

AC 2008-1944: ENHANCEMENT OF TRADITIONAL AND DISTANCE LEARNING THROUGH HYBRID E-LEARNING APPROACH

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Enhancement of Traditional and Distance Learning through Hybrid e-learning Approach

Abstract - The usefulness of hybrid delivery in education has long been realized and with the advancement of computer and communication technologies and the introduction of Web based authoring tools its effectiveness has been further extended. In this work we focus of hybrid e-learning. We refer to hybrid e-learning as those works that utilize courseware modules with an e-learning approach and a mixed delivery system. The main characteristic of a hybrid e-learning delivery model is a reduced face-to-face traditional delivery model complemented by e-lectures. Hybrid e-learning comes in two formats, one with reduced traditional lectures and the other one with virtual face-to-face delivery. Our focus in this paper is hybrid e-learning with virtual face-to-face delivery and will be referred to as hybrid e-learning. Furthermore, a variation of hybrid e-learning where students are given the choice of attending a class via a synchronous online delivery system, as well as traditional face-to-face, will be referred to as flexible delivery. The recommendations given in our work can enhance both traditional and distance learning schemes and can be used as an effective communication model for collaborative research-projects where participants are not from the same geographical area.

Introduction

Clearly, the advancement/affordability of computer and communication technologies during the past decade has had major effects on our everyday life, especially in the rapid growth and usage of the Internet. Online learning offers the prospect of direct delivery of learning to existing learners and to groups traditionally excluded by personal circumstances from institutional learning¹⁻⁵. In this regard, it has affected the traditional distance-learning format by transforming it from a static videotape delivery to a more dynamic format by adding/substituting the web as the delivery media. It should be pointed out that although many teachers are attracted by the scope that the medium has to offer, there are still many questions that have not been fully answered. Among these are: How effective is e-learning? Does this approach really amount to anything more than doing what was previously done but doing it faster, on a greater scale and for more people? Does this new approach add any value to the learning experience? The financial consideration and wider access are, of course, desirable in themselves. To add to the confusion there are also conflicting reports about how successful the web-based learning environment is in meeting student expectations and needs. While some studies reported high levels of student satisfaction with this mode of course delivery⁶⁻⁸, others found that students preferred the more familiar classroom-based environment⁹⁻¹⁰. Some of the difficulties associated with web-based learning, as reported by students, included the feeling of isolation due to a lack of interaction with peers or faculty, lack of prompt feedback about processes and progress in the course and a need for them to better manage their time in order keep abreast of the course requirements¹¹⁻¹⁴. It is our belief that there should not be a distinction between e-learning and learning and most of the problems/questions associated with e-learning are related to lack of integration of learning styles in e-learning based courses. However, designing an effective e-learning course, which includes different learning styles, is not an easy task⁴. It is time consuming and expensive. We

believe that by using a “hybrid” or “blended” e-learning approach we will be able to address some of these concerns. It should be pointed out that among the recent published studies in this area, some define the hybrid as a combination of “face-to-face” and “asynchronous”¹⁵⁻¹⁹ and some like ours, as “synchronous” and “asynchronous”²⁰⁻²¹, where the synchronous part is a “face-to-face” or virtual face-to-face. This methodology is a special case of common hybrid delivery, where technology plays a more significant role, and at the same time, it is more difficult to plan and administer. This approach can also be considered as enhanced distance education, with some distinct differences/requirements and added features. These differences will be discussed later. This paper is organized as follows: (i) hybrid delivery model, which is the base for the proposed delivery system, is briefly discussed, (ii) the motivation behind the flexible delivery system and issues that can be addressed by such an approach is presented, (iii) the implementation plan and related issues are explained, (iv) our experience for the past three years, using the proposed delivery system, is described followed by (v) recommendations and concluding remarks.

