of the system). The department of email/telephone deals with the communication via internet of teacher and trainees.
IV. CASE STUDY

The proposed example of model materialization was used in higher Technological Education Level and concerns the teaching of technological cognitive object (additionally or exclusively from the internet). More specifically it is the teaching of a course in Computer Numerical Controls (CNC) that is offered by the department of Automation of Technological Educational Institute of Piraeus. This is a course offered in the 7th semester and includes theoretical and laboratorial parts. The course is reported an introduction of machine-tools of numerical control with computer and is used in Industry in the area of flexible manufacturing automated system. This period is characterized by a line of important advantages, more basically which are the flexibility of, the high productivity and the better quality of product. It is separated in two sectors. The theoretical part deals with the principles of operation, designing, control and applications of machine-tools CNC and the laboratorial part which deals with the planning of such machine-tools with the use of a simulator. The simulator is the SYBA-CNC for lathe and milling. The computer requirements are: minimal memory 1 GB, disk-drive and card of graphic at least type EGA. The implementation of the example can be done in environment Frontpage (or in other computational tool for creation of web pages). For the production of educational material the following computational tools are used: Word, Powerpoint, Flashmedia, Video, Photoshop, Director, CoolEdit, 3D Max. The technical resources that will be used for the materialization of the system are given in the following diagram.

The pilotage, for the case study, is interactive and identical with that of an electronic book and also has additional interactive multimedia tools such as: use of pictures, sound, text and video. Following a flow diagram is given for the application (Figure 10):

V. CONCLUSION

The integration between information and telecommunication technologies has supported distance learning by providing learning situations that are accessible to individuals at any time and anywhere. The issue of assisting people to “learn how to learn” has been an active research area, and now there is a growing acceptance that understanding the way students learn is the key to improve the education process.

Since few years, E-learning has changed not only the technology of the education environment but also the educational paradigm itself. The advantages of e-learning are twofold: we can overcome the restrictions of time or space, and we can study individually and cooperatively. Consequently, e-learning systems have to be designed in a way to cope with different learning styles and goals of students. This personalization is possible corresponding to the student’s knowledge that the system stores.

The proposed educational model and its concretisation system will focus on a learning trying to offer flexibility, cooperativeness and individualization. Furthermore, there will be offered a specialized environment of technological cognitive subjects that play an important role in distance learning. The main objective of the designers is the completion of this model and the development of the concretisation system and its evaluation in factual action.

Online collaborative learning extends learning beyond the classroom and creates relationships between learners which construct their learning through collaborative learning environments and at their own learning speed.
REFERENCES

[1] Anderson, J., R., Reder, L., M. & Simon, H., A. (1996). “Situated Learning and Education”, Education Researcher, 25(4), pp. 5-11.

[2] Arvanitis, C., Papachristos, D., Koronaios, N. (2005). N., “Educational model self e-learning in e-commerce for residents of mountainous or faraway regions”, Proceedings of the Greek Conference for Lifelong Learning, 16-17 April, 2005, Lamia.

[3] Blumer, H. (1969). “Symbolic Interactionism: Perspective and Method”, NJ: Prentice Hall

[4] Bransford, J., Brown, A. L. & Cocking, R. R. (2000). “How People Learn: Brain, Mind, Experience, and School” (expanded edition), Washington: National Academy Press.

[5] Brown, J. S. & Duguid, P. (2000). “The Social Life of Information”, USA: Harvard University Press.

[6] Cobb, P., Wood, T. & Yakel, E. (1990). “Classroom as learning environments for teachers and researchers”, In Von Glasersfeld (ed.), Radical Constructivism in Mathematics Education, NL: Kluwer, pp. 157-176.

[7] Duffy, Th. M. & Cunningham, D. J. (1996). “Constructivism: implications for the design and delivery of instruction”, In D.H. Jonassen (Ed.), Handbook of Research for Educational Communications and Technology. New York: Macmillan.

[8] Karagiannis, Stef., Karachisaridis, Eust., Papachristos, D. (1996). “Multimedia Application in Robotics teaching”, Conference Proceedings Technology and Automation, TEI Piraeus, May 1996.

[9] Kuhn, T., S. (1996). “The Structure of Scientific Revolutions”, USA: Harvard University Press.

[10] Lave, J., & Wenger, E. (1991). Situated learning: legitimate peripheral participation, Cambridge: Cambridge University Press.

[11] Merrill, M., D. (2003). “First Principles of Instruction”, Retrieved from http://www1.moe.edu.sg/itopia/download/abstracts/Applying%2Fiirst Principles of Instruction to Technology-Based Education.pdf.

[12] Papachristos, D., Tsoukalas, V., Alafodimos, C., Tselenti, N., Mattheu, L., (2007a). “Educational creation and evaluation, University of Thessalia, Abstract Papers, April 7, 2006, Volos-Greece.

[13] Perkins, D. N. (1992). “What constructivism demands of the learner”, Duffy, T.M. & Jonassen D.H. (eds.), Constructivism and the technology of instructions, NJ: Lawrence Erlbaum Associates, pp. 161-166.

[14] Piaget, J. (1970). “Genetic Epistemology”, NY: Columbia University Press.

[15] Piaget, J., Cocklin, B. & Combe, K. (1999). “Learning Communities in Education”, London: Routledge.

[16] Retalis, S., (2005). “Internet Advanced Technologies in learning services”, Athens: Kastaniotis.

[17] Tennant, M. (1997). “Psychology and Adult Learning”, UK: Routledge.

[18] Van den Hooft, B., Elving, W., Meeuwsen, J. M. & Dumoulin, C. (2003) “Knowledge Sharing in Knowledge Communities”. In M. Huysman, E. Wenger & V. Wulf (Eds.), “Communities and Technologies”. Dordrecht: Kluwer Academic Publishers.

[19] Von Glasersfeld, E. (1989). “Cognition, construction of Knowledge, and teaching”, Synthese, 80(1), pp. 121-140.

[20] Vygotsky, L. (1978). “Mind in Society”, MA: Harvard University Press.

[21] Wenger, E. (1998). “Communities of Practice: Learning, Meaning and Identity”. New York: Cambridge University Press.

[22] Wertsch, J. V. (1985). “Vygotsky and the Social Formation of Mind”, USA: Harvard University Press.

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