

# e-Lectures to Support Blended Instruction in Multimedia Programming Course

Anastasios Karakostas, Stavros Demetriadis, Vasiliki Ragazou, Maria Amarlariotou  
Aristotle University of Thessaloniki  
POBOX 114, 54124 Thessaloniki, Greece  
+30-2310-998443

{akarakos, sdemetri, vragazou, mamarlar}@csd.auth.gr

## ABSTRACT

This study explores students' attitudes regarding the use of e-lectures for introducing a blended mode of instruction in a multimedia programming course. In the context of a sixth-month course we supplemented students with e-lectures, available asynchronously from the course website. Most e-lectures presented multimedia programming techniques already been taught in the laboratory; but two of them presented more advanced topics completely new to the students. The results of a questionnaire-based evaluation showed that the students were quite positive about the use of e-lectures as a supporting material to the traditional laboratory course. The e-lectures helped them to better comprehend multimedia programming concepts and procedures, and to develop their projects successfully. However, the e-lectures on new subjects did not support all students effectively to advance their project. Also, half of the students stated that they would still prefer to attend the traditional face-to-face laboratory sessions than being supported from distance using e-lectures as primary learning material. Developing e-lectures may have certain benefits for programming courses, however shifting such a course toward a blended mode entails more complex issues that demand further exploration.

## Categories and Subject Descriptors

K.3.2 [Computers and Education]: Computer and Information Science Education - Computer science education

## General Terms

Measurement, Design, Human Factors

## Keywords

e-Lectures, Blended learning, Multimedia programming.

## 1. INTRODUCTION

Digital technology nowadays, offers the possibility of easily transferring online the typical lecture-based classroom instruction (e.g. [3, 8]). In most cases this comprises an audio or video feed

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

*Conference '04*, Month 1–2, 2004, City, State, Country.  
Copyright 2004 ACM 1-58113-000-0/00/0004...\$5.00.

of the lecture accompanied by a synchronized presentation of supporting material as lecture nodes or electronic slides. An increased number of institutions are reported to include technology-enhanced lectures in their distance-learning courses [11] and several studies explore the efficiency of using digital versions of lectures in various instructional scenarios (e.g. [12, 1, 6]).

However, the development and use of these e-lectures should be based on a valued pedagogical approach that will help learners to deeper understand and develop skills on the subject of instruction. Certain studies present evidence that by simply providing to students the possibility of attending course lectures online without a sound pedagogical basis, might result in deteriorating the quality of the learning experience [1].

Domain-specific knowledge in the discipline of Computer Science involves theoretical foundations of information and computation, as well as their implementation in and application to computer systems. Student assignments typically cover both theory and programming. The complexity and difficulty of learning in the various computer science sub-domains makes the use of e-lectures appear as a promising method for introducing a blended learning course format that would help students reproduce the classroom experience and rehearse learning material in a self-paced mode.

The main objective of this study is to explore students' attitudes when introducing e-lectures as supportive learning material in a multimedia programming course to enhance the typical laboratory instruction. Using a questionnaire-based method we recorded evaluation data regarding the level of students' satisfaction and opinions considering the quality (both technical and pedagogical) and the role of the e-lectures in the learning activity. Moreover, we wanted to record students' opinions on the possibility of replacing parts (or the whole) of the typical laboratory sessions with distance learning activities (using also e-lectures), in order to move toward a blended (and presumably more beneficial) model of instruction.

## 2. THEORETICAL BACKGROUND

### 2.1 e-Lectures as a Blended Learning Tool

In the context of this study, by "e-lecture" we refer to digital learning resources in lecture presentation format captured either "in vivo" (during the learning activity in the classroom or laboratory room) or "in vitro" (in the studio with only the necessary technical personnel) [6]. In the latter case, the lecturer addresses a virtual audience, that is, the students who will potentially attend the lecture at a later time.

The main goal of developing e-lectures is to engage students in blended learning experiences that facilitate a flexible self-paced mode of learning. Blended learning courses try to integrate the advantages of both the online courses (convenience and flexibility) and the traditional courses (interactivity and face-to-face contact) [9]. According to Collard et al. [4] e-lectures as pre-lectures activities can help reducing significantly the time needed to introduce new concepts in the classroom, giving the opportunity to devote classroom time to additional (and perhaps more advanced) activities and subjects. Research has shown that blended learning requires several hours on the part of the teacher to design and organize activities. Moreover the teacher has to be familiarized with new technologies and current software tools [7].

