Application of Technology in Course Transformation from Live to Distance Learning

Ali Mehrabian, Ph.D., M. ASCE
mehrabia@mail.ucf.edu
Department of Engineering Technology
University of Central Florida

ABSTRACT: *A robust project-based engineering course at the undergraduate senior level, traditionally taught in a classroom setting using live modes, has been transformed to a distance course taught using distance modes. In this case, pedagogical transitions, alterations, and adjustments are required for meeting the course objectives effectively and without sacrificing the instructional quality. Project collaboration in groups requires effective communication, which is made possible in this case with extensive utilization of new information technology (IT) and communication tools such as virtual meetings. Some technologies used in transition from live to distance learning modes are summarized and their effectiveness is addressed experientially in this paper. This discussion includes some benefits of implementing project-based courses in the domain of distance learning modes.*

Keywords: Distance Learning, Technology, Project-Based Learning, Asynchronously, Senior Design Project.

INTRODUCTION

Prior to the availability of computer technology used routinely today, "distance learning" was referred to as an individualized mode of learning only available through correspondence. Today, "distance learning" and interchangeably used "distance education" are commonly referred to as a field of education that investigates and examines pedagogical technologies and the design of advanced instructional systems used to deliver education remotely to students who are not physically present in the classrooms. Present technology and the accessibility of internet have made distance learning much more viable, and it has evolved from traditional ways to robust, more efficient, and more convenient for students and instructors. Current technologies allow instructors and students to communicate asynchronously, at times and locations of their own choosing, by exchanging printed and or electronic information. New technology, such as WebCT™, provides a more efficient and robust management system for remote classrooms. With this new trend in distance learning, the use of project-based approach is being recognized in

the literature as a potential component for distance courses in the faculties of engineering, science, and technology [1], [6]. Faculties may have to develop new methodologies, and structure or restructure their course differently to accommodate and facilitate the effectiveness of distance learning. Some very recent studies documented the practicality and effectiveness of distance learning methodologies [6]. Results from an early study of the desirability and feasibility of using project-based learning indicated that this teaching methodology has a useful role in distance learning [5]. The case for employing project-based learning methods as opposed to more traditional teaching methods, where the learning path follows a carefully predetermined structure, has been argued elsewhere [3].

In this paper, the author briefly present his very recent experience with the application of technology in project-based distance learning. This paper discusses the effectiveness of this methodology and the lessons learned from its application within different context. More specifically, this discussion includes mostly the benefits of implementing engineering technology project-based work in the domain of the distance learning courses. This paper includes lessons learned from the application of educational tools such as WebCT™ as a viable and efficient asynchronous remote classroom and document management system. The author hopes to gain invaluable insight by presenting this case and the lessons learned to the interested audience. He is very well receptive of exchanging ideas with the audience for new and improved methodologies and to increase the effectiveness of the methodologies presented here.

COURSE OVERVIEW

The Engineering Technology Department at the College of Engineering and Computer Science at the University of Central Florida offers undergraduate degree programs to more than 600 students in different areas of technology including but not limited to Information Technology (IT), Electrical Engineering Technology, Design-Construction, Design-Mechanical, Design-Operations, etc. With a current estimate of enrollment of 100 students per annum, Senior Design Project is a required design course for all engineering technology students. This course is taken during the last semester of the student's senior year. In this course students combine, apply, and verify, in the form of a project, what they have learned throughout their college education. Thus, it is a "hands-on" and "minds-on" course and requires the students to develop, design, build, and test a product, commonly, a device, presumably to be used in engineering industry. This device may have applications in various engineering industries, from electronics industry to construction industry, etc. Furthermore, the curriculum mandates that the students are to calculate the total cost of their projects, including the labor costs at a present rate of $25 per hour. This cost estimate varies from project to project and from semester to semester to account for inflation and price increases, and it intends to increase the student's awareness on the importance of project's cost analysis. Moreover, similar to a "real-life" project, the project requires a written proposal, bi-monthly progress reports, and a final project report. This is accompanied by a final presentation of the project in a professional format. An estimate of the overall project cost, including the total labor, must be included in the cost-estimate and the project's final report. It is compulsory that students include a time-line in the proposal and in the final report. In most case, students work in teams of two to four members, and the project schedule is approved by a faculty mentor with expertise appropriate for the project. It is the

students' responsibility to schedule time each week for research, design, and fabrication of their project, a challenge to some students with poor time management skills.

This course was traditionally taught in live classroom settings via live modes. In very recent years, it has been transformed into a distance course taught via distance modes. In this transformation process, pedagogical transitions and course tailoring are required, in particular to provide robust communication facilitations and to obtain an optimal balance between the course material and the project work. Among many essential requirements, project collaboration in groups requires effective communication, which is encouraged extensively in this course. This is made possible with extensive utilization of new information and communication technologies, such as virtual communications and virtual net-meetings.

