Using the Web to Invite the Local Community Into the Engineering Classroom

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Abstract- This paper describes the use of the web casting in a new engineering program that started in Fall 2004 at East Carolina University. The program presents a unique design synthesis of concentration areas required to enhance regional economic development and the best practices identified from the work of the National Science Foundation (NSF) Engineering Education Coalition (EEC) program. The paper presents how the Web is used to invite and to link the local community and the local industry to the program through the University’s Global Classroom and how the contemporary educational technology, with computer-based methods of delivering courses are used to supplement traditional lectures. Special emphasis will be given to the students’ design projects with the local industries. Detailed description of the program and the projects is presented in this paper.

Index Terms – Collaborative engineering, computer-based methods, freshmen projects, global classroom,

INTRODUCTION

Over the last several years, distance education has become an important way of providing college level education to a wider population, particularly those in areas remote to a university or college campus. For this reason and due to the rapid development of technology, the internet has become an important and crucial tool in education. The methods conducting distance education differ from one course to another based on the nature of the course and the available technology. Approaches may range from paper-based correspondence courses to the more technical approaches such as two-way video/two-way audio real time courses[1]. For example, the World Wide Web (WWW) and e-mails have been used successfully to support teaching manufacturing engineering [2]. Other educators used interactive strategies to enhance the delivery of these courses including Electronic mail, WWW, virtual teams, WWW Forum discussion [3] and WWW-based virtual laboratories [4]-[5]. This paper presents the story of how the WWW may be used not only as a tool of teaching distance education students but as a way to invite industry and the local community to the engineering class room of a traditional face to face course.

UNIVERSITY BACKGROUND

East Carolina University (ECU) is located at Greenville North Carolina adjacent to the business, medical, and educational hub of eastern North Carolina. ECU is a doctorate granting university offering degree programs at the baccalaureate, master’s, intermediate, first professional and doctoral levels. The university was established in 1907 as East Carolina Teachers Training schools. Its name changed twice and in 1967 was designated as East Carolina University in 1967. For nearly a century, East Carolina University has served the people of North Carolina and the nation. From modest beginnings as a teacher training school, ECU has grown to become an emerging, national research university with an enrollment of nearly 22,000. Today East Carolina is a constituent institution of the University of North Carolina System and offers more than 100 bachelor’s degree programs, nearly 80 master’s degree programs, and 13 doctoral programs in its professional colleges and the Brody School of Medicine. With a mission of teaching, research, and service, East Carolina University is a dynamic institution connecting people and ideas, finding solutions to problems, and seeking the challenges of the future.

ENGINEERING PROGRAM AT ECU

The Engineering Program started at ECU in the of Fall 2004 with 45 students. The Bachelor of Science in Engineering (BSE) was developed to address the following goals:

• Support the economic development requirements of eastern North Carolina by creating professionals to meet the general engineering needs of eastern North Carolina’s private and public sectors
• Develop engineering problem solvers to work in general and emerging disciplines not addressed by traditional engineering disciplines
• Attract, retain, and graduate general engineering students, especially eastern North Carolina students including women and underrepresented minorities. As shown in Figure 1, about 43 percent of the students are from the regional counties (eastern North Carolina) and only 3 percent of the students are from other states.
ECU’s BSE program’s approach to achieving these goals differs from traditional engineering program approaches in three primary ways:

- First, it emphasizes the application of engineering theory to real world problems. Students are engaged in hands-on engineering activities beginning with the first semester and will not have to wait for several semesters or years to experience real engineering and design.
- Second, the mathematics and science content are integrated with the engineering courses and labs to provide an integrated learning experience that provides a coherent learning experience. Students will not be subjected to the independent sound bites that often characterize the courses in many engineering programs.
- Finally, the ECU engineering students work very closely with the engineering faculty and their class mates in a team-based learning process called a cohort system. This system promotes learning, success and team work. In many other programs, students work independently and do not have a close relationship with the faculty they will work with for the four years of their program.

