Distance Education: Not Just for Distance Students

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Abstract

A Mechanics of Materials course was offered with two enrollment options. Students could enroll in the class as on-campus distance students or as regular students. The regular students attended the lectures live in the usual fashion. The on-campus distance students did not come to class, other than to take the exams. The on-campus distance students could watch the class live on the internet, or watch the recorded lectures at a time more convenient to them. Office hours for all students in the class were conducted as distance office hours using Webex®.

The focus of this paper is the distance office hours. The Webex® software allows many people to participate simultaneously. Typically 30 to 40 students participated in each distance office hour session. The faculty member used a microphone, and students used their computer speakers to hear his voice. The faculty member wrote and drew pictures on his tablet computer, and these images were displayed on the students' computers. Students asked questions through a chat box, so that all those participating could see the questions asked. The interaction during the distance office hours allowed the faculty member to develop a personal relationship with the students, and allowed the students to develop personal relationships with each other. Surveys were conducted to evaluate student perceptions, which were very positive, and results are presented in the paper.

Introduction

As we begin to offer the lower division engineering classes as distance education, one of the primary issues to be addressed is how to provide office hour type help for the distance students. Many undergraduate students need help with the homework, and internet based communication tools are the most logical choice for providing the office hour help. As we use the internet based communication tools, we find that they are very convenient and effective for the faculty and traditional on-campus students, as well as the distance students. Class sizes are getting larger, and the amount of time that faculty can spend working individually with students is limited. The internet communication tools help us use faculty time more efficiently to reach larger numbers of students. Faculty spend a significant amount of time traveling, and the internet communication tools help us stay connected with the students. These tools allow us to make more effective use of faculty time so we can provide the same quality education to larger class sizes, and they allow faculty and students to stay connected regardless of where they are physically located.

A large part of office hour help is communication. Students communicate the problems they are having, and the faculty communicate knowledge to help them overcome the problems. A business communication software like Webex® has the potential to enhance the faculty member's ability to communicate with the students. It allows the faculty member to work with a large number of students simultaneously, which makes more efficient use of the faculty member's time. In lower division courses, there often will be several students who need help on the same problem, or who are making the same mistake. Webex® allows the faculty member to explain it once to several students silmultaneously, rather than explaining it many times to individual students. Used properly, a communication tool like Webex® allows faculty to have fewer office hours, but deliver more office hour help to the students. The faculty member can provide office hour help from anywhere he/she can get an internet connection, and students can participate from anywhere they can get an internet connection.

Many faculty resist using computer based communication tools because they seem very impersonal. Meeting students face-to-face in the office or at another location has the advantage of providing personal one-on-one help. The primary disadvantage of traditional face-to-face office hours is that they are inconvenient for the students. Only a handful of students will come to traditional office hours. The students must make the trip to the faculty member's office or meeting place. It's usually a short trip for the on-campus students, a longer trip for those living in an apartment off campus, and an impossible trip for students who are in another city. There are no office hours when the faculty member is traveling. The author's experience is that the convenience of computer based communication tools is more important to the students than receiving personal one-on-one help. It is not unusual to have half the class participate in a two-hour Webex® session.

It has been possible to use the computer as a communication tool for several years, but until recently the hardware and software were not available to make it a good teaching tool for lower division engineering courses. In the last few years, tablet PCs and the associated software have become available which allow the screen to be used just like a chalkboard, and projected onto the students' computers. The result is a very powerful teaching tool suitable for both lectures and office hours, and allows faculty to deliver their knowledge to anyone connected to the internet. It is also convenient and easy for the faculty to use. The technology allows faculty to teach the same way they have always taught, except that now the chalkboard and the faculty member's voice are available to anyone connected to the internet, and students can ask questions from any internet connection.

