GEORGOULI
KATERINA

Enhancing Learning in Higher Education Using an Open Source LMS

Technological Educational Institute of Athens (TEI-A),
Department of Informatics

Technological Educational Institute of Athens (TEI-A)

Abstract: *The aim of this paper is to present a framework for a Higher Education course web-enhancement based on an open-source Learning Management System. The flexibility and ease of such a system to incorporate Internet resources within the classroom and the capability of teaching beyond the classroom by providing out-of-class access to in-class assignments make it a valuable addition to a student's and instructors tool box. Furthermore, the open source technology permits the easy development of different co-operating applications, supporting important educational and administrative procedures.*

Keywords: *Web-based Learning, Learning Management Systems, Higher Education, Educational Scenarios, Open source Software.*

1. Introduction

While teachers in higher education can continue to be highly effective with the traditional lecture-style instructional method, most of them have already realized that they must attempt to stay up-to-date to technological advances, adapting to a more technology oriented teaching style, although this takes commitment and time (Weis and Efaw, 2004). Modern educational research sets the agenda for an in-depth discussion of the most important questions facing those in education today. How should we teach? How can we learn? Do we need a new culture of learning? Are the old methods dead? In a world of rapid technological change, is training enough or do we need to encourage the adaptability that only education can bring? And how can the delivery of education keep up with the pace of change?

Almost every higher educational institution is using nowadays educational technology either to make distance education or to supply in-class lecturing with tools for posting course announcements, homework assignments, lecture notes and slides presentations. The most common educational technology in tertiary education are the so-called Learning Management Systems (LMS) (Georgouli et al., 2006; Kalogiannakis et al., 2006). In this framework, different techniques and educational material should be combined under a well elaborated educational scenario in order to support learning in an effective way.

The most popular LMS are open source software a fact that contributes to their choice over other commercially available e-learning platforms. In the past few years colleges and universities have begun to produce enterprise open source applications like course management systems and electronic portfolios that compete directly with their proprietary counterparts. These e-learning applications are leading a movement in higher education from proprietary software toward open source although the latter can be easily be modified to fit the university's needs, offering the programmers the possibility to develop additional functionality at their own pace without begging a proprietary vendor to include a feature. Problems and bugs of open source LMS, when identified, are usually corrected with the help of other developers from the open source community (Copolla and Neelley, 2005).

The spirit of open source is formed around diversity of input, recombination of ideas, creativity, and collaboration. These are essential ingredients for innovation and clear advantages to the open source philosophy. According to that, smaller applications are built that cover special functions, beyond those which an LMS is designed to offer. These applications might either work separately, using the main LMS platform to meet some specific needs, or be incorporated into it as modules. Several such applications are offered to the educational community nowadays.

An LMS allows teachers to create and administer courses through the web. Additionally, it provides a rich collection of services/features for administration tasks and communication including group management, forums, document repositories, calendar, chat, assignment areas, links, user profile administration etc. All these services are very helpful but it is essential to explore the different ways this platform could be used beyond the basic functionalities it provides in order to design effective blended learning educational scenarios for in-class and out-of class support.

Our belief is that this important shift in education, involving the integration of new technologies and the application of new educational models needs to be associated with a systematic redesign process with emphasis on the actors, both at the institutional level and at the educator level.

When transforming a course that has been delivered for years in a traditional in-class way into an e-learning enhanced one, some decisions have to be taken and some actions must be performed. These decisions and actions should be grounded on a careful analysis of the current situation in educational practice, in order to serve as the starting point towards the development of a successful redesign process, by means of more innovative approaches. For example, a first step would be to study thoroughly the tools provided by the chosen LMS and to see how those tools could be used to support educational methodology and the learning objectives that are used currently. After that, new e-learning activities can be designed, for enhancing learning. Finally, the two tasks would merge, leading to the creation of a new well designed blended learning scenario, from then on followed consistently.

