Evaluation of E-learning systems: Experiences in Teaching Human – Computer Interaction

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Abstract: - E-learning is a very promising way of delivering training and is broadly used in tertiary education. Although e-learning has a great potential, it is still at its starting point in Greece. The present paper describes the experiences we obtained from teaching the Human – Computer Interaction course in the Computer Science Department of Aristotle University of Thessaloniki. Blackboard has been used as the main platform for e-learning. The presented qualitative and quantitative facts reveal the power of e-learning and assure a greater level of success and efficiency after the enrichment of the current course and the development of new online courses.

Key-Words: - E-Learning, Virtual Class, Learning Material,Blackboard,Online Test, Discussion Group, Forum

1 Introduction

E-learning is usually defined as a type of learning supported by Information and Communication Technology (ICT) that improves quality of teaching and learning [1]. Implementation of e-learning contributes to the advancement of higher education. E-learning systems are a powerful tool for achieving strategic objectives of the university (teaching, research and serving the society) and it contributes to the progress on the institutional level as well as the personal level, including both teaching staff and students [2].

Moreover, e-learning systems are more fun and interesting [3], encourage innovation and multimedia capabilities, enable better visualization [4], allow dynamic interaction and adapt easier to the learners style [5].

There are different options for implementing e-learning in the teaching process. As Douglas [6] and Rosenberg [7] state, e-learning systems can be used as a means of support to the already established systems of education; it can also be partially introduced (for a single subject or group of subjects) or can be implemented as an independent form of teaching.

Nevertheless, Georgouli & Skalkidis argue that the lecture has long been the cornerstone for teaching and learning in higher education and despite their known pedagogical limitations, lectures remain a cost effective way for teaching large classes) [8]. The challenge in such situation is to persuade academics that e-learning enhancing the community feeling and offering qualitative educational content could benefit themselves, students and the faculty [9].

2 Implementation of an E-learning platform using Blackboard

Blackboard Learning System is an integrated Learning Management System and is widely accepted in the educational field.

Aristotle University of Thessaloniki uses Blackboard as its main e-learning platform after evaluating and comparing the possible solutions. An adapted framework for evaluating the most popular available Leaning Management Systems has been presented in [10].

Blackboard qualified as the most suitable platform for the needs of our lesson, since it combines all the necessary functional requirements (learning tools, support tools and technical aspects) for the successful design and implementation of university lessons. Moreover, Blackboard is compatible with most educational standards, easy to use and navigate, and has an effective interface. These factors were considered as crucial for the successful implementation of the lesson "Human-Computer Interaction" (HCI).

2.1 The *HCI* course

The objective of the course is the learning of the basic principles of usability in the communication between human and computers and their practice with rapid-prototyping techniques.

Among the subject that the course covers are: Interface design, recognition of basic elements of interfaces, knowledge models, interactive multimedia, data visualization and evaluation of graphical user interfaces (GUIs).

Since the course is absolutely relevant to the notion of e-learning environments, the students were asked to evaluate the whole process after the end of the semester.

2.2 The electronic course

From all the available tools in Blackboard the following facilities were used in order to implement the electronic version of the HCI course:

- **Learning Material**. Multimedia materials were uploaded during the semester, which replaced the 13 2-hour long lectures of the previous year. The material could be attended by the students either at the lab (in the predefined weekly meetings of the course) or at home (anytime after the meeting had been over). Therefore, presence in the lab during the semester was not obligatory.
- **Access to the materials**. Users were separated in 4 categories: tutor, tutor assistant, student and visitor. The tutor could control access to certain materials of students and visitors, while tutor assistants helped in manufacturing learning materials.
- **Discussion Forum**. Users of the platform could discuss about several course-related subjects through the forum threads. A lot of opinions for the evaluation of this learning model were extracted from discussions in the forum.
- **Online exams.** Apart from the 2 online tests that took place during the semester, final exams were also conducted online via the platform.
- **Personal Profiles and Learning Community**. All the participants created their own personal profile and were members of the course learning community.
- **News**. Apart from the learning materials, the participants had access in announcements, information about the course, important dates and grades. These data were occasionally uploaded in the platform by the tutor assistants.