Preparation for Distance Office Hours

During an office hour session, most of the questions will be about the homework problems that have been assigned. Writing the homework problems on the screen and drawing the pictures that go with the problems wastes time. It is possible to conduct the office hours just like a review session in a classroom, starting with a blank chalkboard, or blank electronic tablet in this case. However, the tablet PC has capabilities not available

on the chalkboard, and the office hour session will run smoother if the faculty member prepares files in advance. The faculty member needs to develop a file that has the homework problems, one per page, with suitable blank space to work out the solution on the page. These files can be created by scanning the homework problems from the book and saving them one per page, or they can be created by using software provided by the textbook company. Some textbooks provide the homework problems on a CD or at an internet site, which may be more convenient than scanning. Creating the homework files helps keep the office hour sessions moving and allows the faculty member to start the explanations with a good problem statement and figure.

Conducting the Office Hours

The faculty member creates a Webex® session by logging into the appropriate internet site and using his/her password. It is a short and easy process. Once the session is created, the students can log in by going to the internet site and clicking on the icon to join the meeting. The faculty member will activate Voiceover IP and speak into the microphone for a few seconds so it can automatically adjust to his/her voice volume. A headset microphone plugged directly into the computer is inexpensive and works very well for the office hour sessions. Office hours can be conducted with the faculty member seated in a chair; a wireless microphone is not necessary.

Figure 1 illustrates the student's screen during a Webex® session. The left two-thirds of the screen shows one of the shear stress problems that was assigned for homework. Through Webex®, the faculty member controls the left two-thirds of the screen. The students put the chat box on the right side of the screen, as illustrated in the figure. The students use the chat box to communicate with the faculty member and ask questions. The student had written a question in the chat box saying that she was having difficulty with problem 9.17. The faculty member can then pull up the problem, displaying the problem statement and figure on the screen. The faculty member has the typed problem statement and graphic at the top of the page to start the explanation. All of the hand-drawn text and equations were added as the faculty member explained the solution to the problem. The students were able to ask questions through the chat box as the solution was developed. Some of the figures and circled items on the page were added as the faculty member answered questions about the problem. The left side of Figure 1 is exactly what was generated during a Webex® session, but the chat box was lost, so the chat box shown in the figure was recreated at a later time to illustrate the process. The faculty screen on the tablet PC looks a little different than the student screen, because the tablet PC works in portrait mode, while the student computer is in landscape mode. The faculty screen looks like the left two-thirds of the student screen, and the chat box "floats" and can be moved from place to place on the screen.