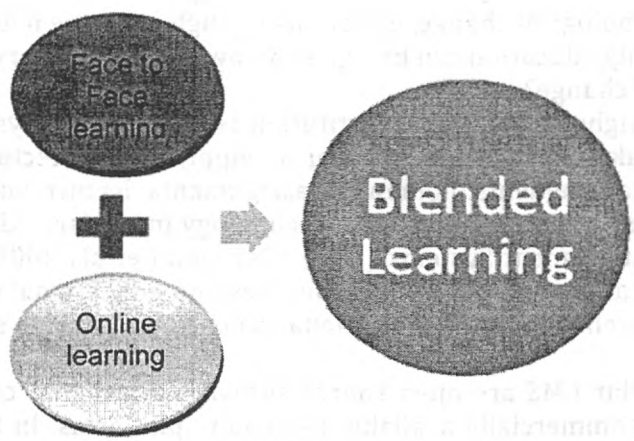

Figure 1. Blended Learning

The framework we propose in this article will assist teachers in converting the structure of a typical face-to-face course into a web enhanced one, following the rules of a well designed instructional model.

In the next section, we introduce the key points that should guide teachers' choices when converting an existing course. We then move on to describe the proposed framework. This presentation is accompanied by an extended discussion on the key challenges, in our understanding, for enhancing the quality of e-learning in the future.

2. Conversion Key Issues

One of the key issues for converting an existing face-to-face course to one based on technology is choosing the kind of blend to be used. A blend is an integrated strategy for delivering on promises about learning and performance, such as coaching by supervisor, participation in an online class, etc. (Rosset et al., 2003). The *term blended learning* is used to describe a learning format that combines several different delivery methods and also to describe learning that mixes various event-based activities, such as face-to-face classrooms, online collaborative learning and self-paced learning.

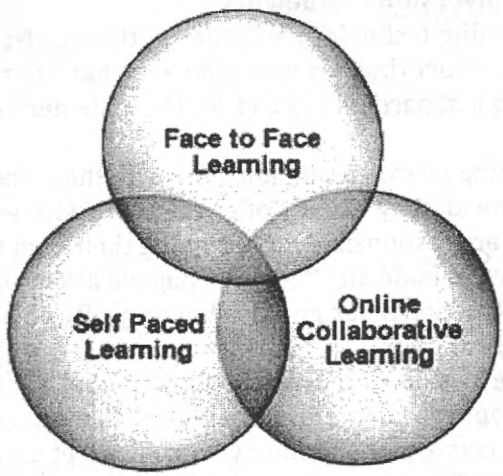

Figure 2. Defining the blend

Options for blended learning go beyond the classroom. They can be formal and informal, technology- and people-based, independent and convivial, and directive- and discovery-oriented. They involve a planned combination of approaches, such as coaching by a supervisor, participation in online classes, visiting websites, consulting manuals, attending seminars, workshops, and online communities.

Heinze and Procter (2004) have proposed the following definition for Blended Learning in higher education:

Blended Learning is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course.

The starting point for the design of a blended learning conversion of an existing higher education program is the set of desired learning outcomes and the breakdown of the key learning points to be covered (EPIC, 2010).

Many higher education programs are heavily classroom-based and contain large amounts of information that must be transferred to students. Such programs can often be improved using delivery methods supported by an LMS, but information delivery does not have to be the only reason to use blended learning. Improving the quality of the learning experience, increasing the availability and accessibility of learning materials, supporting collaborative activities and strengthening the feeling of belonging to a community are also important driving forces.

The next stage in the conversion process is defining the blend, matching the identified objectives and content with the best delivery methods (see figure 1). These methods fit into three main categories: face-to-face, offline individual work and on-line communication. Face-to-face includes lectures, presentations, seminars, projects, tutoring and coaching. Individual work is based on books, manuals, workbooks, magazines, CDs, DVDs, etc.

