

Using Blended Learning in Traditional Face-to-Face Instruction: A case study teaching Algorithms to undergraduate students.

Spyros Papadakis
Hellenic Open University & Research Academic Computer Technology Institute
Patras, Greece,
papadakis@eap.gr

Kostas Paparrizos
University of Macedonia
Thessaloniki, Greece
paparriz@uom.gr

Eleni Rossiou
University of Macedonia
Thessaloniki, Greece
rossiou@uom.gr

Abstract: This paper presents a higher education case study in teaching Algorithms to the first year's undergraduate students of the Department of Applied Informatics of the University of Macedonia (UoM), Greece. It describes best practices using an e-learning approach as a complementary tool in traditional face-to-face classroom instruction. The focus of this effort is to support our students to utilize a cost-effective model based on e-Learning technologies and distance learning methods. This paper presents instructors' and students' experiences, analysis of students' feedback, lessons learned and recommendations for other educators considering the application of blended learning techniques to enhance their courses. The presentation will comment on pedagogical and technical problems, difficulties, constraints and successes we faced by using a blended learning approach in higher education.

Introduction

Higher education and corporate sector turn to blended learning and this is recognized as one of the greatest trends in education and training today (Drossos et. al. 2006). The Sloan Consortium (2003) reported that 81% of all institutions of higher education offer at least fully online or blended courses and 49% among public institutions in the U.S. offer an online degree program. The traditional face-to-face (F2F) classroom or lab learning environment has been in use for centuries. On the other hand, distributed learning environments expanded in exponential ways as broadband internet connection gives new opportunities and challenges. Integrating blended learning techniques into instructing of "applied informatics" courses in a traditional university presents a variety of challenges. In comparison to traditional education, online teaching and learning provides opportunities to customize learning and address individual needs.

The goal of blended or hybrid courses is to combine the best features of in-classroom teaching with the best features of e-learning. In fact, blended learning often means different things to different people. But, each new learning situation requires a fresh approach. Using e-Learning technologies, instructors have implemented a blended model and redesigned some lectures or lab exercises into new online learning activities, such as case studies, tutorials, self-testing exercises, simulations, and online group collaborations.

We utilized a pilot e-learning approach as complementary tool in traditional face-to-face classroom instruction.

Our research questions for the study were set as follows:

- How do students perceive the experience of complementary studying in blended learning format?
- How do students view on-line learning?
- How has e-learning technology impacted face-to-face interaction with students?
- What support issues have emerged from the use of blended learning in traditional university courses?
- How does the blended learning experience compare to traditional course?

This paper is organized as follows: First, an overview of blended learning and the theoretical background of this effort are provided. Second, our experiences of a case study in the University of Macedonia, Greece, using blended learning techniques in a unit of a course are described. Then, we discuss the results of using e-learning techniques as a supplementary tool in traditional education. Finally, conclusions are drawn.

Blended Learning Overview

The concept of "blending" grew out of the successes and failures of e-learning. Although instruction is appropriate for online delivery, there are still many contexts in which it appears that learning is best served by some combination of classroom, Web-based training (WBT), synchronous online delivery, or other electronic resources (Douglass, 2006). Hybrid, mixed and blended are some of the terms we found in the literature. We keep the term «blended» and Blended Learning (BL) to describe an instructional model that combines e-learning and classroom learning. It is in vogue because no one wants to spend so much time and effort on e-learning and people in general want to preserve what they have, so they have made up this nice name for not changing much and called in blended learning. (Schrank 2001). In our attempt to define the term, searching in the dictionary the verb "Blend" means '*to mix... together to improve quality*' (Collins dictionary) or '*form a harmonious combination*' (Oxford English dictionary) and those concepts lead to the fact that the term requires *both action and reflection* of knowledge. As a glossary term BL is *learning events* that combine aspects of online and face-to-face instruction. (Learning circuits glossary, 2006) or it is *learning methods* that combine e-learning with other forms of flexible learning and more traditional forms of learning. (Flexible Learning Advisory Group, 2004).