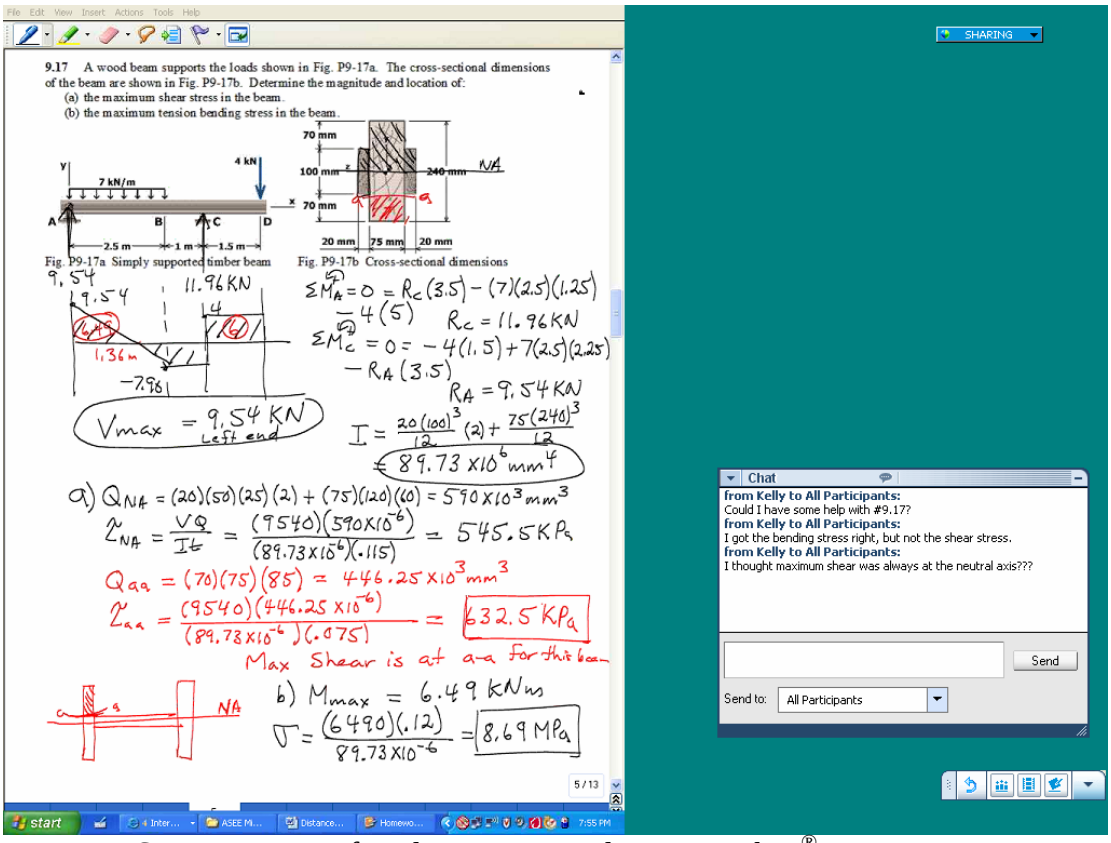

Figure 1. Screen capture of student computer during a Webex® session.

The faculty member will type very little in the chat box because he/she can talk into the microphone. Webex® has the capability for the students to use a microphone too and talk back, but with a large group this becomes difficult to manage. Having the students use the chat box and the faculty member use a microphone is a good system.

In addition to the communication going back and forth between faculty and students, there is also a lot of student to student communication. Some students gather in pairs or small groups around the same computer so that they can talk about the homework during the session. This is especially true for fraternities and sororities, but also happens for roommates in the dormitories or in an apartment. Gathering in small groups around a computer allows students to participate in the session, have discussions among themselves, and not bother the other students in the class. Webex® also allows the students to text each other privately, without sending the message to the whole group, which also allows the students to have off-line discussions without disrupting the rest of the students in the class. If a student is not interested in the current discussion, he/she can get up and get a Coke®, or just tune out for a while without disrupting the class.

Many people regard the Webex® sessions to be impersonal because there is no face-to-face communication. But Webex® gives the students the ability to gather in small groups around the computer and discuss what is going on. It allows them to get help from the privacy of their home. They can log into the session using any name they wish to use, which gives them the freedom to ask any question, no matter how stupid, and no

one else will know who asked it. Webex® sessions end up being a very personal and private experience for the students, and most of them like it better than traditional office hours. It gives the students and faculty more freedom.

For university budgets, Webex® is a relatively expensive software package. The cost for 55 licenses is $75,000 per year. The license allows the university to use up to 55 computers logged into Webex® sessions simultaneously 24 hours per day, so several classes and/or review sessions can be conducted at the same time. The University of Missouri-Rolla teaches 90 distance classes per year using the Webex® software involving approximately 1500 students, so the costs are divided over a large number of classes and students. Most of the 90 classes are at the graduate level and have relatively small enrollments. Using Webex® in a large undergraduate class (Mechanics of Materials) has put a strain on the system. Webex® allows more than 55 computers to log in to the session at the same time, which means that students will not be turned away because all the licenses are used up, but there are significant overage charges for going over the 55 licenses. The university is investigating using a much less expensive software package called Wimba®, which might provide the economic solution needed. Cost of the communication software and tablet PC is an issue today, but this is relatively new technology. The cost will almost certainly decrease significantly over the next few years.

