2006-1431: INTEGRATING TEACHING AND TECHNOLOGY USING COELIVE

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Abstract

Profound advances in communication networks and computer technology have redefined the concept of distance learning and its delivery methods. Even though the trend of integrating teaching with various innovative instructional technologies is here, completely online engineering or engineering technology education is not yet widespread throughout engineering colleges and universities. This is partly due to the quality issues in voice/video in online courses, insufficient support for university faculty to offer such courses, and challenges faced in offering laboratory classes.

"_____University (___)" has various initiatives for innovative instructional technology, whether for a completely on-line or for part of a traditional classroom education. The Division of Engineering Technology (DET) faculty at the College of Engineering (CoE) at (___) has been a part of these initiatives. The CoE at (___) has a real-time, instructor-led suite of online tools to help design, create, and broadcast synchronous and asynchronous online courses. This College of Engineering Live (CoELive) consists of the **CoELive virtual campus** and the **ERMS** (Educational Resource Management System). CoELive is a collection of high-end servers connected to very large fiber network running sophisticated online courseware development and distribution software. At the heart of the CoELive system is the Web-4-M engine offered by JDH Technologies. Web 4-M's comprehensive learning environment mimics the classroom setting by integrating both synchronous and asynchronous online tools to maximize learning.

This paper is largely confined to tackling the three challenges mentioned above via the implementation of CoELive tools. The laboratory-based Advanced Digital Design course is the first to implement the use of the CoELive tools in the Division of Engineering Technology at (___). This paper presents the implementation of this tool. The challenges of implementing an on-line laboratory using the tool will also be presented.

Introduction

The traditional delivery method for higher education has been a classroom setting with an instructor giving a lecture and students listening and writing notes. Interaction between the instructor and students has been viewed as an essential learning element within this arrangement. However, recent progress and rapid deployment in networking and information technology is allowing educators with a wide variety of choices in delivery methods. The distance learning platform today is becoming very different from even a few years ago. The synchronous distance learning infrastructure, for example, is

becoming more and more widespread due to the pervasive penetration of the Internet. With the increased availability of virtual learning environments such as Blackboard and WebCT, instructors are able to support traditional course lectures with a blend of synchronous and asynchronous activities[1,2].

Wayne State University (WSU), like many institutions of higher education, has adopted distance and on-line education as the next logical step in educational delivery systems. While some courses have been developed that are heavily dependent on information technology and the Internet, many courses have taken a more conservative approach and chose to augment conventional classroom instruction rather than replace it. Although technology plays a key role in the delivery of lectures, many educators are still trying to keep the face-to-face relationship between an instructor and students while using a wide variety of virtual learning environments in order to help increase student learning. A wide variety of technological options are now available such as instructional audio and video tools along with a broad range of instructional data[3,4].

(___)'s College of Engineering (CoE) has embarked on new delivery methods a few years ago. Distance learning facilities at (___)'s CoE utilized a custom-built system by a private company. The system operated via ISDN technology through a provider and was capable of data transfers of up to 12 channels (56K per channel) for audio and video - resulting in a fairly sharp and fast signal of 672K. Other combinations (2 channel, 6 channel, etc.) were also possible as well as simple teleconference calls (This is especially useful if the other site is limited to 2, 4 or 6 channels and different data rates). The instructor was able to operate and choose between cameras and other signals via the touch screen interface. The setup provided 6 signals that could be sent to remote sites: one instructor camera, one student camera, one document/transparency camera, PC/laptop, S-VHS/VHS video and audio CD. Further, it was possible to remotely operate these signals from another site (and vice versa) if the other system was identical. With this setup, classes were offered at (___) and simultaneously delivered to another locations. The instructor was able to see and interact with both sets of students. Even though this system worked well, it had many shortcomings. The main setback was the monthly connection costs to the college. The second one was the system's unflexibility: the students still needed to go to another location in order to see and listen to the lectures.

The CoE was looking for cost effective ways to deliver the distance learning lectures while making these available to every student without any additional costs. This led to the implementation of College of Engineering Live (CoElive) tools, which are real-time, instructor-led suites of online tools to help design, create, and broadcast synchronous and asynchronous online courses. This paper describes the implementation of this tool in a laboratory-based, digital design class.