. The homepage of the course has 14 choices:
1. Announcements
2. Course Information
3. Tutors Information
4. Bibliography
5. Course Documents
6. Electronic Resources
7. Projects
8. Evaluation
9. Grades
10. Communication
11. Discussion Forum
12. Communities
13. Links
14. Tools

2.3 The virtual class

A very important feature that was tested during our first experience with the e-learning process is the "Virtual Class". A synchronous session with the tutor has been conducted twice during the semester. This means that in two particular dates and times a synchronous lesson from distance has been taken place. Since the requirements were not so high (Windows 2000 or XP, an ADSL connection of at least 1MBPS and a web browser, e.g. Internet Explorer 5,5 or newer or Mozilla Firefox are adequate for this process), students were able to attend the meetings from home. The first meeting was attended by 43% of the students, while the second one by 67% of them.

The environment of the virtual class contains four main frames (Fig.1). The first one is the frame containing the virtual class tools. Right below, one can see the names of all the participants in the virtual classroom. The largest frame on the right depicts anything that the tutor writes and presents during the lesson. Below that frame, there is place for online chatting. The tutor and the student can exchange messages on the last frame. A participant should log into the class at the predefined time and log out after the end of the session.
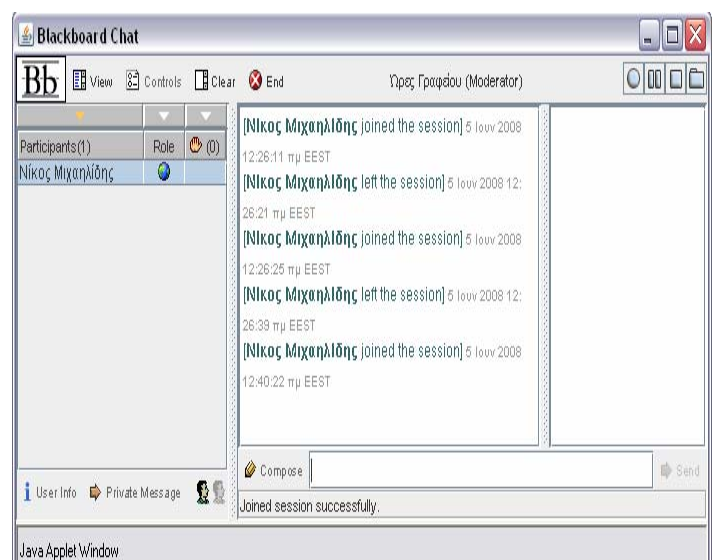

Fig. 1. Environment of the virtual class.

3.4 Supervision of progress

The supervision of the progress of the students in the course is a crucial matter, since it is an indicator of the effectiveness of the e-learning activities. As it is mentioned before, 2 online tests were conducted through the semester on the course syllabus. Moreover, final exams were also conducted via the platform. Tests were created using CourseInfo CourseSite quiz/survey and test generators. These advanced tools allow the creation of the following types of questions: matching, multiple choice, gap filling, short answers, true/false etc. The results from the tests were uploaded on the course homepage.

The tutor was able to supervise the progress of students in both a quantitative and a qualitative manner. Marks, statistical graphs and text comments allowed the tutor to analyze single students or the class as a whole.

3   Experiences in teaching "Human-Computer Interaction"

The first trial experiment of teaching "Human-Computer Interaction" using e-learning methods has resulted in some very useful experiences, which are next juxtaposed. The overall reflection of the e-learning process is analyzed in 3 ways:

(1) *Students' Results.* The results of the students of this semester are compared to the results of the students of last year's course in order to illustrate the effect of e-learning at the progress of the students. It should be mentioned that last year's students used only the compatible method of learning in classroom and writing exams.

(2) *Students' Satisfaction.* Special threads were created in the platform's forum, where the students commented on what they liked or disliked about the e-learning process. Moreover, comments on the way of taking exams and suggestions on how to improve the e-learning process were taken into account.

(3) *Online Questionnaires.* After the end of the course, students were asked to fill in online questionnaires concerning the e-learning process from their own perspective. The collected answers from the surveys resulted in useful quantitative measurements.

3.1 Students' Results

A comparison between the results in final exams of the academic season 2007-2008 and the corresponding one of 2006-2007 qualifies as necessary in order to demonstrate changes in students' comprehension and progress on the HCI course. Before comparing the rates, it should be noted that this year a twofold number of students attended the course (75 against 36 last year). This could be an indicator of the attractiveness of the e-learning process, either because it is innovative or just because it made students curious.