Online methods are delivered either online, via the Web, or offline, via CD ROMs or other non web-based Computer Based Technology (CBT) approaches. They provide interactive customised content, e-tutoring, e-coaching, email, application sharing, video conferencing, audio conferencing, chats, forums, virtual classrooms, document and file retrieval, search engines, websites, PDAs, etc.

The two main aspects influencing the design of the blend are: a) the number of students having access to e-learning technology at home and b) the effort required to upgrade the content in order to make it suitable for the online environment.

3. The Proposed Conversion Framework

Teachers using e-learning technology to enhance their courses should try to incorporate in their pedagogical model those learning factors that Information and Communications Technologies (ICT) boost particularly well and that are derived from educational technology research.

In most cases, e-learning platforms are not subject to the pedagogical considerations of one particular model. Instead, they usually offer the tools with which such models can be built. Therefore, teachers are responsible for designing their own instructional models, discerning the pillars on which to build an effective pedagogical setup. A wide variety of models concerning e-learning instructional design exist, but they often override fundamental pedagogical principles (Voos, 2003).

In order to guide the design of an instructional model for web-enhancing a course through e-learning, we propose a theoretical framework that follows the current educational practice when devising viable plans for innovation (Bonk et al., 2003; Stephenson, 2001; Valcke, 2001). The proposed framework is inspired on the blended learning paradigm, combining face-to-face practices with online delivery approaches.

Our theoretical framework has four major components: Administration, Content, Activities and Community (see figure 3). Each component can be incorporated into a course to enhance learning in a variety of ways and is informed by the other components within the given environment. In each component, there are tools devoted to provide information, to motivate students, to setup activities, to assist interaction and to promote production of new knowledge.

The administration component is an indispensable ingredient in the design of the web-enhanced part of the course, called e-course hereafter. In fact, some fundamental decisions have to do with the e-course access policy (whether it is public or private) and the registration settings. The administration component also contains tools for collecting important statistical information and to prepare documentation for course evaluation but takes no part in the pedagogical setup.

From the other three components the teacher can choose any non-empty subset in the process of web-enhancing a course. In doing so, the teacher must identify the activities that contribute most effectively to student learning and the framework that best addresses pedagogical issues (Khan, 2000; Sgouropoulou et al., 2006).

The starting point for e-learning is providing information. Once that point has been established, it becomes possible to explore new innovative approaches, relying on technology, to go deeper and transform information into knowledge. In parallel, students should be motivated to co-operate in order to reach this goal through their participation in the designed activities. For this task to be successful, each pedagogical setup should incorporate in its content and activities components learning tools like content delivery, objectives and competences description, agenda of lectures, self-assessment exercises, assignments and projects for new knowledge production, lesson plans, etc.

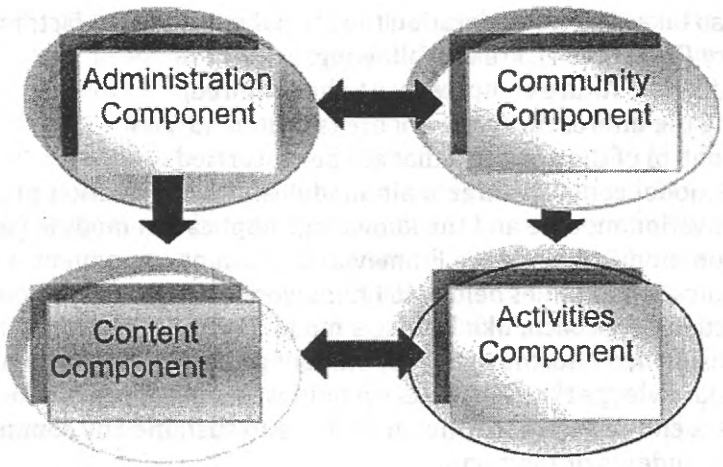

Figure 3. The theoretical framework

Moreover, working as a community requires an intensive design of novel ways of communication for the needs of collaborative work and for spreading and gathering information. Students must be supported and must know that their instructors and peers pay attention to their urges and expectations, especially during collaborative project activities. Community tools like user lists, forums, groups, chat, announcements, news and wiki, but also learning tools like agenda are suitable for these purposes. Furthermore, the use of modern gadgetry, such as mobile phones and iPods, as support for information delivery and sharing, also help to build the sense of community.

