A Framework for Adopting LMS to Introduce e-Learning in a Traditional Course

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ABSTRACT

As more and more teachers in tertiary education experiment with technology, looking for new ways of enhancing their traditional ways of teaching, the need of flexible tools able to support well planned blended learning scenarios emerges. Learning Management Systems, especially those which are based on open source software, have shown to be very helpful in reaching this goal. Nevertheless, technology alone is not sufficient because teachers have to understand beforehand the potentials it offers in order to be able to use it effectively in redesigning their educational scenarios.

In this paper we present a framework for introducing e-learning in a traditional course. The framework can be used as a guideline for the development of an instructional model incorporating a pertinent pedagogical setup which federates learning and "learner-centered" factors. We illustrate this process with a case study that shows how the recommended method has been applied to make a successful transition to a blended learning format that combines face-to-face sessions with distance communication.

Based on this experience and on the results from the evaluations we have conducted in the last few years (3 surveys with 316 participants), we claim that e-learning methods and tools can indeed help in efficiently supporting the students and in improving the quality of learning.

Keywords

Learning management systems, Blended learning, Web enhancement, E-learning instructional model

Introduction

As teachers in tertiary educational institutions across the world experiment with technology, trying to take advantage of it in their courses, it is important to recognize that their role, as teachers, has remained essentially the same over the years: to educate and inspire students, and to offer them the means to build stable foundations for a successful future. While teachers can continue to be highly effective with the traditional lecture-style instructional method, a new technological resource, that of web-based learning management systems (LMS), is spreading out. Research results demonstrate that, although innovation may build upon the technical prospects, concrete difficulties arise, caused by problems of incongruity at the level of the educational model (Griffiths, 2005; Laurillard, 2002; Jonassen et al., 1998).

Learners perceive a shift in the educational culture, which causes stress and creates reluctance to participate. Moreover, traditionally-minded educators often disapprove or feel uncomfortable with this implied change in educational policy. After a long period of using LMSs in tertiary education, it became obvious that these tools cannot reach their full potential if teachers are unwilling to adapt to a different teaching style, based on technology. In order to adapt successfully, teachers must be trained to develop their pedagogical autonomy and to become proficient in the use of technical tools, in order to be able to make experimentations, to discover the need for a sound new pedagogy and to foster it in university teaching.

LMSs are the most representative e-learning applications. Some are open source software, others are commercially provided. They can be used for distance-learning and as a supplement to in-class lectures, on which course

announcements, homework assignments, lecture notes and slides can be posted, for Internet access (OECD, 2005). These days, we observe a movement in higher education leading from proprietary software to open source, for e-learning applications (Coppola and Neelley, 2004). In fact, open source software development can provide the necessary flexibility to combine languages, scripts, learning objects and lesson plans, effectively, without the cost and rigidity of proprietary packages (Williams, 2003).

An LMS is not limited to a strictly determined educational role: it may also function as a new means for communication. Therefore, we have to examine closely the use of these platforms at all educational levels (Pirani, 2004). 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 learning scenario, from then on followed consistently.

Abiding by these principles, after first adopting for an LMS, in our informatics departments, we spend a couple of years becoming familiar with the functionality of the software and becoming capable of using its services effectively and confidently. The Technological Educational Institute of Athens adopted the LMS e-Class (http://eclass.cs.teiath.gr) which is a customized version of the open source software collaborative learning platform Claroline (http://www.claroline.net/), while Universidade Nova de Lisboa adopted the open source platform Moodle (http://moodle.fct.unl.pt).

Both platforms are pedagogically effective, covering the broad range from documents delivering to problem-based and project-based learning. They pay special attention to collaborative e-learning, the interface is user-friendly, navigation is easy, and using the provided facilities is without surprises, both for educators and learners (Kalogiannakis et al., 2006; Cole, 2005). Managing educational content is straightforward and messaging serves its purpose adequately. Learners manage their profiles, updating their data as required or as they wish. Educators can track the learners' activities. Scheduling and management of e-learning activities are supported and privacy of personal data is ensured. Of all the tasks successfully supported by the platforms, the most representative are in-class and out-of-class activities and the procedures for homework assignments and lab practice (Georgouli et al., 2005).