### Freshmen Course and Project Description

#### Course Overview

Integrated Collaborative Engineering I (ICEE 1010) is the first semester introduction to engineering course. It is a six credit course consisting of parallel tracks, each comprised of a two hour lecture and two hour lab weekly for a net of six credit hours. This course is designed to stimulate students’ interest in engineering by describing engineering history, using “brain teaser” problems to challenge creative problem solving while describing systematic approaches for solving well-defined engineering problems.

ICEE 1010 is team taught and provides a hands-on experience in engineering practice areas including graphics, professional practice, environmental issues, systems thinking and basic concepts in machinery, controls, digital circuits, and data analysis.

#### Course Delivery

Although ICEE 1010 is an on-campus class, blackboard (BB) is used extensively. As mentioned above, the course is team taught and all professors have access to the BB course site. Microsoft power point is used to teach all components of the course. Announcements, lecture notes, and homework assignments are usually posted on the BB site. Students are required to submit electronic copy their assignments and exams through the digital drop box of BB.

#### Project Goals

One of the course requirements involves student teams and completion of a project that targets building basic understanding of engineering design concepts appropriate for the level of first semester engineering students. In general, the project targets development of skills in team dynamics, identifying and meeting customer needs, problem solving, and engineering documentation. The deliverable for the customer is a proposal for a feasible problem solution and a complete preliminary design package. Each project has a faculty mentor who advises students in completion of the project. Two student teams of four work on each project and compete for the best outcome. The project requires students to address as many of these objectives as possible:

- Elicit customer requirements: Students should work with the customer to develop a scope statement with clear statement of the problem and detailed deliverables.
- Develop a feasible work plan and assignments: Students should make realistic estimates of effort and make work assignments.
- Manage the customer and meet needs: Students should keep the customer informed and consistently pursue this goal.
- Develop an engineering documentation package using skills from the graphics component of 1010: students should present and document the proposed solution by means of an AutoCAD drawing package including a 3D model and related parts list.
- Compare alternatives and make design trade off analysis: Each report will examine alternatives that were not selected and the reasons for the decision.
- Build team work skills: Students will learn and employ skills in team problem solving.
- Examine life cycle and sustainable design concepts: The proposal must consider the long term performance and cost implications of the solution.
- Presentation and project report: The students must make two presentations on the project and submit a final report
- Research, data gathering, and analysis: The project requires students to learn methods in conducting research.

![Figure 1](image-url)
(library, internet, customer data, etc.), documentation of sources, and use of data analysis tools.

Project Schedule:

The project is scheduled through the semester as follows:

- First four weeks of the semester: Clients are visited by the student team prior to the third week of the semester. Clients identify a liaison for the team who arranges for students to develop the scope and gather data. The Project scope must include a concise problem statement and deliverables and be approved by both the client and the faculty advisor. Figure 2-a and Figure 2-b show the 2004 engineering students with the clients during the first site visit to the Cherry Farms and the East Carolina landfill. Figure 3 shows the students discussing their projects with the site engineer.
- On going: Project teams interface with customer liaison to gather information and proceed with project design.
- Mid semester review: Project teams present progress and status to the client by the middle of the semester.
- Two weeks before end of semester: Final presentation to client.
- End of semester: Complete report submitted. Clients evaluate the final result from the perspective of meeting the need and the agreed deliverables.

ECU’S GLOBAL CLASSROOM

The global classroom (GC) at ECU (http://gcweb.tecs.ecu.edu) was established in Fall 2003 at the university’s Science and Technology Complex. The Global Classroom is a state of the art learning center which supports internet-based, multiple-tool powered video conferencing for groups up to 100 persons. The facility can support up to four concurrent groups at one time in a variety of venues. An associated control room, shown in Figure 4, and editing facility provides the server and bridging capabilities needed for full capabilities in distance education and teleconferencing. Courses from a wide variety of disciplines use the GC in experiences that range from a single ‘guest lecturer’ to shared units to entire courses. This learning facility can be used to web cast live and archived instructional sessions and video conferencing using the state of the art equipment. It is open to any faculty or staff member of East Carolina University.

