AC 2011-80: THIS PAPER DISCUSSES THE USE OF WEBEX AND ADOBE CONNECTPRO TO TEACH EET COURSES IN VARIOUS SCENARIOS, AND THE CHALLENGES AND OPPORTUNITIES THAT THESE TECHNOLOGIES PRESENT IN COURSE DELIVERY.

Judith R Pearse, University of Maine

Judith "Jude" Pearse is a registered professional engineer in the state of Maine and an Associate Professor of Electrical Engineering Technology (EET) at the University of Maine. Judith has been a member of the UMaine community for several years, having received her Bachelor of Science in Electrical Engineering in 1986 and her Master of Science in EE in 1996. Additionally, Judith served as a Teaching Associate in the Electrical and Computer Engineering Department from 1990 to 1995, where she taught introductory courses and co-directed the NSF-sponsored Young Scholars Program. Her most recent service to the University began in 2001, when she began teaching in the EET Program. Her technical courses include Digital Systems, Programmable Logic Controllers, and DC/AC Circuit Analysis, but her strength lies in teaching the more humanistic side of engineering in Introduction to EET and Project Management. Her student evaluations earned her the University of Maine's Presidential Outstanding Teacher of the Year Award in 2010 and the College of Engineering's Early Career Teaching Award in 1995. Prior to 2001, Judith held several engineering and project management positions throughout Maine, including: Project Engineer at Bath Iron Works; Project Management Consultant at Bowdoin College; and Vice President of Client and Technical Services at Animated Images in Camden. Judith has also performed computer networking, training, and project management as services offered by her company, Robash Unlimited, established in 1989. Judith lives in Hope, Maine, with her husband, Tim, and 9-year-old son, Joshua.

Challenges and Opportunities of Distance Learning Using Adobe ConnectPro and Webex

Abstract

When faced with the challenges of a long commute combined with treatment for a serious illness, this author turned to the use of internet-based technology to present course material. As an advocate for a highly interactive classroom, doubts surfaced as to the potential success of teaching "outside the classroom," with little or no face-to-face time with students. Beyond the standard means of one-way communication (e.g., email, FirstClass, BlackBoard), what was desired was a truer classroom feel – with two-way, real-time interaction between the instructor and students. What resulted was an experimental course delivery mechanism using Cisco's WebEx. For an entire semester, two courses were delivered from the author's home office to a large room equipped with two inexpensive webcams. Student assessments are provided to show the relative success of these courses, despite the early challenges of the technology. Of particular note were the assessments from foreign students who commented favorably about session recordings; because they were able to rewind and play each class back, they found note-taking and material comprehension greatly enhanced.

Additionally, when a course in Alternative Energy was proposed, a large response was immediately generated from Professional Engineers throughout the State of Maine who needed to complete Professional Development Hours (PDHs) toward license renewal. By recognizing how a need for public outreach might be met by such a course, a similar internet-based course delivery system, Adobe ConnectPro, was utilized to teach both in-class students and others across the country. This paper focuses on the use of these two media to create an enhanced environment for off-campus online participants. It also focuses on the challenges faced while teaching in such an environment and the potential opportunities it presents.

Background

As an instructor in the Electrical Engineering Technology (EET) Program at the University of Maine, many hours were spent explaining to students how various new technologies would impact and perhaps change their lives. Until diagnosed with a life-threatening disease, this author didn't realize just how true those words would become. The School of Engineering Technology (SET) Faculty had, for years, discussed the possibility of utilizing technology for electronic offerings of its courses. The idea was to enable its constituents to receive course material even if those students couldn't participate in "live" classroom discussions. Until 2008, standard technologies of the day were being used, such as interactive television (ITV) and recorded lectures. As a very hands-on program, the school of engineering technology did not seem a likely place for anything less than highly interactive classrooms and labs; many of the faculty, although open to trying new technologies, were of this mindset. To an enthusiastic professor known to be

"in the face" of students while trying to encourage and motivate, the thought of teaching with limited interaction with students was unappealing.

In July of 2007, the author was diagnosed with a rare form of cancer. After taking the fall semester off to undergo treatment, it was decided that the spring semester could be undertaken with minimal effort. Reality, however, set in quite early in the semester when surgery and radiation treatments were scheduled several miles from the author's home, which was already over seventy miles (in the opposite direction) from the University of Maine. The logistics of trying to receive radiation, commute over 100 miles, and then teach even one class was daunting. At that time, a colleague brought back to life the idea of teaching using distance-education technology.