While gaining experience as users of those LMSs, we realized that, in order to be able to design new instructional models setting up a pedagogy relying on those tools and capable of enhancing our students' learning consistently, we needed to explore different blended learning methods using a well designed framework as a guideline. The existence of a framework for introducing e-learning in a traditional course based on the existing experience on the field will assist teachers for a successful transition from their current traditional pedagogy to a new pedagogy based on e-learning tools and systems.

In this paper we propose a framework for introducing e-learning in a traditional course, based on the experience derived from our personal involvement with the web-enhancement of our courses via the e-learning platforms. This framework 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. As an example of our approach, we present the paradigm of the course of Artificial Intelligence at the Department of Informatics of the Technological Educational Institute of Athens. This presentation is accompanied by an extended discussion of the results of the last survey we have conducted to assess the effectiveness of the approach. Finally, in the last section, we conclude by pointing out the key challenges, in our understanding, for enhancing the quality of e-learning in the future.

Key issues for converting an existing course

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, breakfast with colleagues, reference to a manual, participation in online communities 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, live e-learning, and self-paced learning.

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, face-to-face tutoring, 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 (Harrison, 2003).

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.

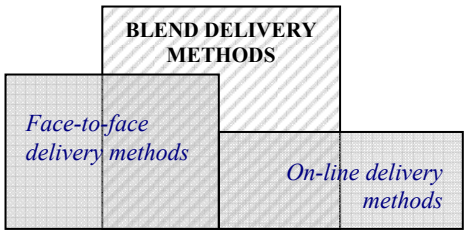

Figure 1. Defining the blend

A Framework for a course web-enhancement

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 (The eLearning Guild, 2003; 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 2). 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).

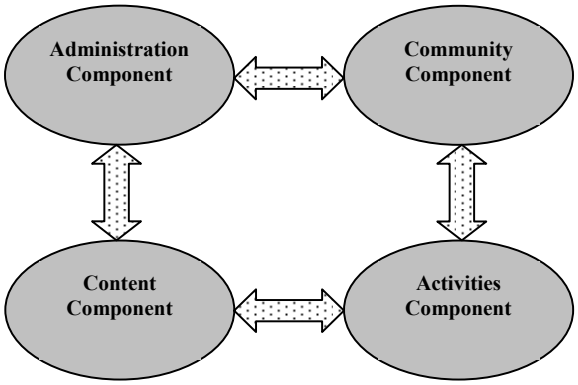

Figure 2. The theoretical framework

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.

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.

Designing an E-learning 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.

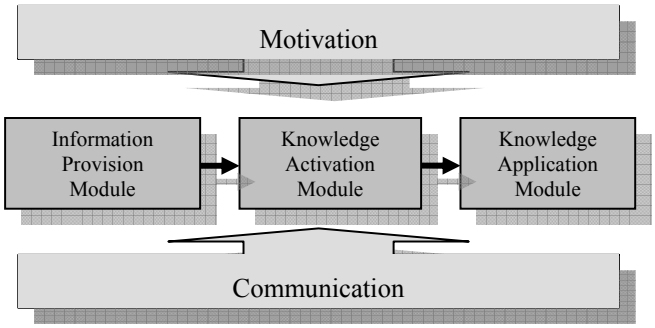

Figure 3. Dynamic representation of the e-learning instructional model

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 we followed to redesign the structure of a typical course with respect to a well designed e-learning instructional model.

Defining the blend in the course of AI

The course of Artificial Intelligence (AI) is a compulsory course offered at the sixth semester of studies of the Department of Informatics of the Technological Educational Institute (TEI) of Athens. Students who enrol the course come from all over Greece, as the Department of Informatics is highly demanded by students who want to study informatics. Nevertheless, for most of these students, our department at TEI was not the first choice: they would rather study at a university department, but their secondary school grades were not high enough. Still, they have all obtained good marks at the Panellenic examinations for admission to higher education. The course is organized in two parts, as most courses at the department. One is the theoretical part, with two hours of lecturing per week, and the other is the laboratory part, with two hours per week of lab instruction. Students apply independently for these two parts and get separate grades. This makes course delivery not consistent for those students who apply for only the one part.