Hybrid Delivery Models

The usefulness of hybrid delivery in education has long been realized and with the advancement of computer and communication technologies and the introduction of Web based authoring tools, its effectiveness has been further extended. The earlier work, during the past decade, associates hybrid with conventional format (live lectures) and courseware modules. The courseware modules were primarily designed for course enhancement¹⁷. In later works, the hybrid delivery/flexible delivery is mentioned in distance learning, where the live lecture has been done through, or substituted with, video-conferencing or the Internet²²⁻²³. We identify these works and the ones where the courseware modules are used just for enhancement, as plain hybrid delivery models. On the other hand, those works that utilize the courseware modules with an e-learning approach will be referred to as hybrid e-learning. The main characteristic of a hybrid e-learning delivery model is a reduced face-to-face traditional delivery model complemented by e-lectures. As was mentioned before, hybrid e-learning comes in two formats, one with reduced traditional lecture and the other one with virtual face-to-face delivery. Our focus in this paper is hybrid e-learning with virtual face-to-face delivery and will be referred to as hybrid e-learning. Furthermore, a variation of hybrid e-learning where students are given the choice of attending a class via a synchronous online delivery system, as well as traditional face-to-face, will be referred to as flexible delivery.

Background

The University College (UC) is the largest college of the Pennsylvania State University, consisting of twelve campuses, which are geographically dispersed across the Commonwealth of Pennsylvania. UC’s focus is undergraduate education, where about twenty baccalaureate programs and thirty-five associate degrees are offered. In addition, the first two years of coursework for most of the University’s 160 baccalaureate majors, including all engineering programs, are offered at all campuses. A common attractive feature for students, in all of the campuses, is the small size of classes. During the past five years, like many other institutions, we have been witnessing a decline in IT related majors. Many of the campuses in the University College are also commuter campuses, which has made the recruitment, especially in engineering,

more difficult. These factors have contributed to significantly reduced class sizes in engineering, especially in computer science and computer engineering. Due to the commitment of the college to offer the engineering program, we have continued offering these courses and at the same time started looking for ways of addressing this problem. The idea of offering cross-campus courses has been entertained several times before by using Pic-Tel technology, where students were able to watch an instructor deliver a lecture on a television set. The major problem with Pic-Tel is that interaction is very difficult. The system is good for video conferencing and similar activities, but not for any meaningful learning experience. Another approach that was suggested was to offer low enrollment courses as on-line courses. This suggestion was also turned down mainly due to the concern that the many of the students who are attending UC may not be able to effectively use the on-line environment for learning purposes, and we believe that for the vast majority of students, regardless of their learning abilities, the asynchronous experience cannot substitute for human interaction.

Although the idea for this project originated from trying to find a cost effective model/solution to the problem of under-enrolled courses across University College campuses, other benefits were realized and other objectives were added to our initial goal. Our expanded goals include: (i) to improve our course delivery system by supporting more learning styles in our courses via e-learning methodology, (ii) to create a teaching environment that is more flexible in scheduling, (iii) to improve student access to academic specialties across the college, and (iv) to retain students at their home campus longer than previously was possible due to inappropriate course scheduling or lack of availability. We also intend to build on our experience from this project to offer additional degree options on each campus. As was mentioned, the delivery structure includes synchronous and asynchronous teaching and learning methodologies. The asynchronous portion will be put together based on the best practices in the e-learning courseware productions. The synchronous portion will be delivered using Centra²⁴ (or Adobe Connect²⁵), a real-time communication, collaboration and learning over-the-Web software. Centra and Adobe Connect are live conferencing tools that can provide a synchronous virtual classroom experience while maintaining the convenience of individual web access. Centra and Adobe Connect allow the students to simultaneously view material presented online by the instructor, while interacting with the instructor and other students. Traditional classroom interaction is simulated in that the instructor can control whether the students can speak in class and when. Computer applications, web cameras, and whiteboards can also be utilized via the Centra (or Adobe Connect) medium. Lectures and all transpired activities can be recorded and played back by students at a later time (asynchronous learning). The software allows the instructor to effectively monitor students' progress. The initial development plan started summer 2005, with the first experimental partial delivery of an undergraduate computer programming course during fall 2005. The trial phase has continued by offering 1-2 courses per semester, including the summer session. We have also delivered a graduate level electrical engineering course to a small group of students residing overseas. It should be mentioned that these courses, except for the graduate course, have been designed and delivered based on flexible delivery model but for one campus only. Cross-campus delivery phase is scheduled for implementation by spring 2009 semester.

Implementation Plan

This section describes, in detail, our implementation plan including the hardware-software. The selection process was done by a committee, which included faculty who have taught the target courses in the past and were interested in using/experimenting with such hybrid approaches, representatives from involved departments, and representatives from the professional development unit of the University College.