Introduction of New Technology – Phase I: Webex

Cisco Systems' Webex[1] was chosen for the first technology solution as this system had been experienced by the instructor in a previous job. In that environment, Webex had been used to link several worldwide offices of a software development company so that implementation specialists could better convey customer requirements to the software development team. Additionally, Webex had been briefly demonstrated at the university during a previous project management course to present to students some of the technologies used to overcome distance barriers in worldwide organizations. As both a project management (EET 386) and an introduction to programmable logic controllers (PLCs, EET 276) course were already scheduled to be taught during the spring semester, these courses were identified for the pilot program. Although only one course was originally going to be used as the test bed, it was decided to use the technology for both a laboratory and classroom-only course. In this way, two distinct course delivery methods would be compared to the new methodology. It should be noted that the Webex system was implemented two days after the semester had begun, in response to an emergency situation that prevented the instructor from regularly teaching on campus. This prevented a thorough evaluation of existing technologies prior to implementation of a system.

The resulting technology configuration consisted of the instructor's presentation base and minimal setup in the on-campus auditorium. The presentation base, located at the instructor's home, included a personal-use webcam, a tablet laptop, and a DSL internet connection. At the students' end, a desktop PC broadcast to a built-in projection unit in the auditorium, where it was displayed on a very large screen. Additionally, two low-cost webcams were installed at the front of the auditorium so the instructor could see all the students. Although this was not necessary, it enabled the use of visual cues from the participants, such as body language, to determine how students were faring with the material being presented. Students could see the instructor, as the home webcam image was displayed in the upper left corner of the screen. As the instructor wrote notes on the tablet, students could see them in real time as the instructor explained information simultaneously, as is done in the "live" classroom. Students could ask questions by either walking to the front of the classroom to speak into the computer's built-in microphone, or could ask questions via a proctor who sat at the front of the classroom and relayed questions to the professor.

Because the EET 276 (programmable controllers) class also had a laboratory-based component, Webex lectures were coordinated with weekly lab experiments. Depending on the timing and health status of the instructor, these were conducted either live or by a lab assistant, with the professor interacting on individual student's computers for questions or additional help. During the project management course, students were often asked to join smaller chat groups for various discussion topics. Examinations were also conducted either live or via proctor, with the instructor logging into the system to verbally answer questions.

Overcoming the Inherent Challenges Associated with Implementation

There were numerous challenges to overcome while implementing this technology. These included: logistical problems, fear of loss of interaction with students, and concerns regarding material retention. Logistical issues arose due to the short timeframe under which the system had to be configured. As the semester had already begun, finding a room large enough to accommodate the twenty-four students enrolled in the class – with the technology needed for student participation– turned out to be quite difficult. Rooms with overhead projection units were already in use, and all the campus' "technology rooms", those with video and audio-conferencing capability, were also booked for other classes. What finally resulted was a large auditorium-style conference room with excellent acoustic attributes, which was normally reserved for special conferences and meetings. Fortunately, the Dean of the College of Engineering understood the special circumstances, and saw a potential opportunity for course delivery alternatives and additional revenue generation.

The human fears of little student interaction and material retention were much easier to overcome once the system was utilized for approximately two weeks and the technology anomalies were eliminated. At first, students were less inclined to ask questions because of the effort involved in walking to the front of the room or because of the delay created by having to ask questions through the proctor. Also, due to the low-end nature of the webcams employed, the instructor was not always able to see a student's raised hand as quickly as in a live classroom environment. These issues, which could have easily been resolved with more time and resources, such as higher-end, movement-tracking webcams as well as room microphone systems, proved minimal once both students and the instructor began working with the technology more and found the classroom rhythm.

Initial Evaluation – Webex Implementation

When the semester ended and it was time to evaluate the course, it was determined that the university's standard evaluation forms were not adequate to evaluate the effectiveness of the new technology. In addition to the standard form, a second evaluation form was created that more directly assessed the new technology environment. The questions posed on this evaluation addendum are shown below:

1. Under the circumstances, how well did the technology serve your needs as a student?

Possible answers included:

1 = Extremely Well   2 = Worked Well   3 = Satisfactory   4 = Unsatisfactory   5=Not at all

    2.   Under normal circumstances, is this a suitable technology to use for course delivery?

Possible answers included:

1 = Very suitable 2 = Well-suited   3 = Satisfactory   4 = Marginally good   5=Not good at all

    3.   Would you consider taking a course in the future that utilizes this technology?

Possible answers included:

1 = Definitely 2 = Possibly   3 = Unsure   4 = Probably not   5 = Definitely not

    4.   Do you feel the technology allowed you to achieve the learning outcomes for this course?

Possible answers included:

1 = Definitely 2 = Possibly   3 = Unsure   4 = Probably not   5 = Definitely not

Of 60 students (24 in PLCs and 36 in Project Management), 53 responded as shown in Table 1. Additionally, several students chose to write comments regarding the use of the Webex system in the classroom, and these comments are also provided.