The College of Engineering Live (CoELive) Tool

The level of interaction in blended education is affected by the choice of synchronous and asynchronous delivery methods. If the medium is synchronous, then the interaction takes place in real time, such as in a traditional teaching environment or live audio/video

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transmissions between the instructor and the students. Depending upon the technology involved, there may be point-to-point and point-to-multipoint connections. In many respects, the classroom structure is similar to a conventional classroom, where students both on-site and at a remote site are expected to listen, take notes, and answer questions if asked. There are several advantages of synchronous delivery systems, including rapid feedback and student motivation.

However, in the case of <u>asynchronous</u> communication, students access any remote source for information, such as the media as web pages, videotapes, or CD-ROMs, on demand. Asynchronous distance education requires an entirely different view of instruction, since it is not time or location dependent as in a traditional classroom setting. For asynchronous delivery, the main advantage is its flexibility.

As part of (___)'s initiatives for innovative instructional technology, it is left up to each instructor to choose the appropriate tool or a blend of these, since blended learning combines the engaging benefits of traditional, instructor-let training with the advantages brought about by a variety of technologies to create an optimum program. In other words, <u>blended learning</u> provides the combination of different training media technologies, activities, and types of events to create an optimum learning environment[5,6]. It uses many different forms of e-learning, perhaps complemented with instructor-led or other live instructions. For this reason, CoELive was created. The CoE at (___) has a real-time, instructor-led suite of online tools to help design, create, and broadcast synchronous and asynchronous online courses. This CoELive consists of the **CoELive virtual campus** and **ERMS** (Educational Resource Management System).

ERMS is an online resource management application that contains large amounts of multimedia-rich classroom resources. It is written by an in-house WSU group in order to store <u>asynchronous</u> files of varying formats in an easy to find database system for students and faculty. Blackboard only allows students that were registered for a class to access certain files, and there was a need for more flexible and open system for students to access certain files. For example if a professor prepares a Matlab laboratory guide for a specific class and wants to share his/her guide with other students, he then can place it on the ERMS system where any student can access without the need of a password. ERMS is intended to be a repository of asynchronous digital material to be integrated into classroom teaching.

CoELive virtual campus on the other hand, is a collection of high-end servers connected to very large fiber network running sophisticated online courseware development and distribution software. At the heart of the CoELive system is the Web-4-M engine offered by JDH Technologies[8,9,10]. Web 4-M's comprehensive learning environment mimics the classroom setting by integrating both <u>synchronous</u> and <u>asynchronous</u> online tools to maximize learning while eliminating software distribution (Figure 1). It offers 3 types of tools:

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- **Peer-to-peer interaction** – This allows student-to-student or student-to-professor instant messaging, remote desktop application sharing and full duplex phone connection with video stream between collaborators.
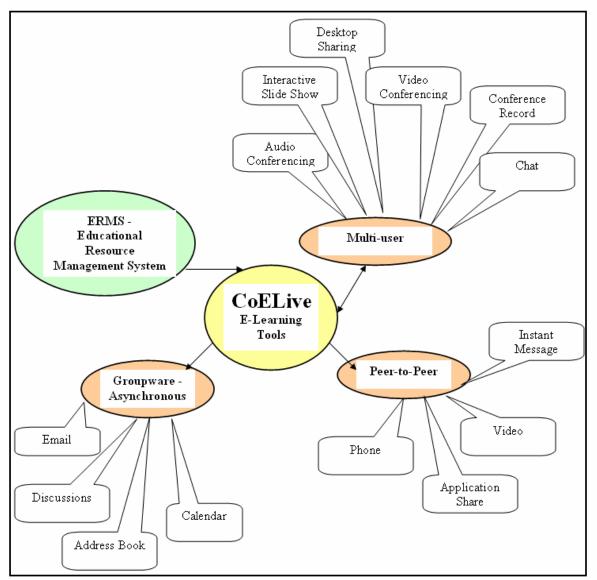

Figure1. WSU CoELive Tools

- **Multi-user interaction -** This allows collaborators to audio conference, chat, share graphics via a white board and view slides through an interactive slide show presentation. Another great option is that when an instructor gives a live lecture, this lecture can be recorded in the background and then made available for the students to re-listen as many times as they want or if any students miss a lecture, then they can playback the lecture along with the questions asked and answered. The only thing they cannot do is to ask questions.

