AC 2008-1231: A METHOD OF PACING ON-LINE COURSES: BLENDING ASYNCHRONOUS ASSESSMENTS AND RECORDED LECTURES WITH SYNCHRONOUS LECTURES

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A Method of Pacing On-line Courses: Blending Asynchronous Assessments and Recorded Lectures with Synchronous Lectures

Abstract

In order to attract students to take UD courses who normally take courses during the summer at a school near their hometown, some professors have begun offering study-at-home and on-line courses during the summer through the University's summer distributed learning program. The Engineering Management Department offers graduate courses using interactive Web Conferencing. However, there was no school of engineering undergraduate courses that were offered in an on-line mode. In the summer of 2004, Engineering Technology faculty developed a course in Engineering Economy that took advantage of the University's Web Conferencing system. Since then, several courses have been delivered in a blended learning mode using a combination of synchronous and asynchronous modes. In 2006, Engineering Technology received a grant from Hewlett-Packard to develop a course that was delivered in the summer of 2007 that employed Tablet PCs and interactive software in an on-line environment. This paper discusses the structure for this course, some of the technology that was used and the results of this effort.

Introduction

Several papers have been written recently about blended or hybrid courses. Duemer[1] discussed the use of online synchronous discussion groups in a traditional course to enhance community formation and professional identity development. Kim[2] discussed a hybrid model that combined face-to-face meeting with significant on-line learning activities. Rosenkrantz[3] also discussed a hybrid course that combined traditional classroom and on-line learning in an engineering economy course. Scott[4] explored student satisfaction and cost savings of blended courses that have traditional and on-line components. Trippe[5] compared faculty and student satisfaction and student performance for a fully asynchronous section of a course with a blended section of the same course that combined face-to-face meetings and on-line activities. Crofton[6] discussed a blended course where 50% of the course was conducted face-to-face and the remainder was delivered using Elluminate software. The common thread among most of these blended courses is that they included some face-to-face component. The course that is the subject of this paper used no face-to-face component. The entire course was delivered entirely on-line using both asynchronous and synchronous components.

Asynchronous versus Synchronous or …?

Asynchronous Learning is defined as any learning event where interaction between individuals is delayed over time. This allows learners to participate according to their schedule, and be geographically separate from the instructor. Courses could be in the form of a correspondence course, web-based, or e-learning. Interaction can take the form of various technologies such as threaded discussions, chats, emails, etc. Synchronous Learning is any learning event where interaction between individuals happens simultaneously in real-time. This requires that learners attend class at its scheduled time. This could be held in a traditional classroom, or delivered via

distributed or e-Learning technologies. Both asynchronous and synchronous learning have their advantages as well as disadvantages.

Advantages of Asynchronous On-line Learning

- Flexibility and convenience. Instead of having set class times, student can work at their own schedule. This is good for working students and others where meeting a fixed time schedule of classes is difficult.

- Better quality discussions. Students have the time to consider the discussion they are part of a little more carefully. They have time to weigh the issues and form their argument or contribution. They can do some research to support their argument. This tends to increase the quality of the discussion.

- Students can work at their own pace. They can speed up or slow down as necessary and not be bored if they feel the class is moving too slow or feel stressed if they feel the class is moving too fast.

- More substantive comments. Topic discussions may be more substantive because class is not restricted by the clock and students have time to formulate well thought out answers to questions and comments.

- Access to course materials. Most asynchronous courses have the course material on-line and students can access the material 24/7 as needed.

- Location independent. Students can take classes from anywhere as long as they can access the Internet.

- Interactive learning. Students are still able to interact with the instructor and other students through discussion forums, chat rooms, email, instant messaging, and other electronic media. In some cases, especially for students who are too shy to speak out in a face-to-face class, they may be more likely to join in the class discussions and express their comments and ask questions.

Advantages of Synchronous Learning

- Live communication. Although it is not face-to-face, with synchronous communication, at least the students are able to have live communications with the instructor and other students. A web camera can be added to provide face-to-face if it is deemed necessary, but most students do not care about looking at the instructor's face throughout class.