The learning and community tools can be included in more than one component and are easily undertaken by contemporary e-learning platforms.

The proposed framework may be used as a guideline for generalising the development of an instructional model incorporating a pertinent pedagogical setup which federates learning and «learner-centered» factors across disciplines. The derived instructional model should support and emphasize soft-skills such as capacity for information gathering, autonomy and communication abilities for team work.

4. Designing the Instructional Model

In this section we present the design of an instructional model, using the aforementioned framework and exploring available physical and learning technology infrastructure, and the pedagogical setup derived from it.

The main goal of the current design effort is to determine those e-course modules that would reflect our instructional approach for web-enhancing a course adopting blended learning instructional methods.

Our pedagogical setup federates learning and «learner-centered» factors as derived from the American Psychology Association (APA, 1997) and is based on Merrill's first five principles of instruction (Merrill, 2002).

- Learning is promoted when learners observe a demonstration, the demonstration principle.
- Learning is promoted when learners apply the new knowledge, the application principle.
- Learning is promoted when learners engage in a task-centered instructional strategy, the task-centered principle.
- Learning is promoted when learners activate prior knowledge or experience, the activation principle.
- Learning is promoted when learners integrate their new knowledge into their everyday world, the integration principle.

The design also takes into consideration the crucial motivational factors which, according to Viau's theory (Viau, 1994), are the following:

- understanding the future competences to be acquired,
- appreciating the interest and value of the task at hand, and
- feeling in control of the activities that are being carried out.

The resulting model contains three main modules: the information provision module, the knowledge activation module and the knowledge application module (see figure 3). Information provision module belongs to Framework's content component while knowledge activation and application modules belong to Framework's activities component. The model follows a constructivist approach, like Lebrun's model (Lebrun, 1999) where introductory information is transformed into knowledge by student activities and this in turn feeds application of acquired knowledge through project activities leading to production of new knowledge. This process is enabled by motivational factors and sustained by communication from other participants, students or instructors.

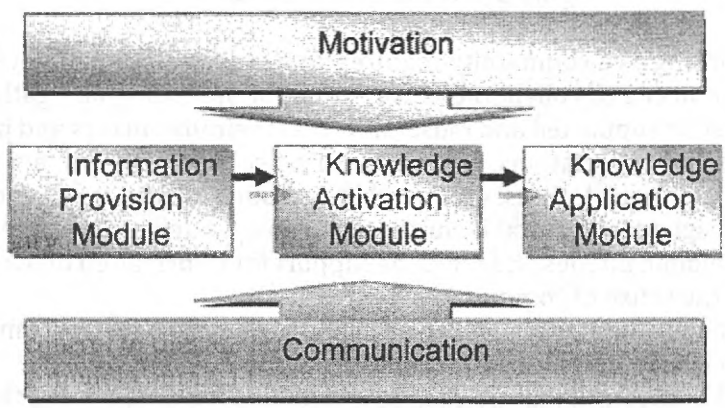

Figure 4. Dynamic representation of the e-learning instructional model

In the Information Provision module, all the existing learning material is presented in an accessible form for reading, downloading or sharing. Learning material, according to Merrill's demonstration principle, should contain lesson notes, questions for recalling previous or recently acquired knowledge, demonstration of specific examples, links to supplementary information on the subject matter or to related knowledge, etc. To increase information provision using Viau's motivation factors, students should be aware of the goals and objectives of the course, should have access to an accurate agenda of the lectures, should receive guidance on how to access the uploaded learning material for effectively enhancing face-to-face learning and how to use pre-designed lesson plans for distance learning.