TECHNOLOGY AND TRANSITION

With the help of technologies such as WebCT™ software, main types of freely available virtual meetings software (Yahoo Messenger™ and Windows Live Messenger™), web-based cameras, microphones and other devices the course transition is made from a live course into a distance learning course. We also use Camtesia Studios™ and Tegrity™ as screen recorder for recording and editing high-quality lectures and communication videos, presentations (including Microsoft PowerPoint™) and screencasts to share lectures online, as Flash™, on CD-ROM, and on portable media devices, including iPod™. During the transition process, we addressed and resolved many issues some of which are discussed below.

A) Electronics' Document Preparation and Submission: The Senior Design Project course must conform to the general guidelines outlined in a master document. There are also other required but informational documents called welcome document, course syllabus, course schedule, and research methods' handouts, etc. At the early stages of the transition, these documents are prepared in electronic format and uploaded to the class WebCT™ website. Students can access the class website and download these documents from anywhere at any time, asynchronously. Within three to four weeks, a written project proposal is submitted by each group by posted deadline listed on the course website. This written proposal must be approved in advance by the team's faculty mentor. Approval will consist of an initialized electronics copy of the project's proposal and request for approval that is attached to the electronic copy of the proposal. This provides a time-saving and robust process in which proposals and other documents are available to the students and submitted by the students via course website. The course instructor can easily and quickly access and download these documents for efficient reviewing and grading purposes.

B) Conformation to Proposed Standards and Specifications: An engineering project, device, etc. usually involves the development of a set of specifications. Before starting the design process, and surely before building and testing any equipment a firm specification must be agreed upon by the customer and the engineer. For creating a realistic design scenario, students start their projects by preparing a set of specifications that include the absolute minimum and maximum values of all crucial "design goals," "design objectives," and "design parameters." Students are not graded on how well the final product meets the prepared

specifications. Rather they are graded based on the depth of the original specifications and the extent to which it truly specifies the anticipated product as part of the design project. In other words, the final project will be evaluated based on the project's proposal. The students must meet all of the project's realistic design goals and objectives as they are outlined in their proposal. To align the project's outcome with the project's previously defined goals, objectives, and design parameters, WebCT™ is employed. This was achieved by using a novel approach in which under WebCT™ menu, an advanced electronic goal and objective-setting function was created. A "Self-Test" icon allows the professor to create a test consisting of multiple-choice questions that students can use to test their knowledge, in this case, their project's goal and objectives. No grades are assigned or recorded for this purpose. Instead, when a student responds to a question in a "Self-Test," they are informed immediately whether the respond is correct. The professor can and may also provide feedback on the answer. Students can access the "Self Test" for the course from the course main menu. Each group inputs the project specifications accordingly and refers to them throughout the project. Accordingly, the function of the project's built end product was measured for consistency with the design parameters for project evaluation purposes.

C) Scheduling and Presentations: It is required that the final results of the project and the final built device, including project demonstration, are presented in three formats: (a) presented orally by the students, (b) submitted as a written report prepared in accordance with the course presentation guidelines, and (c) presented in an electronic format as saved on a CD-ROM. An electronic copy of the final report may be uploaded and submitted through the class WebCT™ site. Oral presentations are "open to the public" and are scheduled for presentation during the last week of the semester. The professor can manage robustly many time management issues involved in scheduling and presentations. This includes room scheduling and setting up the project's presentation time according to an online poll for the most convenient time to accommodate most students. In this case they are managed by employing WebCT™ communication tools such as discussion boards and electronics communications such as emails.

D) Collaboration Among Group Members: Collaboration among group members is a key issue in a project-based distance learning in which students work in teams. In this process, communications among group members are facilitated through electronic communications via different modes. It is important to note that students report that technology improved their collaboration ease and abilities, and it empowers them with more efficient, asynchronous collaboration skills. This is particularly applicable and very advantageous in our case. Due to geographic location of our institution and the scattered student population and urbanization in our state, the State of Florida, some group members live as far as 200 miles apart in some cases. It is needless to say that electronic communication virtually eliminates the distance barriers.

BENEFITS

The myriad of benefits of distance learning have been discussed extensively in much literature [2], [4], [7]. Our experience in this case shows that while application of technology in project-based distance learning within the context of the senior design project might present some

pedagogical and logistical challenges, it has the following substantial benefits. In this discussion only present a few, but major benefits that are directly applicable to this case are presented.

1. *Time Saving:* In an independent senior design project's distance learning environment, time is of an essence. Using software such as WebCT™ as a class management tool saves time. For example, in many instances multiple questions are collectively and effectively answered via one Tegrity™ tape in a few minutes.

2. *Convenience:* Application of distance learning technologies can offer convenient locations for both students and instructors. Many of the technologies, such as the fast access internet and virtual meeting software (i.e., Yahoo Messenger™ and Windows Live Messenger™) are easily accessed wirelessly from any where these days. Many of the lectures can be viewed and reviewed at a later time and frequently. This is particularly applicable to the students that are working adults.