- No delay in communication. Students can get an immediate response; instant feedback fosters communication and spontaneity.   In asynchronous communication, there is a delay while students wait for a response from the instructor or other students through email or discussion forums. With synchronous communication, participants can talk back and forth and hold real time discussions.

- Feeling of community. One of the biggest advantages of synchronous communication is it helps create a feeling of community and classroom cohesion. Students get to know the instructor and other students through verbal interactions.

Disadvantages of Asynchronous On-line Learning

- Lack of human contact. Some students need or want the face-to-face contact with instructors and other students. Some students say that they learn better when they can see a person's face and converse in real time with a peer or instructor.

- Requires self-discipline. The primary drawback of asynchronous on-line learning is that students must be self-disciplined. Students must take the initiative to login to participate in on-line discussion groups and to complete other course assignments. Some students have a tendency to procrastinate until the last minute to do their assignments. If assignments are not spread throughout the semester with hard deadlines, these students will not be successful in this type of class.

- Lack of real time responses. No immediate response, especially where time is significant such as when a student needs clarification before completing an assignment; the student may not know if the other person has received their message; the message loses human contact.

- Impersonal. Without the human contact, the course may feel impersonal to those who prefer face-to-face courses or even the somewhat higher-touch synchronous technologies.

Disadvantages of Synchronous On-line Learning

- Less substantive responses. Students have less time to think about what they want to say or their response to the instructor or another student.

- Coordinating schedules. Time may be a limiting factor, in that students may be taking the course in different time zones.

- Technical problems. Synchronous communication over the computer may be difficult because of the speed of data transaction with slower connections or other technical problems.

 - More equipment. Some extra equipment is required (speakers, microphone, web camera, etc.).

Both asynchronous and synchronous learning have some common advantages. These include flexibility and convenience, 24/7 access to course materials, location independent, and interactive learning. In considering the advantages and disadvantages of both asynchronous and synchronous on-line learning, the decision was made to go with a blended format that combines the advantages of both synchronous and asynchronous learning.   Both asynchronous and

synchronous communication and activities are important in an on-line class. Using both types of communication aids in building a learning community. Additionally, students with different preferences and learning styles will find a variety of individual and team activities and assignments. In this way, each student should have at least one type of activity that matches his or her preferred learning style or method of communication.

Pacing the Courses

Traditional face-to-face college course formats establish the day-to-day pace of the course. Their structured format provides a step-by-step method to complete the course. Some on-line or study at home courses rely on the student to establish the pace. With some on-line or study at home courses, problems arise when students take advantage of the self-paced nature of the course and put off the work until the last minute, or forget to do the work at all. In some courses, students are given assignments that are self-paced and in some cases, all course assignments may be due at the end of the term. There may be little interaction between the instructor and students or between students in this type of course structure. This type of course delivery requires students to be very disciplined to get the course work done without prompting or pacing by the instructor. Course completion is an issue for students who are not good time managers and are unprepared to take self-paced courses. An extreme example of the latter was one such student who stated that he had forgotten that he had registered for a study at home course until he got his grade report at the end of the summer with an "F" for the course.

In order to have more interaction between the instructor and the students, some institutions use a hybrid model that combines some face-to-face classes within on-line instruction. This model typically requires students to attend a certain number of face-to-face classes at the beginning of the term with the rest of the course delivered using on-line classes with little or no additional face-to-face contact. Other models require students to check in once a week or submit assignments on a regular basis.

Our courses were structured using a blended model, which combines synchronous and asynchronous on-line instruction. This learner-centered model allows real-time instructor-student interaction as well as interaction between students. In designing our on-line courses, one of the objectives was to allow students to take the courses from any location and yet not require them to attend any face-to-face classes. The second objective was to have the course-work paced throughout the summer term. Because many students participate in cooperative education or take summer jobs at various locations, attending face-to-face classes is not convenient or in some cases, not feasible. The students who enrolled in our on-line courses were physically located in various cities. In addition to some students who were located in the local area of the University, other students were located out of the area, and one student was sent to China for the last two weeks of the course.