Response:	1	2	3	4	5
Question 1	48	2	3	0	0
Question 2	8	40	2	3	0
Question 3	3	39	10	1	0
Question 4	35	12	5	2	0

Table 1. Student Responses

Student Comments

"English is not my first language. Sometime, in engineering classes, I have hard time following what the teacher does say in class. When the sessions are recorded, I can listen to it over again so I understand better the material."

"I'd rather have the instructor in person, but, given the circumstances, this worked really well – a lot better than I expected! The class still managed to be fun and challenging, even without the professor being in the same room!"

"I missed a few classes due to illness, and being able to see all the material in the recordings got me back on track. It took some time to get through it all, but I feel like I would've missed a lot of information without this."

"Having the instructor available the night before an exam was awesome. I usually don't start studying for an exam until the night before, and I wouldn't feel right calling her at home at night. This worked out well for all of us."

"In the past, whenever I missed a class, it was hard for me to get the materials. If I got them from another student, they'd usually be missing lots of stuff. Even if I went to the professor, there always seemed to be some nuance or piece of material that he or she had told the class, but forgot to tell me. With all the sessions being recorded, I got all the information that the rest of the class got."

"I used the recordings to go back over my notes and fill in where I may have missed some information – that was really helpful."

Results of Initial Webex Implementation

As may be seen by the student comments, many students felt that, although they preferred the live classroom interaction, the Webex sessions were adequate and, in some cases, highly beneficial. Summarizing the positive points of the system (from the students' perspective):

- Because tablet writing space was limited, more time was spent letting students "catch up" with instructor.
- Recorded sessions made continuous review of the material possible. Students with language challenges cited this as being particularly helpful.
- In-class note-taking was augmented with the information in recorded sessions; having the notes with overlying audio helped students understand their own notes better.
- Recorded review sessions for each preliminary exam were helpful when it came time to study for the final examination.
- If a student missed a class, he or she could still get the information from that period. This was much better than just getting information from another student.

From an instructor perspective, the benefits and advantages of using the system during the trial period included:

- The ability to teach scheduled courses without having the long commute everyday;
- The chance to maintain as much face-to-face interaction with the students as possible, given the circumstances;
- Being able to review material to make sure that all aspects were covered thoroughly and ensure that no pertinent information was omitted;
- The opportunity to experiment with new technology in a real classroom environment.

Comments regarding laboratory sessions were not as positive as hoped, but students, overall, felt that they even benefited in lab from using the Webex technology. Webex lent itself well to simulation-based labs, as the instructor was able to directly monitor student progress and offer real-time assistance. In courses utilizing equipment not attached to a computer, though, helping students via Webex was more challenging and a bit frustrating.

Preliminary Conclusions

Once the semester was finished and the evaluation process complete, Webex was deemed a satisfactory solution for instructional delivery when circumstances prevented in-class presentation. One aspect of particular note was Webex-enabled subgroup interactions. As Allwright[2] suggested, it was vitally important to "get (students) talking" – this inherent interaction is vital to student's thorough understanding of course materials. Webex's "breakout rooms" facilitated student-led discussions and closer interaction between students; this enriched overall student learning and classroom experience.

Technology Change: Adobe ConnectPro

Because of the relative success of Webex, the university decided to test a similar system, Adobe ConnectPro[3], for future "interactive online" course offerings. The University of Maine already had a strong and substantial software relationship with Adobe Systems and was evaluating the product using limited trial licenses. It was also deemed substantially less expensive to roll out Adobe ConnectPro on a large-scale basis than it was to implement Webex at the same level. For these reasons, the Continuing Education Department (CED) – who controlled all such alternative technology decisions – asked instructors with a need for this type of delivery tool to pilot the Adobe product. At that time, several opportunities arose (described below) that would utilize this type of technology effectively, so the Adobe ConnectPro pilot began.

Opportunities Presented Using Interactive Online Technology

Of the opportunities that arose at the conclusion of the Webex trials, some were a direct result of students' experience with Webex, while others were entirely new courses envisioned for community outreach and revenue generation.