Results

A survey was developed to measure the effectiveness of the Webex® office hours. Based on the theory of cognitivist, feedback, questioning, and answering are features of interactivity that can improve student learning. Measurement for interactivity in the survey was adopted from Siau et al. (2006)[4] in which interactivity was measured as the degree of students' involvement in the class, students' participation in the class discussions, and students' receiving instructions and feedback from the instructor. The first five questions in the survey were developed to measure interactivity. Each question is measured using a 9-point Likert scale with 1 representing "strongly disagree" and 9 representing "strongly agree".

The questionnaire was also designed to gain a more comprehensive evaluation of the technology, including its perceived usefulness and perceived ease of use. Perceived ease of use and perceived usefulness were adopted from Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989)[1,2] which is used to predict the users' intention to use new information technology. Perceived usefulness is defined as the extent to which a person believes that using a particular technology will enhance his/her performance, and therefore, is an indicator of an individual's extrinsic motivation to use a technology. Perceived ease of use refers to the degree to which a person believes that the use of a particular technology will be free of effort, and is therefore an indicator of an individual's intrinsic motivation to use a technology (Davis, 1989)[1]. Questions 6 to 8 measured ease of use, and questions 9 to 11 measured usefulness of the Webex® technology. Details of the questionnaire are shown in the appendix.

The reliability of the instruments was assessed. The Cronbach's alpha coefficient for interactivity level is 0.904. The Cronbach's alpha coefficients for interactivity exceeds Nunnally's (1978)[3] threshold of 0.70 which suggest that the instruments are highly reliable. The mean for interactivity is 7.56 (out of 9). The relatively high mean suggests that students perceive the interactivity to be high when Webex® is used to conduct virtual office hours by the instructor. This also suggests that Webex® is an effective way to ensure interactivity.

The mean for perceived usefulness is 7.76 (out of 9) and the mean for perceived ease of use is 8.02 (out of 9). The relatively high means suggest that the students perceive the use of Webex® to be free of effort, and they believe that using Webex® makes it easier for them to interact with the instructor. The reliability tests show that the Cronbach's alpha coefficient for perceived usefulness is 0.94 and that for perceived ease of use is 0.92. Both are above the 0.70 threshold (Nunnally, 1978)[3]. In summary, the survey results indicate that the students found the Webex® software to be useful as far as helping them learn the material and be successful in the class. Webex® gave them a high degree of interactivity with the professor, and it was easy for the students to use.

Summary and Conclusions

The distance office hours, conducted using the tablet computer and Webex® software has worked out very well for the students and faculty. The process allows faculty to work with a large number of students at the same time, which is more efficient use of faculty time. More students benefit from the time faculty set aside for office hour help. It is very convenient for faculty and students because it gives them the freedom to participate from anywhere they can get an internet connection.

A survey was conducted to get the student perceptions of using Webex®. Students indicated that the perceived ease of use was high, indicating that they found it easy to use Webex®. Students perceived the usefulness was high, indicating that they were getting the help that they needed. Students perceived the interactivity to be high, indicating that they felt they could interact very well with the faculty during the Webex® sessions.

Appendix (Questionnaire used in conducting the research/evaluation of Webex®)

Please rate the following questions:

1. I can interact with the instructor during Webex sessions.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

2. I am involved in learning during Webex sessions.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

3. I participate in discussions during Webex sessions.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

4. I receive feedbacks from the instructor on my understanding of the course materials during Webex sessions.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

5. I receive instructions from the instructor during the Webex sessions.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

6. It is easy for me to become skillful at using Webex.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

7. I find it easy to get Webex to work as intended.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

8. I find Webex easy to use.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

9. Using Webex increases my interaction with the instructor.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

10. Using Webex makes it easier for me to interact with the instructor.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

11. I find Webex useful in enhancing my interaction with the instructor.

1	2	3	4	5	6	7	8	9
Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree

References

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Biographical Information

Dr. Douglas R. Carroll, PE is a Professor in the Interdisciplinary Engineering Department at the University of Missouri-Rolla. He is best known for his work with solar powered race cars, winning two national championships and publishing a book on solar car design. He has received many teaching awards in his career. His research interests are composite materials, solar-electric vehicle technology, and educational research.

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