The course's goal is to provide the students with an introductory knowledge on artificial intelligence and to make them capable of solving problems using search algorithms and productive rules. Students attending the course must successfully respond to the written exams at the end of the semester. Students' participation at the lectures is not compulsory but they must have a consistent presence at the labs and fulfil all lab requirements. In the labs, students use different AI programming environments in order to put in practice what has been taught theoretically in the lectures.

Every semester, more than 250 students apply, since this course is mandatory. Some of them are "ghost" students who never show up at lectures or at the labs. About half of the enrolled students have already attended the course on a previous academic year but failed to pass the exams. The majority of these, but also some of those who are applying for the first time and have already a job apart of their studies, skip some or even all of the lectures and attend only the lab courses. As a result, those who persistently attend the lectures, and consequently are fully aware

of the objectives of the course and the knowledge that has to be absorbed correspond to about 25% of the class. This means that majority of the students who attend labs are not really aware of the course objectives. Furthermore, labs are overcrowded, and students have to share the available computers with their peers, aggravating the problem.

This situation, common in all mandatory courses of higher semesters in the Department, 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 labs 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 lab groups.

For the above mentioned reasons, we adopted with enthusiasm the department's e-learning platform right from its introduction, three years ago. We tried to use all its functionalities in the framework of a new blended learning scenario that supported in-class work and promoted new e-learning activities both in-class and out-of-class (Georgouli et al., 2006; Georgouli et al., 2005).

At first we decided about the delivery methods that would best suit the objectives and content of the course. The lectures are still delivered in a face-to-face way as well as tutoring in the labs. To the rest of the instructional activities and communication we added blend where appropriate.

The conversion of the course was realised in three steps according to the proposed conversion framework and took us 4 semesters. The first step was to prepare and upload the content to be delivered. As we were totally inexperienced in e-learning we spent a semester to prepare and upload our existing content and to study the opportunities offered by the platform. The e-course was offered for the first time to our students as a file repository at the end of this semester. Before moving to the next step, we studied in depth which platform's tools could be used to enhance existing traditional learning procedures, we decided about the blend and we designed in details our new pedagogical model. The second step was 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. This step lasted a semester and was very successful. Applying for lab groups has been supported by the platform with big success, uploading announcements and sending emails to students was very helpful and the existence of an agenda was welcome from the community. The third step lasted the next two semesters and was to design new knowledge activation activities in the form of assignments and knowledge application activities in the form of semester-long projects. In parallel, we studied all platform tools in depth to see how we could use them more beneficially in order to apply the motivation factors of our pedagogical model. Upon completion of each step we asked students to fill in questionnaires, where they could express their opinion about the effectiveness of the web-enhancement of the course, so that we could correct wrong design decisions and fine tune the approach.

In the next paragraphs we present how the part of blend concerning online delivery methods was conducted.

The Administration Component

All courses offered by the department have already their own site on the LMS. Each e-course administrator, usually the professor responsible for the course, decides about access type. In our AI e-course access was private, meaning only enrolled students have full access. Registration to the e-course remains closed while the students are registering in the school's web-based information system, at the beginning of each semester. Once the central registration is complete, students are automatically added to the users list for the courses in which they have been registered. At that moment, access is opened also to unregistered visitors, although with restrictions: visitors can access the course's content but only registered students are able take part in e-activities or use the communication facilities.

For keeping track of our students' progress and their involvement in the course we use the statistics tool, which collects six groups of statistics: *Registered Users*, *E-course Access*, *Access to Tools*, *Documents*, *Exercises* and *Forum Usage*.

The Content Component

Content delivery for the e-course was prepared carefully. Learning and training elements were 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 have been redesigned in order to be easily accessed through the Internet, both for downloading and for online reading. Well chosen web links have been 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 have been added. Previous exams have been collected, commented and put online. During lecturing, demonstration files and web sites are visited to enhance learning.