A direct comparison on average of students passing the course shows that students with e-learning had a much better percentage of success[1]. While last year 19 out of 36 passed the lesson (almost half of the class had failed!), this year's success reached the percentage of 76% (Figures 2 and 3).
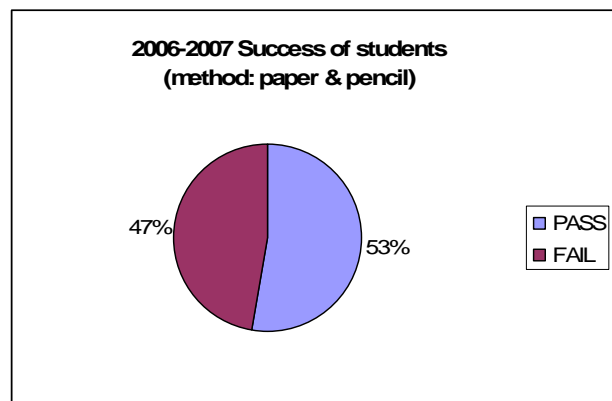

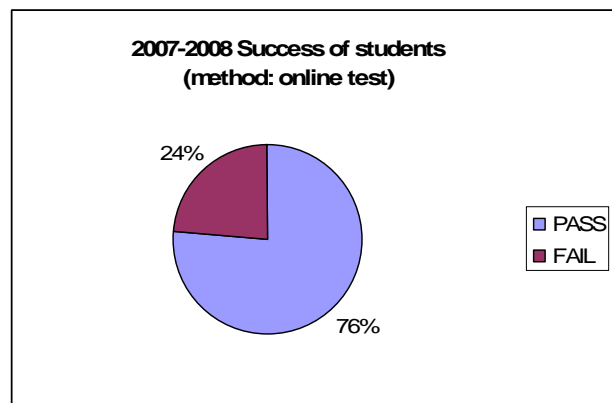**Fig. 2.** Success rate without the use of e-learning

Fig. 3. Success rate using e-learning methods.

The research hypothesis to be tested here is:
RH. *When students follow the E-learning process instead of the traditional class, their performance increases.*

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[1] It should be noted that the questions in the final exams of the two years were of same difficulty. Half of the online test was also comprised of "open" questions, where the student should answer by writing short answers on the online form.

Table 1. Descriptive Statistics.
Table 2. ANOVA test for **RH**.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
PAPER&PENCIL	36	50,444	19,2642	3,2107	43,926	56,963	7,0	82,0
E-LEARNING	75	62,493	16,6975	1,9281	58,652	66,335	16,0	93,0
Total	111	58,586	18,3778	1,7443	55,129	62,042	7,0	93,0

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3531,301	1	3531,301	11,449	,001
Within Groups	33620,636	109	308,446		
Total	37151,937	110			

The two distributions to be compared are: the distribution of exam marks for the students of 2006-2007 that attended traditional learning methods (Distribution 1) and the distribution of exam marks for the students of 2007-2008 that attended the e-learning course (Distribution 2).

In order to examine the current hypothesis, a one-way ANOVA test is performed. The dependent variables are the students' *marks*, while the independent variable is *METHOD* (the variable represents the learning method, which could be either *traditional* or e-*learning*). The significance level for ANOVAs is 0.01.

As it can be seen from Tables 1 and 2, the hypothesis is accepted in the ANOVA test. Sig (= 0.001) is less than the significance level 0.01 and the two distributions are different. Judging from the bounds of the distributions (Table 1 and Figure 4), we accept that "When students follow the E-learning process instead of the traditional class, their performance increases."

3.2 Students' Opinions

The satisfaction of students was apparent, as we can conclude from their feedback and their discussions in the forum. After having collected their views on several issues regarding the e-learning platform, the most important of them are next presented.

3.2.1 Advantages.

The electronic way of lectures and exams. The absolutely electronic format of the course was pioneer for the department. Since most of the courses are taught in a theoretical manner, the current method of e-learning was very interesting and helpful to the students.

Less stressful lectures and exams. Electronic lectures helped students feel

that they actually study in a computer science department. The exams process was not high-pressure, so less stress for the students was achieved.

Computer Based Training. Many students found the electronic course more familiar to them, since the learning materials were applied straight to their object (computers in our case). Moreover, some of them stated that they were practicing their computer skills even more through the e-learning process.

Online tests. The tests online were considered as an innovative idea for the students of the course. Especially, they found absolutely positive the fact that the students could take the test from any computer (not exclusively from the PC lab of the department). Many of them did so, since they had been out of town by the day of the test.