In the Knowledge Activation module, students should, according to Merrill's activation principle, be supported to activate relevant cognitive structures by being directed to recall, describe or demonstrate relevant prior knowledge or experience through well designed self-assessment exercises. Feedback must be intrinsic to help students succeed in this. Furthermore, new activities should be included to assist students in organising and summarising new acquired knowledge and make them aware of its specific structure so that subsequently they will be able to better remember it and use it more effectively (Reigeluth, 1999; Marzano et al, 2001).

During the knowledge application phase, coaching should help students use the structures they are already aware of in order to facilitate the application of newly acquired skills to complete new tasks. Self-assessment exercises should be designed to gauge students' skills like the ability to classify a new example, to predict a consequence or to find faulty

conditions in a specific situation. To assess students' generalised skilfulness, they should be asked to solve a new problem or complete a different task from the one that was used for demonstration. Students should also be encouraged to summarize what they have learned and again examine how the new knowledge is related to what they previously knew via the structure that was recalled or provided (Merrill, 2002). According to Merrill's application principle, students should receive intrinsic or corrective feedback, in order for the application of new knowledge to be effective, and coaching should be gradually withdrawn for each subsequent task, so that the application of knowledge augments constantly.

For fostering the community feeling additional communication means like announcements, emailing, forum and chat tools have to be always available and used in a reasonable way.

In the following paragraphs we use the theoretical framework that we have just discussed to present the procedure that must be followed to redesign the structure of a typical course with respect to a well designed e-learning instructional model.

5. Defining the Blend

Usually, a course is organized in two parts, one is the theoretical part, and the other is the practical work which can be any kind of training.

Unfortunately, usually the students are not attending all lectures systematically. This situation creates a set of difficulties that e-learning could help to avoid. For example, those students who work outside and cannot attend all the lectures could have access to the e-course materials, and be informed on time about any important events, thus being able to get prepared for the labs and for the final exams. Those who do not perform so well in the practical work could have access to supplementary support material, such as self-assessment exercises, exemplary assignments of their colleagues, etc. The existence of an on-line agenda could help students understand the objectives of the course from the very beginning. On line discussions on problem solving issues could motivate students to perform better. Grouping tools could be used for peer collaboration and for designing more efficiently the enrolment to the different training groups.

At first the delivery methods should be decided that would best suit the objectives and content of the course. The lectures usually remain a face-to-face activity but to the rest of the instructional activities and communication blend should be added where appropriate.

The conversion of the course can be realised in three steps according to the proposed conversion framework and may take few semesters. The first step is to prepare and upload the content to be delivered. To prepare and upload the existing content and to study the opportunities offered by the platform may take some time, especially if the tutors are inexperienced in e-learning use. Before moving to the next step, an in depth study is needed about which platform's tools could be used to enhance existing traditional learning procedures, to decide about the blend and design in details the new instructional framework. The second step is to organise the community and to tune the uploaded content and to design activities for recalling existing knowledge in the form of self-assessment activities. The third step follows and is to design new knowledge activation activities in the form of assignments and knowledge application activities in the form of semester-long projects. In parallel, all platform tools must be studied in depth to see how they can be used more beneficially in order to apply the motivation factors of the pedagogical model. Upon completion of each step students should be asked to fill in questionnaires, where they could express their opinion about the effectiveness of the web-enhancement of the course, so that designers could correct wrong design decisions and fine tune the approach.

The administration component

All courses offered in the curriculum must have their own home page on the e-learning platform. Each e-course administrator, usually the professor responsible for the course, decides about access type between private, where only enrolled students have full access or

open with restrictions, where visitors can access the course's content but only registered students are able take part in e-activities or use the communication facilities. Public e-courses, where unregistered visitors could have free access to the e-course content, are not recommended.