The content is 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 we have used the *agenda tool* 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, we collected questions from previous exams and added new questions, thus building up a rich "questions pool" for the *exercise tool*.

The assignments are designed in a way that facilitates personal work and allows students to understand whether the task has been achieved, and what activities still have to be accomplished. In the end, students should be able to assess the efficacy of the knowledge they have just acquired. The objectives of the successive assignments were progressive and diversified but coherent, throughout the semester.

We designed detailed "lesson plans" in order to engage students in our task-centred instructional strategy, and made them available to students through the lesson plans tool. Lesson plans are linked to the related "learning outcomes", self-assessment activities and production of new knowledge, so that the path from prior knowledge and competences to newly acquired ones is clearly displayed.

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

The Community Component

The first step for organizing our community was to redesign the way students attending the labs are grouped, using the *Users Groups* tool. Then, using the communication tools, we established communication channels 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, we opened forums for general discussion and thematic discussions.

For helping students collaborate with their colleagues when they are working on homework assignments, we opened forums that promote distant communication among the participants of each group. 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 is sent to students, in a way that stimulates their critical thinking. Multiple points of view and best solutions are also published at the free access collaboration area of each group after an assignment is over to give time for personal appropriation.

The Activities Component

The platform's assignment tool allows instructors to manage their students' homework efficiently. We 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.

Work as a community is a necessity, given the large number of students, but it is also a requirement that stems from the main objective of the lab which is to learn how to better represent the problem's declarative and procedural knowledge using AI methods so that search algorithms or productive rules can be used to solve it. Students are encouraged to work in pairs in homework assignments, using on-line communication tools to gather information on assignment details and forums for discussing and getting help on the difficulties they encounter. We use this method also for semester-long student projects, which we consider as an essentially collaborative activity.

For activating students' knowledge we have designed a number of self-assessment exercises to recall, describe and demonstrate relevant prior knowledge and also to assist them in organising and summarising new acquired knowledge. Students can submit answers more than once and they receive a feedback with praise for the correct answers and comments and hints for the wrong ones, to motivate them. In addition, students are encouraged to work in pairs in homework weekly assignments, using on-line communication tools to gather information on assignment details. We make a special effort to help students appreciate the interest and value of the task at hand, and feel in control with the activity that is being carried out. When students' assignments are uploaded, the best ones are published to the common group file area to arouse competitiveness amongst students. The existing forums for discussing the course issues and for and getting help on the assignments plays a very important role in helping and motivating the students in the various tasks they are called to perform during the semester.

For knowledge application we design semester-long student projects, which we present at the middle of the semester. Projects are the same for all participants and they are designed in a way that facilitates the application of newly acquired skills to complete each new task. Usually, students are asked to solve a new problem which is based on the one that was used for demonstration. Students belonging to a lab group have their own forums for that task where they can exchange opinions and files. Instructors provide coaching from this same forum when needed. Another forum is available for general discussions involving all the students and for general coaching.

The tools are not used for a formal evaluation during exams for a number of reasons. First of all, technically, it is impossible to have access to the lab's computers simultaneously for all participants because of their large number. On the other hand, to the logistics of separating them in small groups and have them to enter the one after the other is too complicated, in the present conditions. Security problems are also not yet solved. Finally, we believe that tools which offer possibilities to design only closed type questions (yes-no, one of many etc) are not suitable for higher education exams, especially if they are not designed for that purpose (Economidis. and Roupas, 2007).

The Participants' Experience and Opinions'

During the last 3 years we have conducted a survey after each one of the three steps of the AI course conversion in order to assess the effectiveness of our approach through our students' opinions. In total we have collected 316 answers to questionnaires containing different questions at each survey. The last survey was conducted halfway into the last semester (winter semester 2006-07), where we asked the students who attend the laboratory part of the course to complete an online questionnaire concerning the effectiveness of our pedagogical model. The survey was open for one week and 97 questionnaires were collected at the end. This corresponds to 67% of the registered students, which is acceptable taking into account that many students quit after two or three weeks.