Several studies have been exploring the efficiency of using e-lectures as compared to traditional (face-to-face) lecturing. Day & Foley [5] argue that using audiovisual equipment in lectures not only can support learning but also can lead to better learning results than traditional learning. Wofford et al. [13] argue that moving the traditional clinical lecture to the computer, should be an appropriate strategy for efficiently dealing with cost-containment pressures in education. The authors review eight studies concerning medical education. These studies compare the live lecture not specifically to the digital lecture but to various other design interventions based on computer technology (some of them being multimedia computer presentations). Six of these studies show no difference in effectiveness, while two of them favour the computer-based strategy. The authors conclude that e-lectures should be no less effective than traditional lectures.

Dev et al. [7] made available to students a streaming video capture of the classroom event. The researchers observed that students used the video material for review, mainly before the course examinations and not to replace classroom attendance. However, the authors mention that some teachers reportedly complained that the e-lectures contributed to poor attendance and gave students the confidence to skip classes. In a similar study Bell et al. [1] reported that the effect of students' skipping classes was rather intense. The students did not access, to the expected degree, the live digitized lectures although they intended to do so (students' self report). Authors conclude that too much flexibility can lead to learning drawbacks.

## 2.2 e-Lectures in the CS Curriculum

Research projects in higher institutions already explore the digitization and dissemination of classroom events in the CS curriculum (e.g. [8, 3]). Typically these efforts use a digitization device to capture classroom lectures and make them available online to students. It is expected that this helps students to (a) review the material at a later time and (b) attend lectures even when they are not physically present [3].

However, apart from in vivo capturing the classroom event, instructors can also develop in vitro specific presentations in lecture format. The reason for this is to offer students the opportunity to asynchronously review and better comprehend (a) subjects that are difficult for students to comprehend, (b) subjects that include a significant part of visualized information (which, in turn, can be ideally presented using some kind of visualization), or (c) tasks that involve complex work with specific software tools (such as programming techniques).

## 3. METHOD

### 3.1 Participants and Context

Based on the promising results of using e-lectures we developed 13 e-lectures with audiovisual material, to support a laboratory course on multimedia programming. Overall, our intention is to explore the efficiency of using e-lectures as a means to transfer part of the learning/instructional load out of the classroom and reduce time and room demands for face-to-face laboratory instruction. This course introduces students in multimedia programming with the use of Adobe Flash programming and development tool. Typically the course entails 10-12 laboratory sessions where students attend a series of Flash programming techniques of increasing level of difficulty. As a final course assignment the students have to develop individually a small scale project demanding the programming of pilot educational multimedia software.

Each e-lecture was in vitro developed and it presented certain programming tasks in the Flash tool, using explanatory narration and extensive screen captured video clips (see Figure 1). The overall e-lecture presentation was comparable to instructors' presentation of the programming task in the laboratory. The first 11 e-lectures were uploaded at the course site, one at a time, just after the end of the respective laboratory session. Students were instructed to watch the e-lectures whenever they wished, in order to recall the laboratory lessons and rehearse the material as support when working on their course assignment. At the end of the course we uploaded two more e-lectures (in the following: "additional e-lectures") featuring more advanced Flash techniques which were not presented or discussed during the laboratory lessons. Thereafter all of the 13 e-lectures were available to the students. The students were instructed to study the techniques in the 2 additional e-lectures and use them to program a certain part of their assignment.

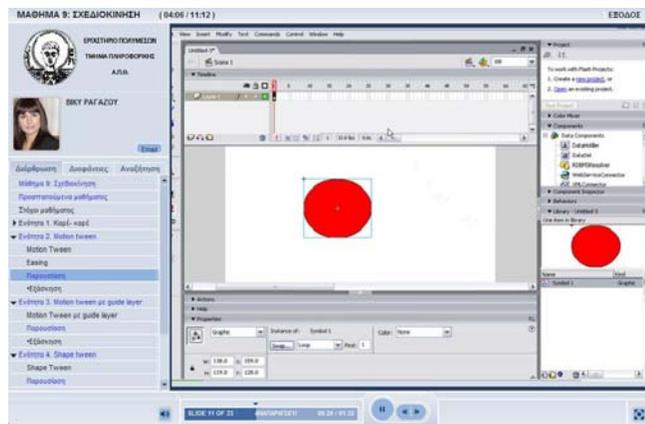
The students who attended the lecture were CS students in their 3rd (out of 4) year of studies. Forty-six (46) students enrolled in the course (23 male and 23 female). Based on prior domain knowledge questionnaire, we identified 27 of them as completely novices, 13 as having minimal experience and 6 of them with medium level knowledge in Flash programming. As soon as the students submitted their assignment, we conducted a course assessment questionnaire including questions on the use of e-lectures. The questionnaire recorded: (a) students' demographic data (gender, prior knowledge), (b) students' opinions on the technical and pedagogical aspects of e-lectures and also on their perceived value as course supportive material, and (c) students' preferences on attending the course in a blended learning format. Most questions answered using a five-point Likert scale, but students were also asked to explain and elaborate their answers in free text format.