For keeping track of our students' progress and their involvement in the e-course activities different statistics tool are offered to the instructors.

The content component

Content delivery for the e-course must be carefully prepared. Learning and training elements must be separated into different layers of resources that could be combined, revised, and added to, in separate operations.

The existing «learning objects» such as lesson notes, PowerPoint presentations, demonstration files, exercises and other supporting documents shouldbe redesigned in order to be easily accessed through the Internet, both for downloading and for online reading. Well chosen web links must be put in place to related research, theory and evaluation. Further links to other parts of the course or to relevant learning material in other courses could also be added. Previous exams should be collected, commented and put online. During lecturing, demonstration files and web sites can be visited online to enhance learning.

The content must be well organised and students are informed about the pedagogical setup on the first lecture of the semester, because otherwise they would soon lose interest, not knowing which elements are important for them and when it's the best time to access those elements. For the same reason the agenda tool should be used to state a precise schedule of the lectures to be delivered, each lecture being linked to relevant documentation and training material.

Training material is divided in two major categories: self-assessment activities and assignments for activation and production of new knowledge. For the self-assessment activities, questions from previous exams should be collected and new questions should be added, thus building up a rich «questions pool» for the student's self-assessment.

The assignments have to be designed in a way that facilitates personal as well as collaborative work as this latter is very easy to be realised using the platform's collaborative tools.

Detailed «lesson plans» should be designed in order to engage students in our task-centred instructional strategy, and made them available to students through the existing platform's tools (e.g. learning path tool).

Learning objectives and evaluation criteria must be published at the home page of the course to illustrate the context.

The Community Component

The first step for organizing our community is to redesign the way students attending the training groups, using the available tool. Then, using the communication tools, communication channels can be established for posting all important announcements online, for delivering urgent messages by email to the whole class, to groups of students or to individual students. Finally, forums must be opened for general discussion and thematic discussions.

For helping students collaborate with their colleagues when they are working on homework assignments, forums that promote distant communication among the participants of each group must be opened. These forums are supervised by the instructors, making clear that the teaching staff is paying attention to the students' urges and expectations, not only during face-to-face lecturing and coaching, but also at a distance.

Whenever appropriate, feedback must be sent to students, in a way that stimulates their critical thinking. Multiple points of view and best solutions can also published at the free access collaboration area of each group after an assignment is over to give time for personal appropriation.

Work as a community is a necessity, given the large number of students in a course, but it is also a requirement that stems from the main objective of the practical part of the course which is to support students to learn how to collaborate and also to learn from others' experiences.

The Activities Component

The platform's assignment tool allows instructors to manage their students' homework efficiently. Instructors should regularly track learners' activities, mark uploaded assignments, add comments, set deadlines, hide activities and open others at specific time periods. Students are informed in class about any new posted activity and a link to that activity is inserted at the lesson's entry in the agenda. For each student the course agenda is merged with the agenda of all other courses in which the student is enrolled. This way, each student can have a clear view of all his or hers obligations, activities and deadlines.

6. Conclusions and Future Work

The demands on higher education require a fundamental change in direction—and technology can facilitate that change. Open source e-learning platforms have paved a new road changing the existing ways of teaching and learning.

As teachers experiment with technology in the classroom, it is important to recognize that the role of educator has stayed essentially the same, to educate and inspire the students.

For enhancing a traditional course, a pedagogical framework must be adopted, a blended learning scenario must be designed and an e-learning platform must be chosen which will be able to be used for out-of class information, educational content repose and retrieval, in-class supporting material during course lecturing, and mainly for labs registration, assignments and examinations. Extra utilities can be added to provide missing tasks.

When first using an e-learning platform, designers should invest in the teachers' experience through thorough training, customization and increase of the level of adoption. They should intend also to initiate a pilot program proposing innovative teaching procedures for all courses based on this experience.

