Using the Internet to Enhance Interactive Television Courses

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Abstract -- *This paper describes the process that was followed in transforming a course previously delivered in the traditional chalk-and-board format, for distance delivery using live 2-way interactive television. The paper describes potential barriers to distance education and strategies for overcoming them, the instructor's familiarization with the distance delivery technology, preparation of new teaching materials and visual aids most appropriate to this mode of education, and development and incorporation of computer-based animations to enhance student understanding. The paper also describes the use of internet tools to promote student-to-student and student-to-instructor interaction, as well as implementation of collaborative learning and teamwork in the class. Strategies for adapting standard collaborative learning techniques to web-based and web-enhanced courses and the instructor's role in their successful implementation in a distance education setting are also discussed. Finally, the paper discusses the administrative procedures that were put in place to ensure smooth running of the class and foster a positive learning experience for both the on-campus and off-campus students.*

Index Terms – Collaborative learning, distance education, interactive television, online course, web-enhanced course.

1. INTRODUCTION

The traditional approach to higher education involves a cohort of students coming together at a specified time in a formal classroom setting to meet with an instructor. In many cases, work, time, location or cost constraints mean that the traditional approach is not viable and alternative methods have to be applied. Indeed the profile of a typical college student is changing rapidly [1]. Experience at Wayne State University (WSU) in Detroit, Michigan; illustrates this changing demographic profile. WSU is a commuter school with fully 75% of its students working at least part-time. The students' mean age is 28.9 years and many of these already have families. 42% of the students are pursuing graduate or graduate-professional programs.

The typical student of the future is going to be more and more like today's WSU student. To reach these students more conveniently, the university has established a number of extension centers around metropolitan Detroit where students can take a large number of classes without having to commute all the way to the downtown campus. This makes it more appealing to working adults because they can take classes close to their places of work or residence and minimize time lost to commuting. The university is also involved in the field of distance education through use of web-based and web-enhanced courses as well as use of two-way interactive television. The course described in this paper was adapted from a traditional chalk-and-board format to a web-enhanced televised distance learning course.

2. LEARNING THE TECHNOLOGY

It is imperative that if distance education tools are going to be used, the instructor designing and delivering the course be completely comfortable with the technology used. To help accomplish this, WSU makes creation of distance education courses voluntary. Incentives for faculty to participate are decided at the department level. During one of our Division's annual faculty retreats, I volunteered to develop the Division's first distance class. Our course in Statics, ET 3030, was chosen for this experiment because it is a required course for all students in the Division and hence needs to be offered frequently both at the main campus and at various extension centers.

To get myself ready, I participated in a two-day workshop for WSU faculty that was taught by Virginia Ostendorf [2]. This proved to be very helpful. It was eye-opening to realize that the experience of a student taking a televised class needs to be deliberately designed to be different from that of someone watching a scheduled television broadcast. In particular, perceptions such as TV being only for entertainment and requiring no action on the viewer's part, or the need for constant sound, have to be radically rethought. Moreover, the common tendency to simply 'tune out' an ongoing broadcast has to be overcome.

3. DESIGN OF INSTRUCTIONAL MATERIALS

Most students and instructors are used to the traditional lecture format. If the student is to learn effectively in a distance education environment, it had better provide at least a comparable experience for students at both the originating site and the remote site. In particular, learning materials should be designed to capture and retain the attention of all students. The successful distance-learning course should be a multimedia presentation including a mix of the following characteristics [3]:

- Active involvement by the students
- Diverse presentation media with planned transitions
- Planned silences to allow students to think
- Animations and simulations where appropriate
- Actual physical models of reasonable size if possible
- Examples of practical applications

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The interactive television classrooms we use are equipped with multiple cameras that allow for great flexibility in how material can be presented. There is an overhead camera that can capture what the instructor is writing on regular paper at the instructional console, another camera shows the instructor, while other cameras show the in-class students. The system also incorporates a computer that can be used for computer-based materials, a VCR that can play regular videos as well as record all transmissions form the classroom, and a controller for all the equipment in the classroom. The controller is under the direct control of the instructor and is used to select which input is transmitted. The input could be from the computer, VCR, or any of the cameras. The transmitted information is also displayed on a large screen in the classroom that on-campus students watch.