### 3.2 Developing the e-Lectures

The rationale of e-lectures design was based on the pedagogical pattern "Tool Box" [2]. According to this pattern e-lectures were seen as components of a tool kit. Using this kit, students should be able to develop a complex artifact (their assignment). Therefore, the e-lectures presented particular Flash programming techniques not as ready-made solutions for students to apply through copy-paste in the course assignment but rather as a programming techniques database which should be adjusted and

extended from the students themselves. The development of all e-lectures followed some key steps, explained in the following.

*Step 1-Objective and materials:* The primary step was to set the instructional objective of the e-lecture and select sufficiently clear and understandable material to be presented. *Step 2-Create slideshows:* Then we developed slides combining text and images (where necessary) to explain the programming concepts and techniques. *Step 3-Structure of e-lecture:* We defined and implemented the structure of the e-lecture in order to achieve easier user navigation and better content organization. The structure of each e-lesson, in general, was the following: Lecture title, Prerequisites, Objectives, Sections (usually 3 to 4 sections with each section comprising: introductory slide, learning objectives of the section, a group of slides, video clip presentation demonstrating the programming technique in the Flash tool, training), Uses (how the techniques could be applied), Summary, Training (closed type questions). *Step 4-Capturing audio and video:* Narrative commenting on the contents was added in each slide. Screen capture video clips were embedded at appropriate points to demonstrate how to implement the programming technique in the Flash tool. These videos were relatively short lasting about one to two minutes (Figure 1). *Step 5-Self assessment:* Self assessment closed type questions (such as multiple choice, matching, true-false, and hotspot) were added at the end of each section and at the end of the whole e-lecture also.



**Figure 1. The e-Lecture presentation: Navigation menu (left), presenter (top left), navigation and presentation controls (below) and content (screen captured presentation of programming technique) (center)**

### 3.3 Results

The course assessment questionnaire was answered by all students who attended the course (N=46). The questionnaire comprised three parts. The first part focused on the technical and pedagogical quality of all e-lectures, the second one referred only to the two additional e-lectures and the third one recorded students' preference on transforming the laboratory course in blended learning format with the support of e-lectures. The summarized results for each question are shown in Table 1, Table 2 and Table 3 respectively.

Overall, the majority of students had positive opinion about both the technical quality (quality of text, sound, image, navigation) and pedagogical quality (presentation pace, level of difficulty, clarity, achievement of objectives) of the e-lectures (items 1, 2).

Furthermore, the e-lectures proved to be a good supportive material for most students (item 3). Almost all students watched the e-lectures for more than one time and some of them more than 5 times in total (item 3). Moreover, 35 students (N=46) preferred to watch the e-lecture while simultaneously practicing in the Flash programming environment. Students' comments on the supportive role of e-lectures were also positive and they seemed to be rather satisfied with the e-lectures pedagogical design. A student mentioned that *"Yes, the e-lectures helped me with most aspects of my assignment"* Another one declared that *"I did not have any Flash programming experience and the e-lectures were the guide I needed for understanding most of the techniques..."*. Additionally, some students asked for more advanced issues to be covered by the e-lectures: *"They were well organized and understandable and I would prefer them to proceed further in advanced topic presentation"*. Finally, there have been reported specific needs for more detailed presentation and for more examples to be included in the e-lectures.

Students also believed that the e-lectures offered them the opportunity to devote more time and get more efficiently involved with multimedia programming. However, they said that more difficult self-assessment questions were needed at the end of each lecture. They also asked to classify the e-lectures based on content level (perhaps also based on content difficulty and complexity), in order to avoid more experienced users watch e-lectures with content they already had mastered. Many students reported that the e-lectures offered important support to the development of their course project. With e-lectures it was easy to review specific programming techniques relevant to the implementation of their assignment. One student commented: *"It was an important tool. I had to look up several times during the implementation to find specific answers"*. Another comment: *"Without the e-lectures I would have needed more time to complete the project"*.

The second part of the questionnaire focused on the role of the last two additional e-lectures. These e-lectures demonstrated multimedia programming techniques not previously presented in any face-to-face laboratory session. Most students (69,56 %) answered that the two supplementary e-lectures were comprehensible (item 5). However, significantly less students (47,83 %) believed that these two e-lectures helped them essentially to complete their assignment (item 6). A student mentioned: *"The two additional e-lectures made me think differently and forced me to combine all the previous knowledge from the other e-lectures"*. On the negative side, a student stated: *"...these e-lectures did not help me because they were too general and I could not see how exactly they were connected to the project"*.