In order to keep students focused on the course requirements, our courses were designed to be in continual communications with the students. A number of methods were used to communicate with students in this course. Communications technology used for the course included synchronous on-line classes and virtual office hours using VoIP, and asynchronous threaded discussions, e-mails, and chat. A class schedule was posted on the course web site each week. The schedule included the dates and times for the assignments for that week:

- Study the recorded class before the synchronous class
- Attending the mandatory on-line synchronous classes
- Optional on-line office hours
- Homework assignments
- On-line quizzes and exams
- Threaded discussion assignments.

Asynchronous Recorded Classes

Instead of face-to-face lecture classes, students were required to study a recorded web cast. Each week a lecture was recorded and posted on WebEX. Students were required to read the assigned text material, study the recorded lecture, and attempt the homework prior to attending the on-line synchronous classes. Students could review the recorded lectures as many times as desired and pause, speed up or slow down the material as desired. Course materials, such as the syllabus, schedule, PowerPoint notes, handouts, etc., were stored on WebCT. Students downloaded the PowerPoint notes and handouts prior to class. The recorded classes were taught using PowerPoint slides that were loaded on the WebEX software, and the instructor solved sample problems on the WebEX interactive whiteboard using a Tablet PC. By requiring students to study the recorded lectures and attempt the homework before the live sessions, it helps to ensure that the students are more prepared to participate in the live classes. This allowed the synchronous classes to be used mainly for answering students' questions about the lecture material and the homework.

Homework Assignments

Weekly homework was always due on the same day and time – midnight on Thursday each week. This provided an element of consistency and was one of the pacing features of the course. The on-line office hours were always on Wednesday night, which allowed the students to ask questions about homework before it was due. Students submitted their homework by drop box, email or Fax.

Quizzes and Exams

All quizzes and exams were administered on-line using WebCT. One quiz was scheduled each week and students could take the quiz twice within a certain period of time; the highest score counted for a grade. There were two exams, a mid-term and a final; both were administered on-line. The exams could only be taken once and were required to be taken during a specified small time period. The difference between the quizzes and the exams is that by allowing students to take the quizzes twice, the quizzes were used as a learning tool. The instructor assumed that students would use their textbook and class notes during quizzes and exams. Problems were designed so that if a student was not already familiar with the material, it would be difficult to read the text and work the problems correctly within the short time frame. Use of randomized multiple versions of questions limited the ability of students to work together on the quizzes and exams. Four or five versions of multiple-choice or calculated questions were selected at random

by the computer for each student. The WebCT software allows equations to be embedded that generate multiple versions of problems requiring calculated answers.

Threaded Discussion Assignments

Students were encouraged to use the discussion board to communicate with the instructor and other students about the course. Each week, students had to respond to one or two discussion items, which were posted by the instructor. The first discussion required students to post an introduction of themselves. Other discussion items generally required students to discuss something that they did not understand about the reading or homework. Students who answered questions from their peers were given extra credit. Using written communications allows students to compose well thought-out questions. This allows a higher quality of instructor response that can go to the heart of what the students are not learning.

On-line Synchronous Classes

Live on-line classes were conducted one hour per week. This time was in effect used as virtual office hours. Students were able to ask questions and answer questions posed by the instructor and other students. The software synchronizes the audio and video transmissions so that during the live classes students could see as well as hear the instructor's and other students' explanations simultaneously. On-line polls were used to obtain real-time feedback on the students' understanding of the course material. The software allowed the students to use the whiteboard to show the instructor how they attempted the problems. The instructor could then see where the students were incorrect in their attempt to solve the problems. Also, other students could see the attempted problem solution on the whiteboard and hear the discussions as well as ask questions or offer help in solving the problems.

Technology Support for the Course

Teaching this type of class requires significant technical support. WebEX, web conferencing software was used for this course. The software allows live streaming video and interactive streaming audio Webcasts using Voice over Internet Protocol (VoIP). The instructor controls what the participants are allowed to do. The participants cannot speak until given permission by the instructor. Normally, the participants click a button that indicates they are holding up their hand, like in a face-to-face class, asking permission to speak. The software has the ability to conduct tests, and instant surveys. Course materials such as PowerPoint slides were loaded on the server and shown during the class. Two other significant features of the software that supported the interactivity of the course are the whiteboard and application sharing.