Students who had participated in the trial Webex sessions requested that future course sessions be recorded because of the benefits they had experienced (see **Student Comments**, above). In addition to everyday course material, students requested that prelim review sessions also be recorded. This was primarily due to the complexity of aligning students' schedules for a prelim review time that occurred during regular school hours. By offering them via Webex, these sessions could be offered from the off-campus instructor base later at night, when most students were studying for exams. Recording the sessions allowed students with full time evening jobs the benefits of the instructor-led reviews.

At the same time, a number of students, both on and off-campus, requested independent study courses. These students were unable to attend regularly scheduled classes for a number of reasons. Those reasons included: leaving the university prior to graduating for a good job opportunity; failing a required course that served as a prerequisite for another course; course offerings conflicting with a much-needed technical elective being offered at the same time, etc. Independent study courses, in the past, took considerable time and energy to conduct. By recording class sessions, students learned and reviewed the material on their own time.

Another opportunity came in the form of a new one credit seminar course on alternative energy. This course was proposed for engineering students who wanted to learn more about different types of alternative energy projects. When a faculty member asked if he could take the course as part of his professional development, it was decided to open the course to professional engineers, many of whom were coming up for license renewal at the end of the year. Once that decision was finalized, it was obvious that a distance education methodology was the only option for course delivery. The Alternative Energy Seminar Series was formed, and Adobe ConnectPro was chosen as the delivery medium. Speakers delivered alternative energy project presentations from a room at the university equipped with various video- and audio-recording systems. This was done in anticipation of potential problems with Adobe ConnectPro so that sessions would still be recorded for later distribution. The room also had a wireless microphone system for the speaker and a higher-end camera, which alleviated the webcam bandwidth issues previously encountered. Although some students did pose questions via personal webcams, most questions were entered via Adobe's chat pod, where students typed questions. Speakers reiterated questions so both live and off-campus participants could hear them, and otherwise presented using Microsoft Powerpoint slides, videos, and other presentation media loaded onto their computers (via ConnectPro's desktop sharing component).This course generated abundant enthusiasm, and has served as a launching point for other similar courses (see **Results**, below).

This past fall, in addition to another offering of the Alternative Energy Seminar, Adobe ConnectPro was used to teach a new Fundamentals of Engineering (FE) Review Course. This course was taught previously for a number of years by faculty who volunteered their time in weekly two-hour time blocks. Unfortunately, many engineering and technology students could not participate in past sessions because of other course conflicts. A convenient time slot was found that accommodated the majority of students wishing to take the course as well as faculty available to teach it, and Adobe ConnectPro was utilized for course delivery. As an incentive, the dean's office offered to pay a small stipend for any faculty who taught a session. Over the semester, 28 different sessions were provided to students in the classroom as a free service (unless students took the course for university credit) and recorded for use by students who could not attend the in-class sessions.

Results from Additional Opportunities

The immediate results obtained from each of the opportunities discussed above were positive and rather exciting. Students who requested session recording commented similarly to those who had participated in the Webex trials. They noted the added benefits of repeatedly reviewing recorded materials, and also noted the helpfulness of after-hours live and recorded help sessions.

For independent study students, help sessions were held at the convenience of both instructor and student because the traditional time constraints no longer applied. Only during exams were limitations felt: Examinations either had to be open book, open note format, online (which created limits in test question content for design and mathematical problems), or proctored by an independent third party. Students in these independent situations did not fare as well as their traditional counterparts (only two of the five students completed their respective courses with a grade of C or better), but there was no direct correlation between each student's success in the course and the technology used. The majority of students in these situations struggled to

complete coursework in traditional classroom environments; the additional struggle of completing coursework while working full time added to that challenge. Those students who were successful in the traditional classroom environment were as successful using the distance technology.

The Alternative Energy Seminar Series was an overwhelming success. Enthusiasm for the project was greater than expected, and the audience grew from an expected eight traditional students and one professional engineer to 13 traditional students and 89 professional engineers located throughout Maine, New England, and the southwest United States. Off-campus parties were allowed to view one, many, or all of the 14 sessions offered, and charged for only those sessions requested, with participation tracked within ConnectPro. Because the university had difficulty in receiving payments for varying purchases in one course, the course was offered through the Maine Association of Engineers (MAE). The MAE charged the electrical engineering technology program a minimal fee for advertising and postage services, then submitted the rest of the participant fees to the department's gift account. This course generated almost $10k in revenue for the department which was used on scholarships and laboratory equipment. Although no formal student evaluations were conducted of this course, comments by the participants were all positive with respect to the course delivery method. Most cited the ability to get their professional development hours without ever having to leave the office as a great reason to continue using this type of technology. The second offering of this course was completed last fall and, before the end of the series, off-campus professionals were asking for another similar series. As a result, this course will be offered on a continual basis each fall using the interactive online technology.