During the past two years many faculty members have taught distance education courses through GC. The new technology of the GC allows faculty to conduct face-to-face meetings with the students and to share files and data in an efficient way. Access to streaming presentations from the GC requires basic connectivity such as a computer with 56k or higher connection and 256 MB of computer memory. To view the web cast, viewers choose the desired presentation/instructor from the global room website as shown in Figure 5. A menu box pops up in a separate window that asks the viewer to choose Broadband (cable modem, DSL) or...
Dial up (phone modem). Whether the session is live or from a previous date the video will buffer the stream as shown in Figure 6.

INVITING THE COMMUNITY INTO THE CLASSROOM

In Fall 2004, freshmen engineering students worked with the AgroMedicine Institute and Cherry Farms Center for Environmental Farming in Goldsboro, NC, on three projects and with the East Carolina Land Fill in Aulander, NC, in three different projects.

The goal of the Cherry Farms Center projects was to develop next generation upgrades for the farm tools featured in a NIOSH publication [6] and to assure workers are uninjured, safe, and comfortable, as well as productive. In these projects, students were required to work in teams to develop:

- A Harvest Cart to reduce repetitive use injuries from stooping, kneeling, or crawling. The cart will allow farmers to sit and roll while they harvest.
- A Weeding Stand to reduce bending when weeding trays of “pre-potted” newly propagated plants that must stored on the ground.
- A Lifting Tool to reduce repetitive use injuries when farmers stoop, grip, and lift plant containers.

Other teams of students who worked in the East Carolina Land Fill projects were required to:

- Analyze commercially available Leachate Evaporation Systems and identify a cost effective approach that potentially uses landfill gases in the evaporation process.
- Develop a conceptual design and estimated cost for a biodiesel plant that uses landfill gases to produce biodiesel.

Prior to the final presentations, invitations were sent to all interested parties (e.g. parents, industry, supporting groups). The presentation videos were streamed from the GC and archived on the GC webpage. Figure 7 shows two teams of students presenting their projects. Using the GC software, MediaSite, students can be seen in the left side of the screen and their presentations can be seen in the right side of the screen at the same time. This allowed the web users to easily follow the presentations and interact with the students. Questions were allowed through the GC software during the presentations, so clients were able to interact with the students at any time.

DISCUSSION AND CONCLUSIONS

The success of the delivery method of the final projects was evaluated based on feedback received from students, industry clients, and parents.

Both the Cherry Farms and the East Carolina Landfill are at least one hour from the university. Without using the global classroom, all clients would have had to spend most of the day.
at ECU to attend the presentations of the final projects. This is a barrier which might have prevented the participation of the clients specially if there were more than one project to view.

The use of the global classroom allowed the clients to watch the final presentations without having to interrupt their work and from the comfort of their own location (work, home, etc.). All the received comments from students and from parents and industry clients who watched the presentations were positive and some of these comments are provided below:

From students

- I enjoyed knowing that I could present my work with my group over a media that allowed my parents to view the accomplishments I had made in my Engineering class. I do believe that it was difficult to think about the fact that a camera was filming my every move while my group and I were displaying our project with it being the first presentation.
- Last semester's presentation was very helpful to the extent that it helped me interact with my group members more and apply the knowledge that I learned with AutoCAD to the project. In addition, it allowed me to practice my social skills in front of the class, professors, and potential buyers. This project was definitely a great learning experience to me because it basically concluded everything that I learned that semester. I was surprised that this program would let us do a major project and presentation like this especially since it was our first year. I definitely felt like I was out in the real world addressing future employers.

From parents

- I was very thrilled and proud to see my child involved in such a project with the first Engineering class of ECU and that I was able to access that through my own personal computer.
- The projects were impressive and I liked how I could watch the presentation live over the internet.
- I was proud of my son and surprised how much they had learned in one semester of school.

From industry

- I thought the students’ efforts were demonstrated in a most positive manner with the conclusion being a question and answer period between their professors and them.
- I thought the students demonstrated that they had done their homework with their subject matter and presented it in a very intelligent manner which for the common layman, as well as myself, found some of the information hard to understand. I am very impressed though, because the general idea was clear that our engineers of the future are trying desperately to find ways to preserve our environment.

As a final remark, after the success of the first trial, starting from next semester, students will have to present the mid-semester progress using the global classroom.

REFERENCES