Questions were classified into five sections; in first section, various pieces of general information were collected, e.g. semester of attendance, sex, part/full time work, etc. The next section contained questions related to the quality of the uploaded content (either for the lectures or for the labs). The third section was related to the students' satisfaction concerning the use of the platform and its contribution to the course enhancement. The fourth section was related to community issues. The last section was related to the e-activities. All the questions concerning the satisfaction level of the students were on a 5-point Likert-scale (1, for totally disagree, 2, for disagree, 3, for neither agree nor disagree, 4, for agree and 5, for totally agree).

The participants were 65% male and 35% female which is typical on the Department of Computer Science. Half of the students who have answered were on their regular semester (6th semester). Only 3% belonged on earlier semester, i.e., they applied for the course earlier than they should. The remaining 47% were on older semester, denoting that they have failed the course examinations in the past at least once or that they are delayed with their studies for other reasons. Almost 90% of the students have an Internet connection at home and are able to access the platform easily anytime. Almost half (49%) of the students work in a full-time or part-time job and this affects their attendance to the lectures. Worth noticing is that only 26% of the students attend the lectures on a regular basis.

The e-learning platform has reached a very high acceptance: 75% of the students strongly agree that it was very helpful and less than 5% of disagree. The students answered that the quality of the content and the relevance to the targets of the course were of high standards, the educational material was up-to-date and the updating process was frequent. Furthermore, they believe that there were enough hyperlinks to relevant websites, leading them to further information. Approximately 90% of the students strongly believe that the use of the platform allowed the teacher to use a greater variety of material than in the traditional course. It is remarkable that 97% of the students believe the agenda was used with consistency by the teacher and 81% think that having clear deadlines for the assignments made them be more consistent and to show greater commitment to the course. The use of the announcements tool and the messages from the teacher were satisfactory, with 96% of the respondents stating that it is useful. A high percentage of the students never used the discussion tool, which explains why 50% answered that they do not agree nor disagree that this tool was helpful.

Although the posting of the best student assignment was an innovative idea that could give time to students for personal appropriation, 54% strongly disagree that it helped them towards this goal. This could be interpreted by the fact that the best assignment posting was introduced as an educational innovation just one week before the survey and many of the students did not know yet how to take advantage of it.

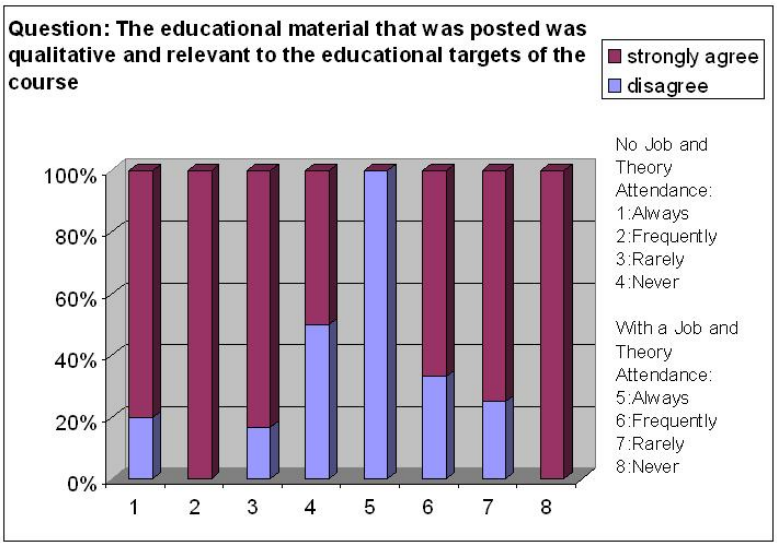

Figure 4. Differences on satisfaction concerning the quality of the educational material between students that have job and those that do not have one

Furthermore a univariate analysis has been used to analyse the collected data. All associations that follow were assessed with the X^2 test. There was an attempt to investigate the satisfaction level of students, by analyzing if having a job combined with the attendance of lectures affected their responses. The students were categorized into three groups depending on whether they do not have a job (53%), whether they have a part time job (36%) and whether they have a full time job (11%). They were also grouped into four categories depending on the attendance of lectures: those that always attend (11%), those that often attend (16%), those that rarely attend (40%) and those that never attend theory (33%). In this particular section of the analysis only the students of the 6th and 7th semester were considered (70% of the total), so that students, who are not on the regular semester do not affect the results. We created a new variable called "job and lecture attendance", combining the occupation of each student and the

attendance of lectures, in order to associate it with the answers from the questionnaire. The results that were obtained at a statistically significant level showed significant difference depending on whether students have a job or not, especially on students that do not attend lectures.