Independence from space and time. Most students were pleased to attend to the lesson anytime they want and always have the lectures online for studying. Some of them claimed that the whole
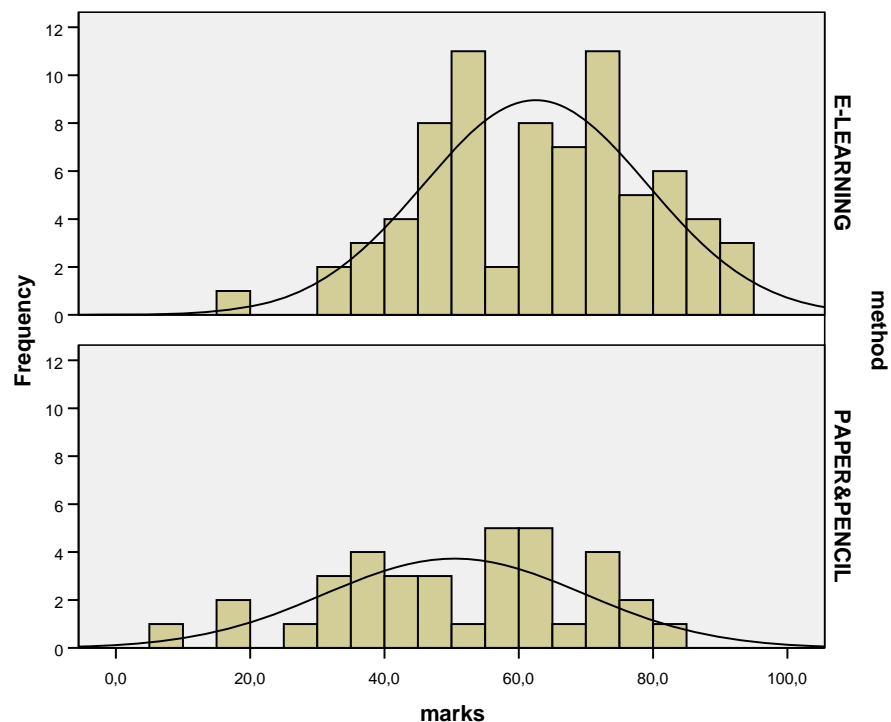

Fig. 4. The distribution and normal curve for variable "***marks***".

process of e-learning had been constitutive for them.
Virtual class. Students that attended the pilot meeting of virtual class expressed their satisfaction on their new experience. Online help on using the platform helped them a lot to attend the meeting from home and participate in the discussions. Some of them suggested the recording of the meeting for later re-attending.

3.2.2 Disadvatages.

Learning material was focused on theory. Many students observed that although the electronic approach of the course was well organized, the materials were focused on the theoretical parts of Human Computer Interaction. Their suggestions were about interactive multimedia where they can practice the theory online and online programming.
Online Test issues. Some students claimed that the online tests and exams were more difficult than the "pen-and-pencil" exams mostly because they had no previous experience on such a way of taking a test. Their problems were: time was not enough, they could not write on the pc as fast as on paper, there was not option for checking the answers they submitted again, and the marks were not automatically calculated right after the test. The reason for the last claim is that the "open" questions should be evaluated by the tutor in non-real time.
Technical issues. Finally, some technical issues were observed by the students. There was a small time delay after the submission of the answers in tests, which caused loss of available time and more stress. Some features of virtual class were not easy for some students to understand the first time. Finally, a delay in communication was noticed during the meeting of e-class.

3.3 Questionnaires

Students were asked to evaluate the e-learning process after the final exams. They had to answer questions on an online questionnaire. The main part of the questionnaire should be answered in the form of likert 5 - scales. Some other questions were of closed format. Due to space constraints, only some of the statistics are next presented. The sample consists of the 75 students that attended the course.

The respondents were asked to rate in scale from 1 to 5 the e-learning education process, their interaction with Blackboard and their interaction with other students via the platform. As Figure 5 shows, the average score on these three questions were 3.84, 3.47 and 3.63 respectively. It is obvious from the ratings that students were satisfied with e-learning in general, but not absolutely. Certain