Course and Faculty Selection

Initial Trial: Fall 2005

The first programming course in computer science/Engineering (CSE 103), a four credit course meeting four hours a week, was chosen as the starting point of this experiment. The reason for this choice was based on the course's projected low enrollment for fall 2005 semester, and the students' background in using technology. Moreover, based on our experience, we expected a great majority of them to be proficient in using computers. The committee decided to limit this trial to two campuses and to have two faculty involved, one from each campus. The trial period was not designed to save money, but to gain experience in delivering courses in such a format and to evaluate its potential and identify its limitations. We decided to have two faculty involved in this project for the following reasons. (i) To train two faculty at the same time, and (ii) if learning objectives were not being met the faculty could continue the course through the traditional face-to-face delivery approach using on-line supplementary material, switching from hybrid e-learning to the usual delivery format.

Spring 2006-Spring 2008

Since the initial testing, we have used the flexible delivery system ten more times in four different courses, three undergraduate and one graduate. For implementation of the cross-campus course delivery system, several faculty are trained in the use of technology and the processes involved. The full implementation of the cross-campus course delivery system is expected to start in spring 2009.

Hardware-Software requirements

The hardware and software requirements/recommendations were handled by the Information and Technology Services (ITS) department. This included Centra, and later on Adobe Connect, platform for virtual face-to-face delivery. The ITS department also provided a list of recommendations for communication equipment that will be used; i.e., Internet-camera and headsets for instructors and students. Since Centra includes a built in white-board for the instructor, a graphics tablet or a Tablet PC can be used as a pen input device to enable accurate drawing of formulas, graphs and codes. It is also recommended, if possible, for the instructor's computer to have two video cards in order to have a split screen for better control of the classes. Internet connection is also an important issue, which was identified as capable of handling the required bandwidth. While broadband Internet connectivity is preferred, Centra scales well even at 56K phone modem speeds and connectivity between campuses is not expected to create any problem.

Design and Delivery Consideration Issues

The following were identified/recommended for the design and delivery process.

- Hybrid-based course(s) should be clearly designated and advertised as such to prevent student confusion at the time of enrollment.
- Students should be informed regarding course delivery methodology and the requirements for student participation. This is particularly important from the point of view of student satisfaction, as student expectations must be molded to fit the constraints of the online-based course delivery.
- Support for online delivery classes needs to be expanded. Both students and instructors require support. Student and instructional needs may differ, but lack of support leads to low satisfaction in both groups.
- Clear and specific specifications for the student's computer hardware, software, and telecommunications must be published prior to course registration so that enrolling students can be ready to participate in the online course.
- Students should be trained on how to effectively use the Centra (or Adobe Connect) system. This should happen before the first formal lecture.
- Course syllabus should clearly identify the number of synchronous class teachings, amount of expected asynchronous learning by students, expected conduct during the synchronous delivery, and grading and attendance policies.

E-Lectures

- Every lecture should include objective and appropriate hands-on activities.
- In order to have the students engaged, lectures should be designed in such a way that after a certain period, e.g. 10-15 minutes, a hands-on activity (programming or short questions) occurs. This also promotes active learning.
- Every lecture should include appropriate measures of learning.
- To insure uniformity, lecture topics will be put together based on suggested syllabi from the computer science and engineering department.
- Several worked out problems will be included at the course website.

Recommendations:

- Learning Style: The notes/presentations are structured to include the main learning styles.
- Teaching Style: The teaching style matches the learning styles incorporated in the notes/presentations.
- Diverse Students: The notes/presentations take into the account the diversity of the students' backgrounds.

Estimated design time for each hour of synchronous delivery: 3-5 hours

Estimated design time for one hour of e-lecture: 4-6 hours.

Teaching Process

- Maximum of two hours of synchronous lecturing per week, for a 3-4 credit course.

- Students are expected to take a pre-assessment quiz before the beginning of each synchronous lecture (to measure the learning level from the asynchronous portion).
- 1 hour of on-line questions and answers (on-line office hour) per week.
- 30 minutes for weekly programming quizzes (asynchronous).
- Exams will include programming and concept type questions.
- Course will include a textbook for reference and homework assignments.
- ANGEL (A New Global Environment for Learning ²⁶) will be used as the CMS (Course Management System) tool for this course.