For the particular course under discussion, PowerPoint slides were used extensively. These allow the instructor to plan out the main points of the presentation so that less time is spent in writing on the board and more on explanation. In particular, PowerPoint's animation capabilities proved to be of great value as they allowed the instructor to present procedural steps in problem solving in a succinct yet fully engaging manner. Consider for example Figure 1, which shows a slide presenting steps in the analysis of 3-dimensional force vectors. By sequentially presenting the steps involved in the process, it was possible to demonstrate the analytical procedure much more effectively than any textbook can. This takes advantage of the capabilities of the computer medium being used and enhances student interest in the material. It goes without saying that this would not be possible in a simple chalk-and-board lecture.

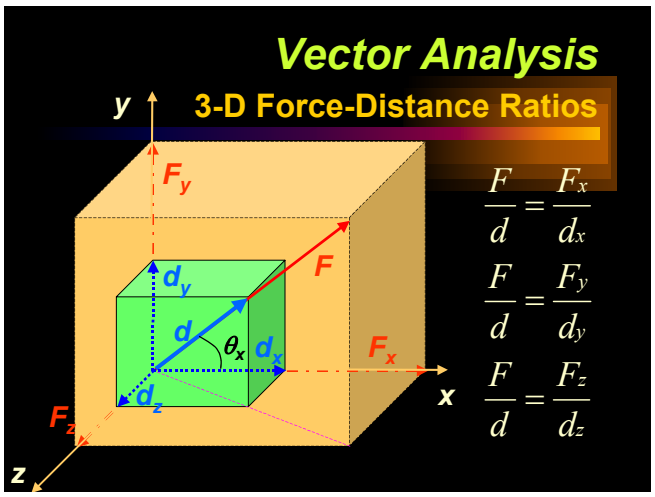

FIGURE 1
POWERPOINT SIMULATION OF 3-D FORCE ANALYSIS

Visualizing 3-dimensional vectors is usually very challenging for students who are just starting out on this technical subject. Therefore in addition to the computer simulation described above, a physical model was designed that is used in the class when the topic is first introduced. Figure 2 shows a photograph of the model. The red rod represents a vector that can be visualized acting in three dimensions. The rod's orientation in space can be varied freely around its base. This demonstrates to students how the orientations of force vectors (or any vector for that matter) can vary in space. The use of a physical model like this is particularly helpful in a televised class. The students can get a much better understanding of the topic than would be possible based only on drawings on the board.

When it comes to discussing projections of the 3-dimensional force vector into its 2-dimensional components in the three planes shown in Figure 2, the use of the television camera proves invaluable. The camera angle can be changed to show the various projections. With the camera directly above the model for example, the resulting view would represent the projection of the force onto the horizontal (blue) plane. Appropriate camera angles are used to illustrate projections onto the other planes.

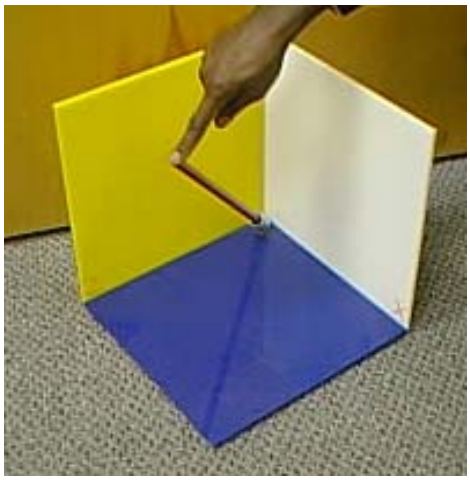

FIGURE 2
PHYSICAL MODEL OF A 3-D FORCE VECTOR

Using computer animations and physical models is very helpful in making important concepts easily understandable to the students. One disadvantage of this however is that the students find it more difficult to take notes because the use of materials prepared in advance tends to make the pace of the class faster. If the concept being demonstrated is fairly simple, this may not be a major problem. For more complicated animations or models such as those discussed above, I have adopted the technique of providing the students with a stripped down version of the relevant slide as a classroom handout. Figure 3 shows an example of such a handout. The students can annotate these types of handouts as the class progresses to keep track of the key points of the lecture. This reduces the students' anxiety because they do not have to copy a complicated drawing off the screen and they can pay more attention to the explanations being given in the lecture. This has the additional advantage of keeping

the student actively involved in the class while saving on the time required to cover the material.