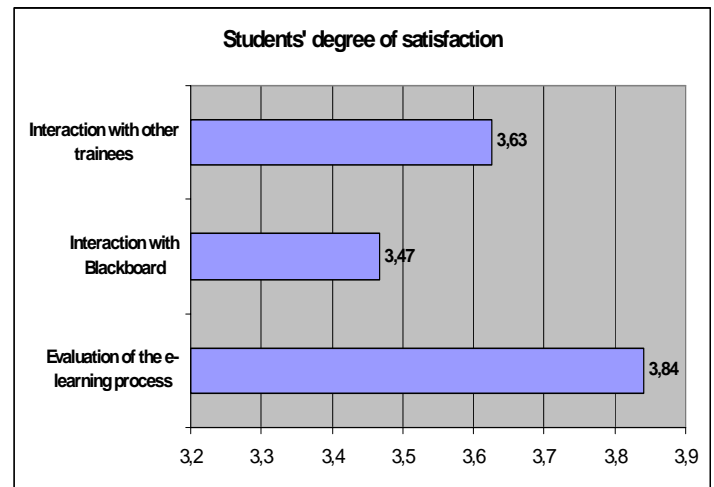improvements in the system are needed in order to reach a higher degree of satisfaction and effectiveness.

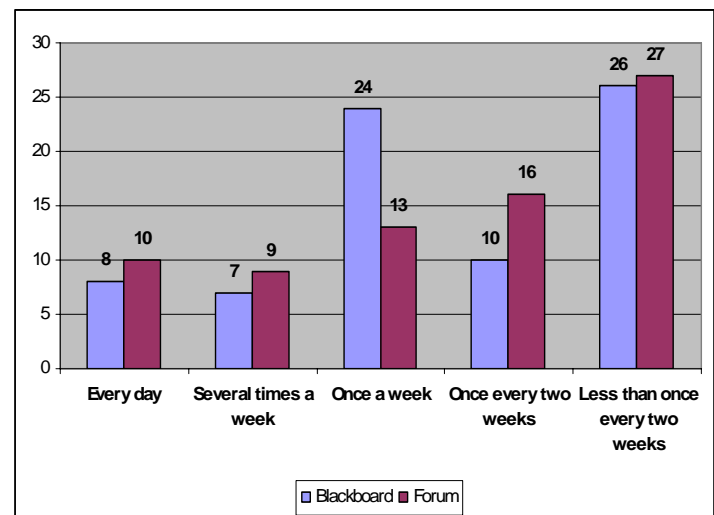

Fig. 5. Satisfaction about the e-learning process.

Fig. 6. Frequency of Blackboard use.

The respondents were also asked to give information on how often they did visit the blackboard[2] and the forum during the semester. The available responses were: "Every day", "Several times a week", "Once a week", "Once every two weeks", and "Less than once every two weeks". Figure 6 shows the sample's replies in actual number of replies. It is interesting that about 35% of the sample stated that they visited Blackboard facilities less than once every two weeks, which is actually against the learning process. This should be related to the degree of failing, which has been presented in section "*Students' results*".

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[2] It is about visiting the educational functions of the Blackboard, not just visiting the forum and the discussion groups.

4 Future Directions

Research studies (eLearning Guild, 2003) show a dramatic rise in using e-learning approaches in the coming years. Such findings indicate that e-learning systems are a permanent trend rather a passing fad in higher education. No institution or higher education will be able to do without either an open source or a commercial version of the software. Given this significant adoption of e-learning, it is vital to create strategic plans and directions for it. In addition to such general e-learning trends, there is a need to focus on the pedagogy and technology that will be utilized in such e-learning environments. There are still lots to do. More work in the areas of raising awareness, engaging in systems studies involving integration and the use of e-learning systems in varying disciplines, diverse cultures and different institutional settings will help in the development of well informed future.

Our future goal, in the Computer Science Department in Aristotle University of Thessaloniki, is to share with a wider audience our experience and to open up the path to e-learning for those of our colleagues who are still sceptical towards the use of this type of ICT.

5 Conclusions

Today, e-learning systems primarily function as a replacement for or extension of face-to-face environments. For instance, it might be used to foster learning communities, extend training events, offer follow-up resources in a community of practice, access guest experts, provide timely mentoring or coaching, present online lab or simulation activities, and deliver prework or supplemental course materials [11].

The Blackboard asynchronous e-learning system has proven a valuable, versatile and powerful tool that can assist in many educational tasks in the Computer Science Department of the Aristotle University of Thessaloniki. After adopting the Blackboard e-learning system, for enhancing teaching and learning at the department, we redesigned the course map in order to see where technology can be effective. New educational activities and scenarios have been developed to be used for the Human Computer Interaction course needs in order to support the use of Blackboard for out of class information, educational content repository, in-class supporting material during course lecturing and mainly for labs assignments, surveys and examinations.

The main outcome of this evaluation is that students are satisfied from the quality of the educational content, evaluation processes and the communication through the announcement, agenda and discussion board tools.

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