In the question "The educational material that was posted was qualitative and relevant to the educational targets of the course", all the students (100%) that have a job and do not attend lectures strongly agree, whereas only 50% of the students that do not have a job and do not attend lectures strongly agree (see figure 4).

Additionally, in the question "The agenda and the links to the relevant educational material helped me to be better prepared", 92% of the students that have job agree, against only 50% for those that do not work. It is worth noticing that all the students that attend the lectures regularly, independently of having a job, agree on this question (see figure 5).

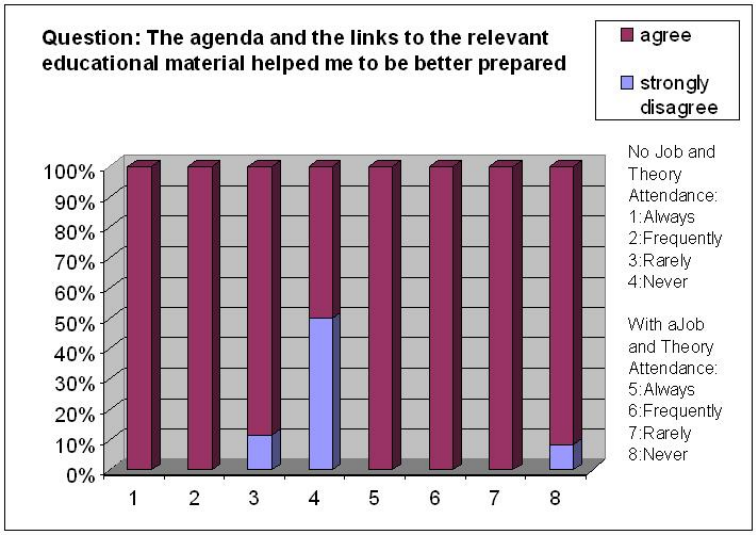

Figure 5. Differences on satisfaction concerning the contribution of agenda and existing links between students that have job and those that do not have one

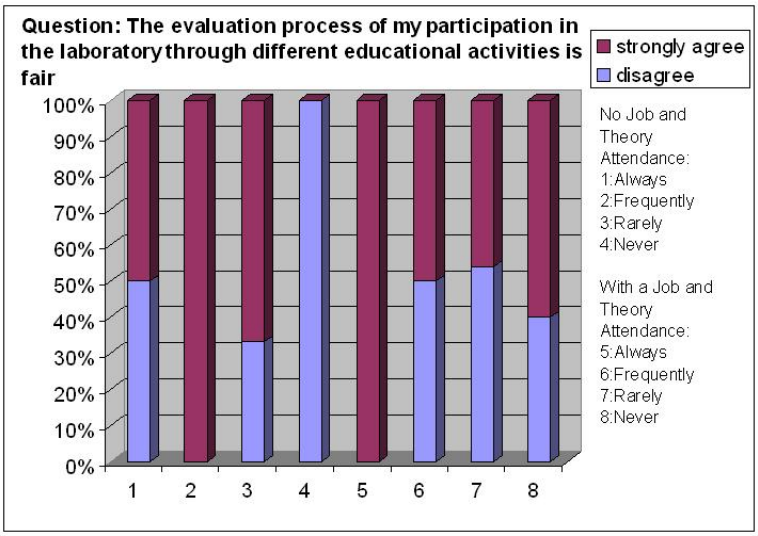

Figure 6. Differences on satisfaction concerning the evaluation processes between students that have job and those that do not have one

Finally, in the question "The evaluation process of my participation in the laboratory through different educational activities is fair", all the students (100%) that do not attend lectures and do not have a job disagree, whereas only 40% of those having a job disagree. This analysis suggests that students who do not have a job and do not attend lectures have a mentality that relegates the use of new educational processes, whereas the students that work and therefore have no time to attend lectures, tend to more promptly adopt the new educational model for their own improvement (see figure 6).