The two-hour synchronous session was chosen in case the project has to be stopped and we have to switch from hybrid e-learning to the usual delivery method. ANGEL is Penn State's CMS tool that was used for course administration tasks, such as postings of syllabus, daily schedules, homework folders, lectures, attendance, and grading. The most important issue during the design and delivery of the synchronous portion is that this portion should be focused on discussion and engagement of students and not on information delivery. The information delivery portion is expected to be handled by the e-lectures and tested by online quizzes and activities during the synchronous part. Clearly, the competency of the instructor in using the on-line delivery software plays a crucial role in the success or failure of the project. For this reason, several training sessions were conducted by the ITS department.

Student and Course Assessments

The assessment of student learning objectives is crucial in this work. Thus, the evaluation of students is both formative and summative. The following integrated, but separately assessable components will be used in the assessment process:

- Class participation
- Student contribution during the synchronous delivery mode
- Homework assignments
- Examinations and on-line quizzes
- Comparison of the students' grades with previous semesters

During the full implementation of the synchronous online delivery we will require students to fill out an online evaluation every 3-4 weeks, focusing on the effectiveness of the delivery system. This will provide the opportunity to adjust/fine-tune the delivery system.

Delivery Software

Centra and Adobe Connect were used for the virtual delivery segments. The following lists some of the features of these software packages that we found to be useful in a distance and flexible delivery system.

- A Meeting Room function that allows a host to e-invite participants for a virtual conference, or attends a lecture. With a set of headphones and microphone, the host can either share the computer screen, document, or an application.

- There is also an option to start the camera and voice, and then under Meeting, record the meeting. Adobe Connect creates a URL for the student to revisit the lecture at later time. Centra will allow students to download the recorded sessions. Based on our experience, we consider this a significant advantage.
- Instructors can teach students via Microsoft PowerPoint presentation with audio and video communication.
- The software offers several interactive functions that could increase learning effectiveness.
- Since the software is equipped with audio and video capability, students can see instructor's movement and hear the voice, which is similar to a real classroom.
- There are also interactive functions that would be helpful in soliciting responses from distance students in a real-time. For example, instructors can poll a multiple choice question and student chooses one answer. The answers from the students are available to the instructor real-time anonymously. In this way, the student is more encouraged to participate actively in a real-time Centra/Adobe Connect "classroom" than in a traditional physical classroom.
- Another useful function that focuses on interactivity is a chat session. Student can send feedbacks to instructor real-time and contact classmates through a chat session as well. In comparison, a chat session in a real-time Centra/Adobe Connect "classroom" is not as disruptive as a chat session in a physical classroom.

Delivery Experiences

Fall 2005

We introduced students enrolled in CSE 103 to the aforementioned delivery system. The class scheduled met Mondays from 8:30-9:20 and Wednesdays from 8:30-10:20. Classes were conducted using the flexible delivery model. Toward the end of the semester, after making sure that students knew how to effectively use the system, students were allowed to connect from home if they chose to, but nobody took advantage of it. Several inter-campus guest lectures were also conducted during this time.

Spring 2006

The intermediate programming course (CSE 120), which consisted of the same students as in the introductory course, was designed using the flexible delivery model, with the exception of not reducing the course contact hours. The course schedule consisted of Mondays 8:30-9:20 and Wednesdays 8:30-10:20. Students were given the permission of connecting from home from the beginning of the course. From a group of six students enrolled in this course one student chose to do so for almost the entire semester. A graduate course, special topics in control systems focusing on chaos, was also delivered to a group of 6 students residing overseas at Ferdowsi University. The course structure format was designed to reflect the level and maturity of the students. Class met online twice a week. Hybrid e-learning methodology was used in the design and delivery of this course.

Summer 2006

A programming course for engineers (CMPSC 201), a 3-week course meeting everyday for 3.5 hours, was delivered according to the flexible delivery model. None of the students took advantage of connecting from home, but many of them downloaded the recorded lectures.

Fall 2006

Two courses were delivered using the described model: CSE 121 (new number for CSE 103), with an enrollment of 7 students, and CMPSC 201 with a larger enrollment were delivered using the flexible delivery model. CSE 121 met Mondays from 8:30-9:20 and Wednesdays from 8:30-10:20. This was the second delivery of this course using the same approach. The CMPSC 201 course schedule included Mondays-Wednesdays from 8:30-9:20 and Tuesdays 8:30-10:20. Students were introduced to Centra during the first week of the semester, and by the fourth week of classes, after we made sure that they knew how to use the system, students were given the choice of coming to class or connecting from home. For the CSE 121 course, as in our first experience, no one took advantage of connecting from home. By the end of the semester for CMPSC 201, 5 students from a group of 16 were connecting from home on a regular basis.