The term 'BL' has gained considerable currency in recent years as a description of particular forms of teaching with technology. However, like so many terms within this field it remains ill-defined. (Oliver M., Trigwell K., 2005). The common word between the many definitions that have been given seems to be the word "combination"; So BL is a *combination* of:

- *Benefits* of traditional instructor led training with the advantages brought by a variety of technologies to create an *optimum program* (Alvarez, S. 2005).
- Online learning, face-to-face learning, and self-paced interactions *among instructors, students and the instructional system* (Choi 2004).
- Instructional methods (Rosset, 2002; Driscoll, 2002)
- Online and F2F instruction (Sands, 2002; Ward & LaBranche, 2003; Young, 2002)
- *Traditional learning with web-based online* approaches or
- Media and tools employed in an e-learning environment or
- A number of pedagogic approaches, irrespective of learning technology use. (Whitelock D., & Jelfs 2003).
- *Mix modes* of Web-based technology (e.g., live virtual classroom, self-paced instruction, collaborative learning, streaming video, audio, and text) *to accomplish an educational goal* or
- various pedagogical approaches (e.g., constructivism, behaviorism, cognitivism) to produce an *optimal learning outcome* with or *without instructional technology* or
- *any form of instructional technology* (e.g., videotape, CD-ROM, Web-based training, film) *with face-to-face instructor-led training*. (Driscoll, 2002).

'The idea behind BL is that instructional designers review a learning program, chunk it into modules, and determine the best medium to deliver those modules to the learner' (Hofmann J., 2001). BL is part of the ongoing convergence of two archetypal learning environments. On the one hand, we have the *traditional F2F* learning environment that has been around for centuries. On the other hand, we have distributed learning environments that

expanded in exponential ways as new technologies have expanded the possibilities for *distributed communication and interaction*. (Bonc, Graham 2006). BL is *the effective combination of different modes of delivery, models of teaching and styles of learning* (Procter, 2003).

In most cases, BL is hosted by a Learning Management System (LMS) that supports the lifecycle activities. However, contemporary LMS does not address the key issue of associating factors such as cost, quality, and infrastructure with the BL experience in a quantifiable form. The reasons of supporting undergraduate students in traditional education with methods of distance education, especially with blended approach are the weakness of additional hours of (traditional) teaching, the lack of possibility of F2F tutorials at the university, the lack of available students' time for attending additional lessons and the difficulty of synchronization between students' individual study and lectures.

A case study in University of Macedonia, Greece

It is well known that most current teaching and learning practice in higher education settings is still focused on *transmissive* rather than *interactive* strategies. Aiming at more effective pedagogical practices, we pilot blended approach with first year undergraduate students of the Department of "Applied Informatics" in the compulsory module "Algorithms with C". Our attempt was firstly implemented for the unit "sorting algorithms" of the module and 20% of the registered students participated in asynchronous and synchronous teaching parallel to traditional one. In asynchronous communication we used two main tools, Forum and Webcasts. In synchronous communication we used virtual classrooms. We used Learning Management System COMPUS (Electronic Environment of management of courses of University Macedonia), Webcast Producer for video lectures and Centra Symposium to support the eLearning components of our course (with virtual classroom interaction which is a complete set of features for highly interactive, effective group learning, bringing together voice, video, data and graphics in a structured online learning environment for up to 500 simultaneous users). Our teaching planning included various media, such as:

- *traditional classroom* (2 hours per week)
- *CD-ROM*
- *performance support tools* (visualisation tools available for free in the web)
- *stand-alone web-based learning* (studying educational material on LMS Compus)
- *asynchronous web-based teaching* (forum of LMS Compus and webcasts)
- *synchronous web-based teaching* (virtual classroom).

Part of our strategy was to define who, what, when and how students should be supported in their studies. We used the wrap-around model (Mason R., 1998) which consists of tailor made material (study guide, activities and discussion) wrapped around existing materials (text books, www – resources and tutorials). We expected that online interactions and discussions would occupy about 30% of student's time while the predetermined contents and F2F meeting would occupy the other 70%. Real time events like virtual classrooms featured in this model. The tutor's and instructor's role was more extensive than that in the traditional model, because only some of the guidelines of the course were pre-determined and most of them were created each time the course was taught, through discussions and activities. Because on-line support can help students on a one-to-one or one-to-small group basis, we used webcast, one-way video lectures (Papadakis S. & Hadjilacos, 2005), exercises, links to other sites, sets of tasks, sharing software from distance. During virtual classrooms students could interact through posting email questions or forum discussion or communicate in real time in collaborative activities. The content of the lecture during the virtual classrooms was fluid and dynamic as it was largely determined by the individual and group activities.

Research Methodology

In our case study online learning did not replace some face-to-face time or classroom activities and the instructor was willing to participate voluntarily in this experiment. The e-Learning part becomes a natural extension of traditional classroom learning. The used blended approach was piloted at the *course level* (Graham, C. R. 2005)

for a particular unit of the course (simple sorting algorithms), in order to design a whole semester blended approach for the next academic year. A central point to our study was the exploration of the support students received with e-learning tools in traditional higher education. In so doing we limited our study on issues such as how synchronous (virtual classrooms) and asynchronous (webcasts, forum) e-learning tools can support students in achieving the educational goals.