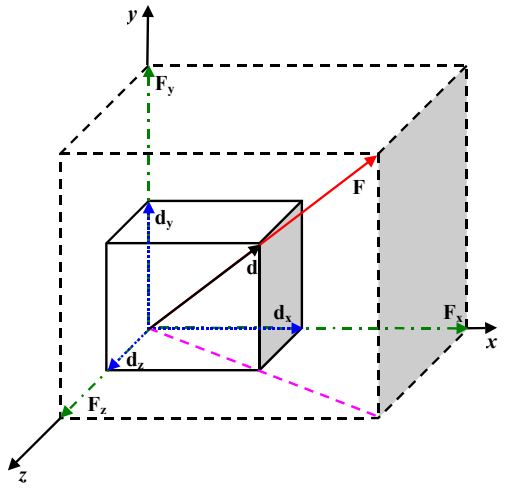

FIGURE 3
CLASSROOM HANDOUT FOR ANALYSIS OF 3-D FORCE COMPONENTS

4. INCORPORATING COLLABORATIVE FEATURES

The above discussion has focused on the technologies used in offering a specific type of long-distance course. In this section, we will consider how collaborative features were introduced into the course, and subsequently incorporated into the long distance version of the course. I have adopted the use of collaborative learning groups in several of my courses including the one discussed here. In this case, students are required to work in groups for their homework assignments, rather than students working independently. They are assigned to their groups taking care to balance membership based on various factors including performance in previous courses, gender, and race. There was some resistance to this idea when first introduced but I persevered and at the end of the first semester, most students realized the value of the innovation and said that it helped them learn. One issue that came to light along the way was the difficulty that many students had in getting together for their group study sessions. This was an especially important issue for a commuter school like WSU. To help alleviate this problem, I decided to start including *'place of residence'* as a factor in assigning group membership. This helped the study groups to work more effectively.

In the Fall 1998, we started offering this course as a distance class using two-way interactive television, with one on-campus section and one live remote section. As the course was transformed from a traditional course to one that included a distance section, implementation of cooperative learning became a major consideration. Students at the remote sites usually take fewer classes per semester and consequently have fewer opportunities for interacting with other students. For these students, the collaborative groups were helpful in strengthening a sense of community that would have otherwise been more difficult to build. Nevertheless, operation of the groups at the remote site was a challenge because there were fewer natural opportunities in the students' schedules for interaction. Therefore, despite its benefits, working in groups became a considerable burden due to the difficulty involved in getting the group members together.

In the Fall 1999, the university adopted SiteScape™ as a university-wide web-based instructional conferencing system [4]. The timing proved to be opportune. I decided to experiment with the use of this new system in my course to help improve the workings of the study groups in the course. Among SiteScape's features, the most relevant one for the current discussion is the ability to create sub-groups or teams within a general discussion area. Once a team is created, only team members can access to the team's discussion area.

There are a variety of features within the team discussion area that facilitate teamwork. Specifically, team members can carry out asynchronous threaded online discussions, post documents, edit posted documents (all team members have edit/modify access to posted documents) conduct live chat, set up a team calendar, and even create a team mailing list and a team newspaper. These features promote cooperative learning. The asynchronous discussion proved to be the most widely used feature. This was in line with expectations because online asynchronous discussion helps alleviate the need for face-to-face meetings, which was a major concern in this course. Figure 4 shows an example of an ongoing online discussion about a homework problem in the course.