In the summer of 2006, Engineering Technology received a $69,000 Technology for Teaching grant from Hewlett-Packard that included 21 tablet personal computers and other equipment and $15,000 for course development. The grant was used to redesign the Engineering Economy distance learning course for use with tablet computers. In the summer of 2007, the redesigned engineering economy course was delivered using the tablet PCs along with DyKnow interactive software. Students in the course signed out one of the tablet computers for the duration of the summer term. WebEX was used for VoIP. The tablets along with DyKnow fostered student

interaction through collaborative note taking and student response tools. The instructor's PowerPoint slides, handwriting, text, and other electronic content were instantly transmitted to each student's tablet freeing up students from the some of the burden of note taking and allowing them to concentrate on the understanding the material. Using the electronic pen, students annotated the slides with their own notes in addition to the instructor's notes.   During the on-line class session, students were able to send their solutions to problems or answers to questions to the instructor and the instructor was able to retrieve, display, and replay student work to spark class discussion. After class, students could access their class sessions from any Internet connection and replay lessons to reinforce concepts.

Course Comparisons

Student evaluations are not completed during the summer terms, so student performance was measured as a function of the grades earned during the summer on-line course and compared with the same course taught in the traditional face-to-face mode during the Fall semester. The average grade for each term was computed using the quality points awarded for the letter grades; A= 4.0 points, A- = 3.6667 points, etc.

Summer On-Line Course			Traditional Face-to-Face Course		
Semester	**Number of Students**	**Average Grade**	**Semester**	**Number of Students**	**Average Grade**
Summer 2004	10	3.37	Fall 2004	26	2.95
Summer 2005	12	2.81	Fall 2005	14	2.67
Summer 2006	8	3.17	Fall 2006	23	2.49
Summer 2007	7	2.78	Fall 2007	37	2.99
Average	9.25	3.03	Average	25	2.78
Standard Deviation		$\pm$ 0.25	Standard Deviation		$\pm$ 0.24

Figure 1. Grade Comparison for Engineering Economy Courses

The difference in student performance between the two courses was found to not be statistically significant (p = 0.270). Several studies resulted in similar conclusions. Silcox[7] found no differences in students completing a fully on-line course and a conventional section of the same course. Trippe[5] found the same results.

Conclusions

In order to help ensure student success, it is important for on-line courses to pace the assignments and class activities similar to traditional courses. Most students are used to reacting to deadlines that are spread throughout the course. Many students who are not good time managers do not function well in an unstructured environment.

Recorded asynchronous lectures added an element of the traditional classroom to the on-line courses. Students could "attend" the recorded classes and study the lecture material and then be ready to ask good questions in the live synchronous classes.

Both synchronous and asynchronous courses have their advantages and disadvantages. Blended on-line courses that integrate both synchronous and asynchronous communications can allow rapid interchange of ideas, generate enthusiastic discussion involving all participants, achieve a reasonable level of professional engagement, and recreate certain elements of face-to-face discussion. All of this can take place where attendance and participation are encouraged by fixing a set time for the live meeting and limiting the time frame of the discussion.

The HP project has been able to successfully demonstrate the use of the tablet PC coupled with DyKnow interactive software for distance learning classes. Students indicated that the Tablet PCs improved their learning environment and made them more attentive in class. The effect on teaching was positive in that instructors have to rethink how they are going to present the material. The current distance learning programs in the Department of Engineering Technology that are taught during the Fall and Winter semesters rely on videoconferencing technology to deliver content synchronously to a resident class and a population of students at another location. A side benefit of this project was to successfully demonstrate that a lower bandwidth product, coupled with the tablet PC will provide a viable alternative to the more costly videoconferencing solution. The future of distance learning in the department will rely on this platform, and allow a much larger population of students to be served. This project has also generated additional faculty and student interest in using the Tablet PC for both teaching and learning in a traditional classroom. It has served as the impetus for changing the requirement for student notebook computers in the School of Engineering to requiring all incoming students to purchase Tablet PCs.

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