Two approaches of data collection were used: a survey for all students and a series of focus group interviews of a subset of the virtual class. An 18-item survey instrument was administered to the first year computer science students at the end of the course, during the final examination. It was an investigation of experiences and attitudes of students of UoM for the utilization of tele-education methods as an additional tool in the traditional higher education. Questions were partitioned into three sections (student's profile, learning difficulties and the use of information technology). The survey instrument had an 87% return rate. More data were elicited from one focus group and through an interview with the virtual class instructor. The focus group involved a total of 35 participants. The focus group survey contained open-ended questions asking students to verbalize their learning experience and preferences, their use of face-to-face and on-line support and the impact of this support on their learning.

Results

The purpose of the survey was to gain a better understanding of students' learning preferences for their studying support in relation to on-line and classroom enhanced environments, in order to design a better learning environment for the next academic year. The data collected in the initial part of the survey provided background information about the students' gender, level of education and internet access. The data revealed that over 55% of the students were male and predominantly (66%) first year students, (Fig 1).

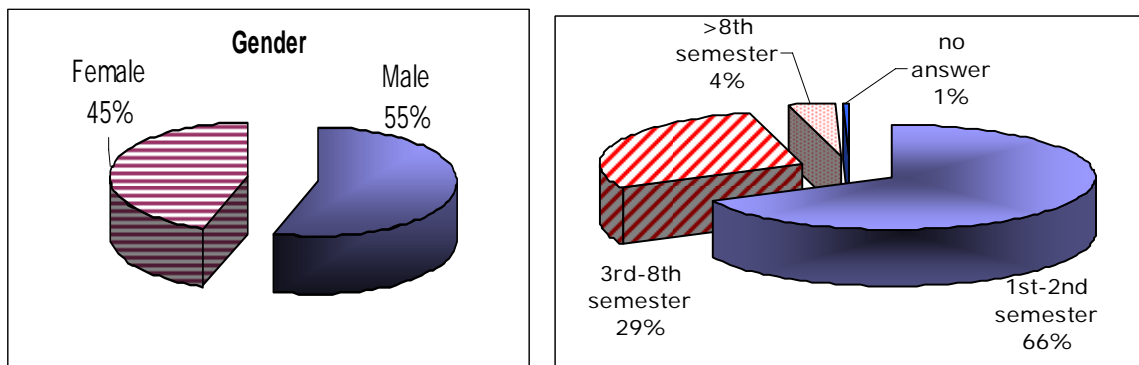


Figure 1: Students' profile (gender and level of studies)

The majority of the responders use pc's at home (93%) and have got an internet connection (74%).

The second component of the survey sought information about students' learning difficulties and learning preferences including their choice of learning supports and tools. The survey also attempted to determine what learning support (e.g. the instructor, the learning technology etc) students were more likely to use when they faced particular problems (Fig. 4). The findings showed that half of the students (47,4%) prefer traditional face-to-face instruction (Fig. 3), but 59% has also expressed the need of tutorials to support traditional teaching.