Finally, the third part of the questionnaire explored students' opinions regarding the potential transformation of the laboratory course in blended learning format with the use of e-lectures. Most students were reluctant to support this perspective. Although half of them (47,83%) think they can learn new programming subjects using only e-lectures (item 7), most of them (71,74%) believe that e-lectures should be used only as additional supporting material (item 7). More emphatically, the majority of the students (52,17%) prefer to attend the traditional face-to-face laboratory sessions (item 9). Those who see positively a blended (or distance) learning format based on e-lectures emphasize the need for instructors' support. Characteristically a student mentioned: *"...in order to replace completely the laboratory lessons (by e-*

lectures), there should be some way to support live question answering when learning the domain...”  
communication with the instructor... there is always need for

**Table 1. Questionnaire results regarding the overall quality of e-lectures**

Questions (N=46)		Answers				
		Positive	Rather Positive	Neutral	Rather Negative	Negative
1	How would you rate the technical quality of e-lectures?	27 58,7%	16 34,78%	2 4,35%	1 2,17%	0
2	How would you rate the pedagogical quality of e-lectures?	13 28,26%	27 58,7%	5 10,87%	1 2,17%	0
3	Did the e-lectures help you to recall the programming techniques presented at the laboratory lectures?	26 56,52%	15 32,61%	4 8,7%	1 2,17%	0
		<b>Answers</b>				
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 and more</b>
4	How many times did you attend the e-lectures?	1 2,17%	18 39,13%	10 21,74%	5 10,87%	6 13,04%

**Table 2. Questionnaire results regarding the two additional e-lectures**

Questions (N=46)		Answers				
		Yes	Rather Yes	Not sure	Rather No	No
5	Were the two additional e-lectures comprehensible?	18 39,13%	14 30,43%	6 13,04%	5 10,87%	3 6,52%
6	Did these two e-lectures support you to develop the respective part of your assignment?	7 15,22%	15 32,61%	7 15,22%	10 21,74%	7 15,22%

**Table 3. Questionnaire results regarding the whole activity and the use of e-lectures**

Questions (N=46)		Answers				
		Yes	Rather Yes	Not sure	Rather No	No
7	Do you believe you can learn new Flash programming subjects only with the use of e-lectures? (without face-to-face lab lessons)	7 15,22%	15 32,61%	13 28,26%	10 21,74%	1 2,17%
8	Do you believe that e-lectures should be used only as additional supporting material? (not as a substitute for the face-to-face lab lessons)	22 47,83%	11 23,91%	2 4,35%	6 13,04%	5 10,87%
		<b>Answers</b>				
		<b>I prefer to attend a laboratory course in the traditional way, that is, in a laboratory room with the instructor present and use the e-lectures as additional supporting material.</b>	<b>I prefer to attend the first key subjects in the laboratory (for example, 3 or 4 lessons) and then I could proceed to new topics using only the e-lectures and working on suggested exercises.</b>	<b>I prefer to attend all lessons from distance using e-lectures and working on suggested exercises, following instructors' guidance.</b>		
		<b>I expect that the instructor would answer my questions from distance (via email, forum, FAQs, etc.)</b>		<b>I expect that the instructor would answer my questions from distance (via email, forum, FAQs, etc.)</b>		
9	Select your favorite among these three course scenarios	24 52,17%		12 26,09%		10 21,74%

## 4. DISCUSSION AND CONCLUSIONS

This study provided field evidence on the use and effectiveness of e-lectures to support a typical laboratory programming course. A first conclusion is that students are quite positive about the use of e-lectures as asynchronous supporting material. Students visited frequently the course website, watched the audiovisual material as many times as they needed and stated that e-lectures helped them to a) recall the face-to-face laboratory instruction and b) develop their course project successfully. Additionally, they asked for more advanced subjects and more detailed material than this presented in the e-lectures.

However, when we provided two additional e-lectures on new subjects (that students were not familiar with from the laboratory sessions) the overall picture changed. Fewer students believed that these lectures were sufficiently supportive to advance their course project. This probably happened because the additional e-lectures presented advanced Flash techniques and students with not so strong background found difficulties in understanding the new material and were confused on how to benefit from it. Another reason could be the learning strategy that students had already developed. Students were used to attend the laboratory lesson and then watch the relevant e-lecture. The additional e-lectures forced them to think differently. Perhaps the missing experience of the face-to-face lesson made them think that the additional e-lectures presented only a part of the necessary knowledge on the topic. As a result they did not try enough to integrate these new concepts to what they had already learned. These students could possibly be effectively supported by out-of-classroom teacher-student communication (something not available in this case study).