Moreover, an association of the variable "home internet" which indicates whether a student has internet access from home has been tried with the answers from the questionnaire. The students were grouped in two categories, those that had internet availability at home (92%) and those that did not (8%) and were accessing the internet from their work, from the department or from internet cafes. The following results were obtained at a statistically significant level: In the question "The links to relevant material on the internet were useful and enough", all the students (100%) that do not have home internet connection strongly agree, whereas only 55% of the students with home internet connection strongly agree. This indicates that students that have home internet and therefore are more likely to search easier for what they look for, have greater expectations from the teacher on the suggested hyperlinks, whereas for the students that cannot spend a lot of time on the internet, the links were satisfactory. Finally, in the question "I believe that the laboratory is more interesting with the use of the cs e-Class" only 22% of students that do not have home internet connection strongly agree, whereas the students that have internet at home agree on a 57%. This suggests that for students with easier access to the internet it is more interesting to use e-learning tools than for students with limited access.

At the end of the questionnaire there was free text to enter some comments. Students that have previously attended the laboratory but failed to pass the class, admitted that the educational process was improved through the use of the platform. There were also many comments that stated that the laboratory part of the e-course is very well organized and compared to the rest e-courses on the platform the e-course of AI is the best well organized one.

Conclusion

Learning management systems are likely to become as commonplace as the Internet or email. No institution of higher education will be able to do without either an open source or a commercial version of the software. LMS will occupy an ever increasing and prominent role in the teaching and learning process, paving a new road changing the existing ways of teaching and learning, from a traditional in class way to totally synchronous or asynchronous distant one.

Learning management systems are just collections of tools, even if they embody some kind of a pedagogical "vision". We believe that their successful adoption by teachers and instructors of any discipline will be fostered by the guidance that frameworks such as the one we propose can provide.

In the case of AI course the transition from the traditional instructional method to one enhanced by e-learning has followed with success the three steps conversion according to the theoretical framework proposed in this article in respect to a well designed e-learning instructional model.

The e-learning instructional model we have designed for the e-course has employed a traditional pedagogy which has been enhanced by the e-learning tools in order to deliver the educational material, to activate existing knowledge, to produce and apply new knowledge, to support the community and to motivate the students. We believe that this model can be easily generalized to other higher educational courses in the field of applied sciences. The generalization across disciplines should also face no particular problems at least no more problems than traditional pedagogies face when they have to be applicable both to technical and theoretical classes.

The survey results show that students are in general satisfied from the quality of offered e-learning practices and content. The analysis suggests that students who do not have a job and do not attend lectures have a mentality that relegates the use of new educational processes, whereas the students that work and therefore have no time to attend lectures, tend to more promptly adopt the new educational model for their own improvement. Moreover, students with easier access to the internet are more interested to use e-learning tools than students with limited access.

Further studies should be performed following this model or maybe revisions of it. There is an ongoing study trying to collect again the opinions of the students to validate the results of this study and also trying to correlate the results with further demographic data of the students, their grade levels and the times they took this course.

Our key challenges for enhancing the quality of e-learning, not only for our course but also for the rest of the courses at the Department, relate to overcoming perception from early unsatisfactory experiences and the standardisation of educational design at an Institutional level.

The issue of staff workload is a major one. It is a challenge that must be resolved. Furthermore, getting take-up of the quality assurance is very important and composes one more challenge to embed.

References

APA (1997). *Learner-Centered Psychological Principles: A Framework for School Redesign and Reform*, Washington, DC: American Psychological Association.

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, PA: Idea Group, 54-85.

Cole, J. (2005). *Using Moodle*, Sebastopol, CA: O'Reilly.

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.