3. *Flexibility:* Many forms of distance learning provide students the option to participate asynchronously and on an individualized basis. For example, some students may want to review a pre-taped lecture in the middle of the night or read their e-mail during early morning hours. In addition, not all students learn at the same pace and with the same efficiency rate. In this case, while one student may wish to spend 30 minutes reviewing the class website and the project specifications, another may spend an hour or so. This flexibility is particularly beneficial in project-based courses where students live some distance apart but work in teams.

4. *Student/Faculty and Faculty/Faculty Interaction Rapidity:* Unlike a live classroom settings in which faculty/student interaction is limited to live class time and perhaps office hours, utilization of technologies such as electronic mailing (E-Mailing), message boards utilization in WebCT™, and instant messaging help increasing the rapidity of the student/faculty interaction. This is particularly applicable in project-based distance learning environments where the students, many of them working adults, work in teams and require more rapid response due to a tight schedule between work and school. In some instances where a group has more than one faculty mentor, the faculties can rapidly interact among themselves to discuss different issues.

5. *Ease of Document Delivery*: Unlike a live class in which the instructor shall make hard copies of the documents to be hand-delivered, electronic documents and files delivery and management systems work much easier and faster. In our case, we utilized WebCT™ extensively to upload, download, and post document files electronically and asynchronously.

6. *Reduction in classroom occupation time:* Due to the fast growth of our institution and budgetary constraints, any reduction in classroom occupation time is highly desirable and is beneficial to the department and college. This savings in classroom occupation time directly translates to cost saving benefits mentioned next.

7. *Cost Saving:* Considering the cost of learning and instruction time, document duplicating and delivery costs, and other costs such as classroom occupation time, there are many associated cost saving benefits with distance learning environments. In this case in which the educational physical space is limited, this process is highly desirable and cost-reductive.

8. *Equity:* Educational inequity is a major issue in many institutions in many countries. Rural schools may need more technology and often have less contact with educational trends. Distance learning offers great potential for alleviating these issues and has been employed very effectively in our institution with geographically diverse student populations where in some cases, some team members live as far as 200 miles apart.

CONCLUSION

In this paper, the author discusses experientially the application of technology to transform a project-based live course to a distance learning course efficiently and robustly. This is made possible by utilization of currently available technologies such as WebCT™ as a course management software and Camtesia Studios™ and Tegrity™ software as screen recorders for capturing, recording, and editing high-quality short lectures. These technologies also help with developing a responsive interaction mechanism between the faculty and the students. Project collaboration in teams requires effective communication, which is possible with extensive utilization of new information and communication technology, such as virtual meetings. In this case, students use main types of freely available virtual meetings software (Yahoo Messenger™ and Windows Live Messenger™), web-based cameras, microphones, cellular phones, and other devices to communicate effectively. Some empirical issues surfaced during the transition process are discussed here.

It is suggested that the faculties of engineering and technology may have to revamp and restructure their project-based courses to accommodate and facilitate utilization of effective modes of distance learning. In most cases, pedagogical transitions and adjustments are required to accommodate for distance learning modes of instructions and collaborations. This paper discusses the course transition from live to distance modes and touches on some lessons learned from its application. This study confirms that there are many benefits to distance learning. Some of these benefits that are directly applicable to our institution and our department are presented. They include, but not limited to time-saving and cost-saving benefits, convenience, flexibility, equity, and reduction in classroom occupation time.

REFERENCES

[1] Azad, A., Song, X. (2006). *"Internet-based Physical Experiments: Application Within A Laboratory Course,"* American Society of Engineering Education (ASEE) Annual Conference, Chicago, IL.

[2] Casey, P., Dager, N. and Magel, M. (1998). *Emerging Technology: Tools for Today and Tomorrow.* AV Video Multimedia Producer. 20(1), 44 - 53.

[3] Farnes, N. (1975). *"Student Centred Learning,"* Teaching at a Distance, 3, 2-6.

[4] Ko, C. C., Chen, B. M., Hu, S., Ramakrishnan, V., Cheng, C. D., Zhuang, Y. & Chen, J., (2001). *"A web-based virtual laboratory on a frequency modulation experiment,"* IEEE Transaction on Systems, Man, and Cybernetics, -Part-C, Applications and Reviews, 31(3). 295-303.

[5] Macmillan, B. (1975). *"Project memo 1: Project-based learning in Open University courses (Project memo series),"* Milton Keynes, UK: Open University, Institute of Educational Technology.

[6] Mehrabian, A., Alvarado, K., and Nahmens, I., (2007). *"Application of Technology in Project-based Distance Learning,"* EISTA 2007, Orlando, FL.

[7] Short, N. M., (2000). *"Asynchronous distance educations: a five step approach to eliminate online problems before they happen,"* The Journal, 28, 56-65.