Students were divided regarding the option of attending part or all the laboratory sessions from distance using e-lectures as primary learning material. Transforming a course in blended learning format entails many complexities [10] but one crucial point is, always, the level of teacher support. The students need to feel that teacher support will be available whenever necessary.

Overall, our study confirmed what we already expected; that carefully designed e-lectures would be positively accepted by students as a supporting material for the CS laboratory course. Using e-lectures the instructor can reconstruct an important part of the programming learning experience and help students overcome problems emerging from the limited practice time in the lab, the difficulty to remember important techniques and topics after a laboratory lesson, the limited time available (in lab) to deeper understand the complicated functions of programming. However, our exploration indicated that these benefits emerge only when students participate first in the face-to-face session and use later the e-lectures material as supplement. Dissociating the “live” event from the e-lecture material requires a more sophisticated course design to make sure that all students get the appropriate feedback and support they need not only from the teacher but also from peers. Perhaps, also, a laboratory course in blended learning format might be beneficial only for students of a specific learning style. More research is needed to clarify these issues and toward this research direction we shall do our next steps.

## 5. REFERENCES

- [1] Bell, T., Cockburn, A., McKenzie, B., and Vargo, J. 2001. Digital Lectures: If you make them, will students use them?

- Constraints on effective delivery of flexible learning systems. Interactive multimedia electronic journal of computer-enhanced learning. 3,2 (Oct, 2001). Available from <http://www.imej.wfu.edu/articles/2001/2/06/index.asp>; accessed 12 January 2010.
- [2] Bergin, J. Fourteen Pedagogical Patterns. Available from <http://csis.pace.edu/~bergin/PedPat1.3.html> (2000); accessed 12 January 2010.
- [3] Chandra, S. 2007. Lecture video capture for the masses. In Proceedings of the 12th Annual SIGCSE Conference on innovation and Technology in Computer Science Education (Dundee, Scotland, June 25 - 27, 2007). ITiCSE '07. ACM, New York, NY, 276-280. DOI=<http://doi.acm.org/10.1145/1268784.1268864>
- [4] Collard D., Girardot S., and Deutsch H. 2002. From the textbook to the lecture: Improving prelecture preparation in organic chemistry. *Journal of Chemical Education*. 79, 4, 520–523.
- [5] Day, J., and Foley, J. 2006. Enhancing the Classroom Learning Experience with Web Lectures. *IEEE Transactions on Education*. 49, 4 (Nov. 2006), 420–431.
- [6] Demetriadis, S., and Pombortsis, A. 2007. e-Lectures for Flexible Learning: a Study on their Learning Efficiency. *Educational Technology & Society*, 10, 2, 147-157.
- [7] Dev, P., Rindfleisch, T. C., Kush, S. J., and Stringer, J. R. 2000. An analysis of technology usage for streaming digital video in support of a preclinical curriculum. In Proceedings of the AMIA Symposium. 180–184.
- [8] Dickson, P. E., Adrion, W. R., and Hanson, A. R. 2008. Automatic creation of indexed presentations from classroom lectures. In Proceedings of the 13th Annual Conference on innovation and Technology in Computer Science Education (Madrid, Spain, June 30 - July 02, 2008). ITiCSE '08. ACM, New York, NY, 12-16. DOI=<http://doi.acm.org/10.1145/1384271.1384277>
- [9] Jones, V., Jo, J. H., and Cranitch, G. 2003. A blended e-learning solution for the delivery of tertiary education. In Proceedings of IADIS International Conference e-Society (Lisbon, Portugal), 42–47.
- [10] Liotsios K., and Demetriadis S. 2010. ‘Going blended’: experiences from the implementation of blended learning design and the perspective of a model. *International Journal of Web Based Communities*. 6,1,128-142.
- [11] Rui, Y., Gupta, A., Grudin, J., and He, L. 2004. Automating lecture capture and broadcast: technology and videography. *Multimedia Systems*, 10, 3–15.
- [12] Spickard, A. III, Alrajeh, N., Cordray, D., and Gigante, J. 2002. Learning about screening using an online or live lecture: does it matter? *Journal of general internal medicine*. 17, 540–545.
- [13] Wofford, M. M., Spickard, A. W. III, and Wofford, J. L. 2001. The computer-based lecture. *Journal of general internal medicine*. 16, 464–467.