Economidis, A., & Roupas, C. (2007). Evaluating Computer Adaptive Testing Systems. *International Journal of Web-Based Learning and Teaching Technologies*, 2 (1), 70-88.

Georgouli, K., Kantzavelou, I., Skalkidis, I., & Zahariou P. (2005). Integrating an Open Source LMS into the Traditional Educational Process. *Proceedings of 2005 WSEAS*, retrieved March 30, 2008, from http://www.cs.teiath.gr/georgouli/WSEA%20paper.pdf.

Georgouli, K., Kantzavelou, I., Guerreiro, P., & Koilias, C. (2006). Enhancing Student Learning Using Asynchronous e-Learning Platforms. *Proceedings of the International Conference on Cognition and Explanatory Learning in Digital Age (CELDA 2006),* Lisbon: IADIS, 73-80.

Griffiths, M. (2005). Building quality into ICT-based distance education. In Fallows S. & Bhanot R. (Eds.), *Quality Issues in ICT-based Higher Education*, London: Routledge, 48-60.

Harrison, M. (2003). *Blended learning in practice*, retrieved September 1, 2007 from http://www.epic.co.uk/content/resources/white_papers/blended_2.htm.

Heinze, A., & Procter, C. (2004). Reflections on the Use of Blended Learning. *Paper presented at the Conference on Education in a Changing Environment*, September 13-14, 2004, University of Salford, UK.

Jonassen, D., Peck, K. L., & Wilson, B. G. (1998). *Learning with Technology: A Constructivist Perspective*, Upper Saddle River, NJ: Prentice Hall.

Kalogiannakis, M., Vassilakis, K., Liodakis, G., & Psarros, M. (2006). Approaches for the exploitation of the e-class platform in tertiary education in Greece. *Paper presented at the International Conference of Telecommunications and Multimedia (TEMU2006)*, July 5-7, 2006, Heraklion, Crete, Greece.

Khan, B. (2000). A framework for e-learning. *Distance Education Report, 4* (24), 3-8.

Lebrun, M. (1999). *Des technologies pour enseigner et apprendre (Deuxième édition)*, Bruxelles: De Boeck.

Laurillard, D., (2002). *Rethinking university teaching* (2nd Ed.), London: Routledge.

Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom Instruction that Works, Research-based Strategies for Increasing Students Achievement*, Alexandria, VA: Association for Supervision and Curriculum Development.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50* (3), 43-59.

OECD (2005). E-learning in Tertiary Education, Policy Brief. *OECD Observer*, retrieved September 1, 2007 from http://www.oecd.org/dataoecd/27/35/35991871.pdf.

Pirani, J. (2004). *Supporting E-learning in Higher Education*, retrieved September 1, 2007 from http://www.educause.edu/ir/library/pdf/ERS0303/ecm0303.pdf.

Reigeluth, C. (1999) *Instructional Design Theories and Models: A New Paradigm of Instructional Theory* (Vol. II), Mahwah, NJ: Erlbaum.

Rosset, A., Douglis, F., & Frazee, R. (2003). *Strategies for Building Blended Learning*, retrieved 20 February, 2007 from http://www.learningcircuits.org/2003/jul2003/rossett.htm.

Sgouropoulou, C., Chalaris, I., & Fouka, M. (2006). Applying Systematic Learning Design to Curricula. *Paper presented at the International Conference on Information Technologies in Education for All*, May 29-31, 2006, Kiev, Ukraine.

Stephenson, J. (2001). *Teaching and learning online*, London: Kogan Page.

The eLearning Guild (2003). *The blended learning best practices survey*, retrieved September 1, 2007 from http://www.elearningguild.com/pdf/1/Blended_Learning_Best_Practices_Survey.pdf.

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*, London: Portland Press, 51-66.

Viau R. (1994). *La motivation en contexte scolaire. Pédagogies en développement*, Bruxelles: De Boeck Université.

Voos, R. (2003). Blended Learning: What is it and where might it take us? *Sloan-C View, 2* (1), 2-5.

Williams R. (2003). Integrating Distributed Learning with just-in-content Knowledge Management. *Electronic Journal of e-Learning, 1* (1) 45-50.