The materials from the FE Review Course, which was also deemed a success, are currently being downloaded to the college of engineering's website so students may access them at anytime. Again, students cited the ability to review the recorded sessions at their convenience as the most prominent benefit of Adobe ConnectPro. The plan is to continue to offer this as a free service to anyone wishing to use the course information, and to update the information approximately every two years to maintain currency. An important question was raised during the teaching of this class by one of the faculty members. He was concerned that the university administration would use recorded class sessions to eliminate faculty positions. His reasoning was that, if a course was recorded, there would be no need for a faculty member to teach it until an update was needed in a few years' time. Although there exists verbiage in the faculty's union contract regarding the use of course materials without a faculty member's consent, the language is outdated and does not strictly address many of the concerns. All other FE review course instructors expressed no concerns regarding this issue for this particular course, but suggested further review of the university's policy surrounding electronic media usage.

Limitations to the Adobe ConnectPro System

There were still some noticeable limitations to the Adobe ConnectPro system. For instance, bandwidth issues became problematic if a large number of users connected to the system at once, particularly if those users also wished to use their webcams and have their video displayed on the main Adobe screen. There also existed some audio feedback complications that occurred when the teacher spoke with someone who had the "hands-free" option selected for his or her audio

settings; the teacher heard his or her own voice through the student's microphone, which created an annoying echo. This was often alleviated if both parties used the "push to talk" button (vs. the hands-free option) because only one person was able to speak at a time. It was inconvenient, however, to set down the laptop pen or stop using the keyboard to push the button and speak. Since the initial writing of this paper, Adobe has produced a version that includes "universal voice," a system that allegedly eliminates the audio feedback issues encountered, but this has not yet been fully tested. The final challenge encountered when using the system was the choppiness that occurred while annotating slides in the Adobe ConnectPro content area. There was a noticeable delay between a line being drawn and having it show on the screen, which made it difficult to create complex drawings. This problem was eliminated by using ConnectPro's desktop sharing feature in conjunction with Microsoft Window's Journal Writer; diagrams and/or schematics were printed to Windows Journal Writer where they were more easily annotated.

Overall Conclusions

Despite the minor difficulties encountered, Cisco's Webex and Adobe's ConnectPro Systems worked very well for the conditions under which they were utilized. The ability for students and instructor to share control of each others' screens greatly aided the one-on-one feel of classical laboratory and classroom environments. Carroll and Sheng (2007) stipulated that, for adoption of a new technology on a large-scale basis, the following three criteria must be met:

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1. The new technology should be able to facilitate student learning and understanding. It should be better than a traditional lecture.
2. The new technology should be easy to use. Learning to use the technology should not create excessive work for the faculty member. Class preparation should take approximately the same amount of time as for a traditional lecture.
3. The new technology should be reliable and convenient. "[4]

Anderson (2004) further addressed this point by stating "that technology has an important role in supporting classroom instruction, and that technologies perceived as beneficial to instruction will become widely adopted." [5]

The technologies used <u>did</u> meet these requirements: Student learning and understanding of course material was facilitated and often enhanced by using this technology; both Webex and ConnectPro were extremely easy to use, and required virtually no additional preparation time; and the technology, once initial challenges were overcome, proved to be quite reliable and convenient.

Although this instructor still prefers the traditional classroom experience, enhancing that experience with "living" powerpoint slides, session recording, and the ability to communicate face-to-face at odd hours and under unusual circumstances is most assuredly a good practice. Because of these positive experiences, along with those of other faculty, the University of Maine is embracing these course delivery options for future use. In the Electrical Engineering Technology Program, the ConnectPro system is currently being used to offer a senior-level

project management course to working professionals scattered throughout the state. Other immediate and future uses include the introduction of a Bachelor's of Science Degree offering to a number of professionals who wish to complete their BS EET degree via distance-education while continuing to work full-time. From a simple crisis solution to the implementation of classroom-enhancing, revenue-generating programs being offered, technology certainly changed this instructor's life.

Bibliography

1. Webex, by Cisco. www.webex.com
2. Allwright's paper
3. ConnectPro by Adobe Systems Incorporate. www.adobe.com
4. Carroll, D. and Sheng, H. "Incorporating Technology Into the Traditional Engineering Mechanics Lecture."*ASEE 2007 Southwest Section Conference Proceedings.*
5. Anderson, R. (2004) Beyond Powerpoint: Building a New Classroom Presenter, *Campus Technology,* 6/1/2004, http://www.campustechnology.com/article.asp?id=9537