- **Groupware interaction –** This allows collaborators to find contact information, schedule meetings, and maintain calendars.

CoELive Implementation

The Division of Engineering Technology (DET) faculty in the College of Engineering (CoE) at (___) has been a part of this new educational delivery system. The Advanced Digital Design class with a laboratory section was the first one to implement it. We have tried varies ways in this implementation. As seen in Figure 2, we first uploaded all our slides onto the CoELive tool using "Slide Show Builder". Then we added the audio. This is not different from having your slides be available through Blackboard. However, this tool allows us to change the order of the slides, add or eliminate them, and better yet, to add an audioportion to only the ones we need. Now the students can access the lectures through the internet from wherever they are (Figure 3).

However, the best capability of this tool is the ability for students to logon and listen to the "live" lecture, free of charge, from wherever they are as long as they have a broadband connection. They are able to ask questions and if they have a camera, then the professor can see who is asking the question. In the meantime, this session can be recorded in the background while the "live" lecture is occurring. Students then are able to replay the lecture, listen to the questions and answers, and watch it as a matter of convenience. While replaying, the only thing they cannot do in this case is to ask questions. In this advanced digital design course, we use Altera's programmable logic devices (FPGAs and CPLDs) [11]. We have other courses which use the same set of tools. We have prepared our own audio/video tutorials (MAX+PLUS II and Quartus) for these tools and made these available on the ERMS system. This way, a student who is not in this class is able to access this tutorial without having to sign on.

This course has a laboratory section. Altera Corporation provides students its instructional edition of tools free of charge. While we have a laboratory full of Altera's simulation tools, many students (whether in-class or online) choose to download these tools from Altera's site and use it. We also have a tutorial placed on the ERMS system for them to use. For hardware laboratories, students can borrow the UP1, UP2 or UP3 boards from the instructor and implement their designs. Obviously, this would not be possible without free tools.

There are some challenges in implementing this system. The main one assumes that the professor already has a set of PowerPoint slides. This, itself, is quite time consuming. The next challenge is to be able to use these tools. Even though these tools come with their User's Manuals, we prepared our own simplified user manual for students to follow. This type of implementation would not be possible without time commitment and extra support such as course release for the instructor and the technical help to get started with this setup[8].
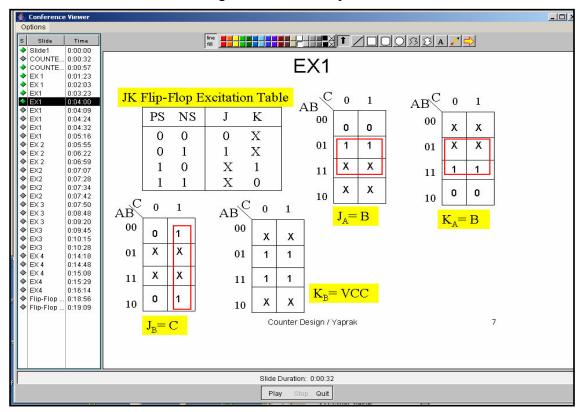
Fig.2. Slideshow Preparation

Figure3. Re-playing of lecture using "Conference Viewer"

Conclusion

The Internet is a useful tool that can enhance interactivity in classes whether it is synchronous, asynchronous or a blend of these two. In this paper, we explain the implementation of CoELive tools.

The feedback from students shows that they are quite happy with this new virtual learning environment. This system does not force them to use any specific platform, for example, if a student is more comfortable with a face-to-face lecture, then the student comes to the lecture, but still is able to use the tools available in order to replay the lecture. Others may want to join the live lecture from a distance, participate in it, and still able to replay the lecture at another time. Others, may not be able to participate in the live lecture, but will still have a choice of replaying the lecture during their leisure time. We are making good progress in instructional interactivity and user choice through CoElive tools in the CoE at (___).

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