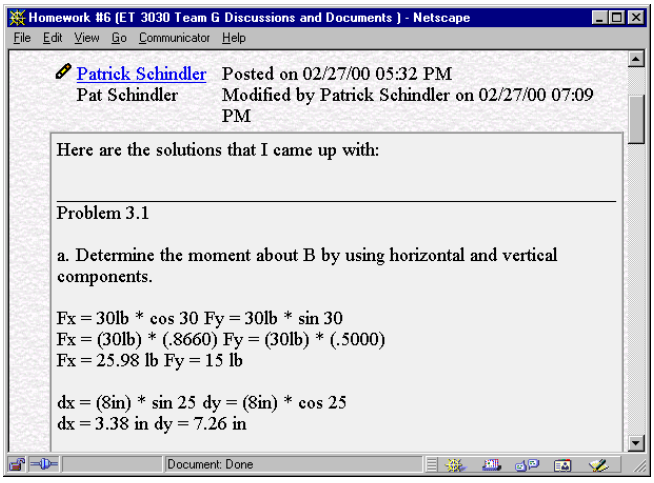

FIGURE 4
ONLINE DISCUSSION OF HOMEWORK PROBLEMS

5. IMPLEMENTATION ISSUES

A number of implementation issues arose and these are instructive for effecting collaborative learning in both traditional and long distance courses. It is a common

temptation for some students to not participate fully in the work of the group. In such instances, students can get credit for work to which they have not contributed. This is unfair to those group members who end up doing the bulk of the work. It is also detrimental to the lax students themselves as they do not get to comprehend the material as fully as they otherwise could. Another temptation is to simply divide up the work among the members, with individuals not paying attention to what other members have done. This is possible because the homework problems are independent of one another. In this case, students can miss out on the nuances contained in problems they did not attempt.

Several policies have been instituted to address these issues [5]. In the first instance, the group members are required to police themselves. Specifically, when a group assignment is turned in, they are instructed that only the names of members who have actually contributed to that particular assignment be included on the assignment. In other words, one is not entitled to group credit simply by virtue of membership in the group; the credit has to be earned. This simple step has helped to alleviate problems on a number of occasions.

Secondly, a significant portion of the final grade (25%) has been allocated to the performance on the homework assignments. This ensures that the students indeed take the assignments seriously since anyone not participating in the group work (and hence not getting credit for the assignments) is guaranteed to get no better than a grade of C in the course. This builds in a major incentive to contribute to the group. What is more, tests have to be done individually, but they are set to be similar to the homework assignments. Consequently, the homework assignments serve as preparation for the tests.

Finally, a bonus system designed to encourage true teamwork has been instituted. The bonus is presented in the form of a challenge prior to each test. If all members of a team score above a specified threshold level, then, each team member is awarded a set number of bonus points to apply towards that test, over and above their individual score. This encourages team members to cooperate beyond the homework and to help each other in preparation for the tests. My experience so far has been that when some groups receive this bonus while others have not, then for subsequent tests, it gives extra motivation for the group(s) that missed out. Of course this is good news for the instructor.

The incorporation of the online discussion in any class offers many potential advantages including increased access to course information, greater student engagement with course material, more thoughtful discussions by students, and increased interaction between students [6]. However, getting students to participate meaningfully in the online discussions can be a challenge but it is worth the effort. W.R. Klemm has suggested some very good ideas for getting students to participate actively in online discussions [7]. Some of these, including required participation, use of learning teams, having a structured activity, requiring a deliverable, and peer grading, have been implemented in this course.

6. LOGISTICAL SUPPORT

If a distance course is to progress smoothly, it is critical to have good logistical support. In our case, we have used various levels of logistical and technical support to ensure smooth running of the course. The key elements of this are the telephone, the fax machine and the internet. Class handouts are sent to the administrator of the remote site in advance of the class in which they are going to be needed using either fax or email. The phone is handy for verifying receipt of the materials. A similar approach has been used for handling homework assignments and examinations. We are currently experimenting with the posting of handouts and homework assignments on a course web site. This offers increased convenience and flexibility for both the instructor and the students although accessibility can be an issue.

In our experience, the equipment used in the classroom has been reliable for the most part. On one occasion however, equipment failure meant that we could not establish connection with the remote site. We have tried several different approaches to handle this type of situation. One was to continue with the class at the originating site but have the lecture recorded. The videotape was then mailed to the remote site where the students could watch it at a pre-arranged time. This was not very convenient for the students as they had to arrange for an extra class session just to watch the tape. A modification of this approach was to digitize the videotape and post it on the course web site in streaming format. This overcame the time constraints but it also had its limitations especially video quality, and some students not having access to high-speed internet connections. Another approach was to just cancel the class at both sites and simply reschedule the missed lecture. This latter approach was more acceptable to the students because it treated all students equally. However, we were fortunate to have a flexible schedule that worked for all the students involved. This is an atypical situation and it is the author's opinion that the videotape backup should always be considered.