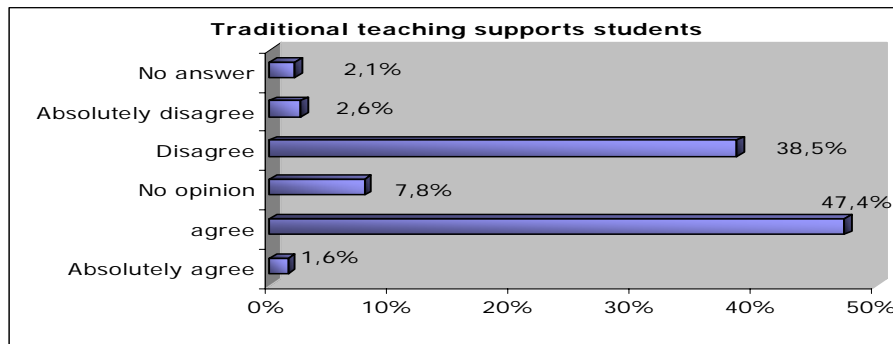


Figure 3: Students' preference in traditional F2F instruction

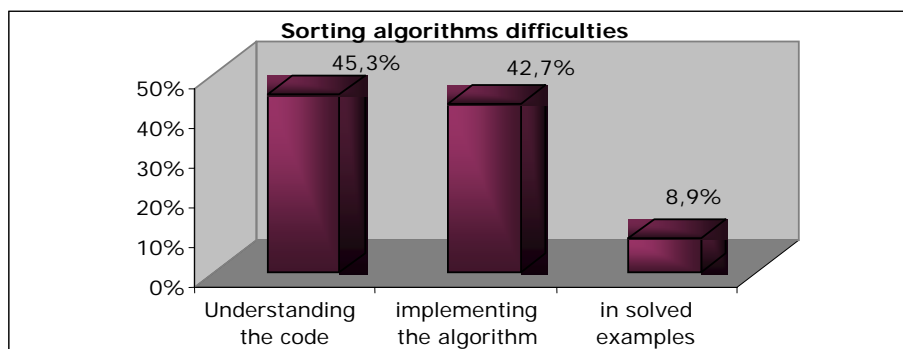


Figure 4: Sorting algorithms difficulties

The final component of the survey sought information about the students' use of e-learning tools and the purpose for using them or not. The data revealed a general variation in learning and technology preferences. Webcasts, lecture notes and power point slides were available to students prior to each lesson in order to download and review before and after the lectures, allowing them to focus on the lesson rather than trying to record all presented material. Ninety five percent (95%) of the students who attended webcasts in sorting Algorithms (14,5% once and 8,9% more than once) believe that learning of educational material was effectively supported.

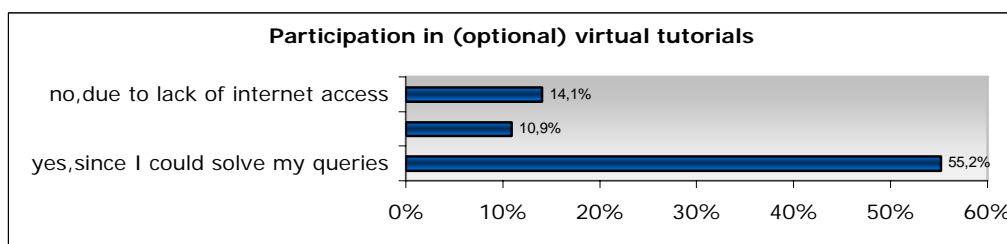


Figure 5: Preference to participation in virtual tutorials and attendance of webcasts

The survey also explored the types of learning activities and learning material in which students were more likely to work off-line (to pursue individually) or/and on-line (to work with others in groups). Most of the participants (78%) prefer to work individually (since they were attending lectures) and only 12% took part in virtual classrooms to work with others. The small participation was due to the fact that first year students are still teenagers, do not have easy internet access and their aims are based on material motives but the most of them (55%) are willing to participate in virtual tutorials with virtual classrooms or/and webcasts (Fig. 5).

From our own observations we found that the use of blended learning techniques was effective from the perspective of increasing students' active participation in learning activities. Furthermore, virtual classrooms seem to be an effective tool in decreasing the instructor's required time to answer questions and queries during class time

and although it needs a lot of instructor's time for the preparation of virtual tutorials, it is worthwhile. Instructors stated that the selected used technology was a way to enhance and expand the classroom and not to replace it. The use of blended learning techniques helps us to acquire experience by increasing the interaction with students through the application and techniques of distance learning. Both students and instructors referred to the online components as a means to encouraging critical reflection. Students were happy with the ability to "fast forward or rewind" the video lectures (webcasts). The virtual classrooms enabled instructors to get to know their students better than in the traditional face-to-face class course and solved their students' queries and they saw this as a major benefit of blended learning. Students' satisfaction is highly dependent on the level of interaction with instructors and other students.

Conclusion and Research Directions

It is clear from the literature that blended learning environments will increasingly be recognized as an important dimension of higher education (Graham et al., 2003). While blended learning environments is a combination of traditional F2F learning and e-learning, it is not sufficient to *simply* synthesize/mix the research literature from these two different areas of learning in order to develop a blended learning model. An increased and continuing effort should be done to effectively design blended learning experiences for both instructors and students.

Integrating e-learning into computing curriculum presents a variety of challenges. At the University of Macedonia, Greece, the undergraduate introductory "Algorithm and C" course will be redesigned to change from a traditional lecture to a blended learning centric format. We continue to explore additional techniques and tools in traditional higher education instruction that will enhance students and instructors' experience in blended learning. Future plans for the next academic year include also the incorporation of team communication and instructional tools (e.g. instructional games).

This case study does not pretend to provide explicit answer to issues around blended learning but to help us to redesign our lessons for the next academic year so that our approach ensure effective, accessible and engaging teaching and learning providing a range of technological learning support for teaching and learning. Despite the beliefs that blended learning in higher education provides an effective instructional strategy, there are persisting and open-ended questions that remain unexplored. Further investigation is required for the development of practical principles that can guide our decisions on how, where, what and when blended learning is needed.

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