Spring 2007

The intermediate programming course, CSE 122 (new number for CSE 121), was delivered using the flexible delivery model. The course enrollment was only five and by the fourth week of the semester all of the students chose to connect from home. Students were required to come to the class for exams. We also experimented with delivery of the lecture part of the electric circuits course (EE 210) using a modified version of the described model using Tablet PC. Results for this trial will be reported later.

Fall 2007

Two courses were delivered using the described model: CSE 121, with an enrollment of 12 students, and CMPSC 201 with an enrollment of 24 students were delivered using the flexible delivery model. CSE 121 met Tuesdays and Thursdays from 10:30-11:15. This was the third delivery of this course using the same approach. The CMPSC 201 course schedule included Tuesdays and Thursdays 8:30-9:45. Students were introduced to Centra during the first week of the semester, and by the third week of semester, after we made sure that they knew how to use the system, students were given the choice of coming to class or connecting from home. For the CSE 121 course, unlike our previous experiences, three students took advantage of connecting from home. By the end of the semester for CMPSC 201, 4-5 students were connecting from home on a regular basis.

Spring 2008

The intermediate programming course, CMPSC 122 (new abbreviation for CSE 122), is being delivered using the flexible delivery model. A graduate course, special topics in control systems focusing on estimation theory, is in the design process for fall 2007, to be delivered to a group of students residing overseas at Ferdowsi University. We are also repeating our experimental delivery of EE 210, similar to the one that we did last spring.

Remarks

The followings summarize our observations and recommendations:

- The process requires several test runs in order for faculty to get comfortable with the synchronous delivery system.
- Our experience indicates that it will take students 2-3 weeks to get comfortable using the synchronous delivery system and connecting from outside the campus.

- Computer science and engineering students adapted to the hybrid e-learning system faster than the rest of engineering students.
- Our freshmen students took advantage of the flexible delivery in their second exposure to the system, while the sophomore students took advantage of the system after a few weeks.
- Class attendance for the targeted courses increased between 15%-20%.
- Class participation did not change much, but the ability to share student work with the rest of the class has had a positive effect.
- No significant change in homework grades was observed.
- Student reactions, based on an online survey, have been positive and encouraging.
- The ability to download lectures and watch them again was referred to as the most positive aspect of the new delivery system. After that the ability to connect from outside the campus was cited.
- When students were asked on an online anonymous survey about reviewing the previous lecture notes or Centra recordings before the class, 30% chose “yes”, 40% indicated “sometimes”, and the rest selected “no”. When asked whether they watch Centra recordings on a regular basis, 36% said “yes”, 28% indicated “sometimes”, and the rest selected “no”.
- We recommend delivery of a first semester freshman course to be done using flexible delivery. Subsequent courses, for the same students, could be done using the hybrid e-learning method.
- Pre-assessment quiz plays an important role in successful role in reduction of delivery time.
- Hybrid e-learning delivery is ideal for upper division undergraduate- and graduate-courses.
- Based on students’ feedback and our observation, from the first delivery of our synchronous distance delivery course, we feel that the use of virtual delivery systems such as Centra provides an effective distance delivery system.

Conclusion

It is our belief, and many others, e.g. [4], that teaching and learning must move towards more innovative and inclusive ways and that active participation should replace passive learning. Such a vision, although not altogether novel, recognizes contemporary educational themes that include [23]:

- Electronic distance learning (e-learning)
- Lifelong learning (LLL)
- Open and flexible learning, and
- Widening participation.

In this context, we believe hybrid delivery can play a significant role. It can help to change passive delivery to a more active and flexible delivery methodology. Hybrid e-learning can minimize the negatives sometimes associated with more traditional, primarily asynchronous distance learning offerings. It is also a very effective means for delivering quality distance-workshops and collaborative research-projects where participants are not from the same geographical area. The recommendations given in the previous section can significantly reduce or eliminate possible shortfalls that are associated with such a delivery system.

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