In the same vein, when course delivery relies heavily on the use of a computer, such as with PowerPoint slides, backup materials that can be used with just the overhead camera should always be available. It is not unknown for a computer to malfunction and, as happened to us on one occasion, for the technician to be absent on just the day that the malfunction happens to occur. The advice here is to be prepared for the unexpected.

7. EVALUATION

Developing and delivering this distance course was indeed an interesting challenge. It was therefore with some equanimity at the end of the semester that the usual student evaluation of the course was carried out. I was particularly

interested to see how the students in the on-campus section would compare with those in the remote section. Table 1 shows results for selected questions from the university's Student Evaluation of Teaching (SET) instrument. The rating scale used is 1 - 7, with 7 being the best.

TABLE 1
STUDENT EVALUATION OF COURSE, WINTER 1999.

Evaluation Factor	Mean Rating	
	Local Section	Remote Section
Course met my expectations	6.00	5.33
Course was well organized	5.25	6.50
Overall course rating	5.50	5.67
Course plan clearly presented	6.25	6.67
Student responsibilities were clear	6.25	6.67
Instructor provided prompt feedback	6.00	6.33
Overall instructor rating	5.25	6.33

The first broad observation is that the students at both locations were generally happy with the course and the instructor. That said, it is surprising that the students at the remote site generally rated the course and instructor better than the on-campus students did.

There were three evaluation factors that resulted in significant rating discrepancies and these are worth discussing. The first was course expectations, which was also the one area that the on-campus students gave a higher rating than the off-campus students. I believe the on-campus students had better opportunities to interact among themselves and with students who had already been through the course. Therefore their expectations coming in were probably more realistic and hence the high rating. The other areas of discrepancy relate to course organization and overall instructor rating. A close look at the detailed response data showed that in each case, the mean ratings were severely skewed by the response of a single student to the relevant survey questions. Comparison with evaluations prior to the conversion of this course into a distance course did not show these to be areas of concern.

Although the differences were not considered major areas of concern, it was thought prudent to compare with evaluation results from other semesters. Unfortunately, the evaluation instrument has been changed in the interim and so a direct comparison is not possible. Other than changes in the specific questions asked on the instrument, the most significant change in the instrument was the change in the grading scale. Instead of a rating of 1-7, current instruments use a scale of 1 - 5 (5 being best). Because a direct comparison is not possible, we will focus on a more qualitative approach in this paper while awaiting more data that would make a quantitative analysis possible. Table 2 shows the results of the student evaluation of the course for a recent semester.

TABLE 2
STUDENT EVALUATION OF COURSE, WINTER 2002.

Evaluation Factor	Mean Rating	
	Local Section	Remote Section
I learned a lot	3.8	4.0
Course was well organized	4.0	3.9
Overall course rating	3.1	2.9
Instructor demonstrated knowledge	4.6	4.4
Student responsibilities were clear	4.1	3.8
Instructor provided prompt feedback	3.7	3.5
Overall instructor rating	3.3	3.1

What is immediately obvious for this set of evaluation results is that there is no major discrepancy between the two sections. This supports the premise that the discrepancy in the first set of results was the result of data being skewed by a single student's response. What is most satisfying is that students in both sections of the course feel they learnt a great deal in the course. This is strong evidence that a well-designed distance education course can be just as effective an educational tool as a traditional course.

8. CONCLUSION

Adapting this course for distance delivery was an invaluable experience. The materials used in the classroom had to be changed to meet the needs of distance education. PowerPoint and having multiple cameras in the room made possible the use of animations and physical models in a manner that had not been tried before. Incorporating collaborative learning features proved more challenging with the distance section. However, the use of online tools helped to alleviate the major difficulty of students arranging face-to-face meetings for their study sessions. Collaborative learning has to be monitored carefully for both traditional and distance courses to avoid potential abuse. Student evaluations in both local and remote sections show this to be an effective approach.

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