An imminent goal of those taking decisions in a faculty lever adopting an LMS for enhancing learning is to convince all the colleagues who are still afraid of technology to get involved, which is the real challenge of this new e-learning era.

LITERATURE

1. APA (1997). Learner-Centered Psychological Principles: A Framework for School Redesign and Reform. Revision prepared by a Work Group of the American Psychological Association's Board of Educational Affairs (BEA).
2. Bonk, C. J., Wisher, R. A. & Lee, J. Y. (2003). Moderating learner-centered e-learning: Problems and solutions, benefits and implications. In T.S. Roberts (Ed.) Online collaborative learning: Theory and practice, Hershey, Pennsylvania: Idea Group Publishing, 54-85.
3. Coppola, C. & Neelley, E. (2004), Open source – opens learning: Why open source makes sense in education, retrieved September 1, 2007 from http://www.rsmart.com/assets/OpenSourceOpensLearningJuly2004.pdf.
4. EPIC (2010). Blended learning in practice, an EPIC white paper, retrieved from http://www.epic.co.uk/assets/files/wp_blended_learning_practice_2010.pdf
5. Georgouli, K., Kantzavelou, I., Guerreiro, P. & Koilias, C. (2006). Enhancing Student Learning Using Asynchronous e-Learning Platforms. In Proceedings of the IADIS International Conference on Cognition and Explanatory Learning in Digital Age (CELDA 2006), Barcelona, 73-80.
6. Heinze, A. & Procter, C. (2004). Reflections on the Use of Blended Learning. In Proceedings of the Conference on Education in a Changing Environment, University of Salford, UK.

7. Kalogiannakis, M., Vassilakis, K., Liodakis, G. & Psarros, M. (2006). Approaches for the exploitation of the e-class platform in tertiary education in Greece. In Proceedings of the International Conference of Telecommunications and Multimedia (TEMU2006), Heraklion, Crete, Greece.
8. Khan, B. (2000). A framework for e-learning. Distance Education Report, 4 (24), 3-8.
9. Lebrun, M. (1999). Des technologies pour enseigner et apprendre (Deuxième édition). Bruxelles: De Boeck.
10. Marzano, R., Pickering, D. & Pollock, J. (2001). Classroom Instruction that Works, Research-based Strategies for Increasing Students Achievement. Alexandria, Virginia: Association for Supervision and Curriculum Development.
11. Merrill, M. D. (2002). First principles of instruction. Educational Technology Research and Development, 50 (3), 43-59.
12. Reigeluth, C. (Ed.) (1999) Instructional Design Theories and Models: A New Paradigm of Instructional Theory. Volume II. Mahwah, NJ: Erlbaum.
13. Rosset, A., Douglis, F. & Frazee, R. (2003). Strategies for Building Blended Learning, retrieved from http://www.astd.org/LC/2003/0703_rossett.htm.
14. Sgouropoulou, C., Chalaris, I. & Fouka, M. (2006). Applying Systematic Learning Design to Curricula, in Proceedings of the International Conference «Information Technologies in Education for All», Kiev, 29-31.
15. Stephenson, J. (2001). Teaching and learning online, London: Kogan Page.
16. Valcke, M. (2001). Models for Web-based Education: Have We Forgotten Lessons Learned? In Van der Molen, H.J. (Ed.) Virtual University: Educational Environments of the Future, University of Gent: Portland Press, 51-66.
17. Viau R. (1994). La motivation en contexte scolaire. Pédagogies en développement. Bruxelles: De Boeck Université.
18. Voos, R. (2003). Blended Learning: What is it and where might it take us? Sloan-C View 2 (1), 2-5.
19. Weis, E. & Efaw, J. (2004). Using Blackboard, Instead of a Blackboard in the Classroom, In Proc. of IADIS International Conference Cognition and Exploratory Learning in Digital Age (CELDA 2004), Lisbon, Portugal, 149-156.

Поступила в редакцию 05.09.2011