Effectiveness of a Web-Centric Ceramics Course

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Abstract

The objective of this effort was to effectively use a computer-based educational environment with traditional methods in executing an upper level materials course. Some constraints included a minimum contact time of one hour (out of four total), and the development and application of appropriate computer-based infrastructure. Motivation for this effort came from many areas including current education philosophy, politics and personal interest. Seed money was available for faculty interested in expanding the format of the class to include a web-based forum. It was intended that the results of this effort be applied to other appropriate courses in the future.

A four credit elective course was chosen (MET483 Ceramics and Composites) for implementation. The class was comprised of mechanical engineering technology, electronic engineering technology, and industrial technology students. One quarter of the class meetings was committed to computer-based education. A virtual environment was created to support the objectives of the course. One area allowed threaded discussions to occur. The discussions were generated via questions and case studies. The scenarios included material data collection, material selection, material source selection, and case studies in material design. The course was first offered in the spring of 2000. The computer system required orientation, and at least one round of feedback before it was operational. Seven (of ten) Fridays were declared 'virtual days' and work was required by the following Monday. Live feedback was possible, and Monday debriefings were held in conjunction with traditional lectures. Wednesdays were targeted for traditional laboratory exercises.

The students' interests and the ease of Internet-access led to an increased variety and depth of effort in assignments compared to similar courses. Students could interact asynchronously, which generated a synergy that encouraged interesting interdisciplinary discussions. Timely class discussions and feedback helped motivate the less self-directed students.

Implementing this web-centric course caused minimum impact to the program and measurable impact to the educational environment. A similar effort is planned for another elective course MET382 Plastics and Composites.

Introduction

Web-based education is a growing field and is making an impact at all levels. The recent report of the Web-based Education Commission [1] states: "The power of the Internet to transform the educational experience is awe-inspiring, but it is also fraught with risk." This quote was downloaded off the Internet (awesome), and anyone can access and use it in any context (risky). Among their fourteen stated goals, they generally desire 'high quality online educational content' and also 'a comprehensive research, development, and innovation framework for learning technology." Until such a framework reaches out to support our Mechanical Engineering Technology (MET) Program, we have chosen to create a web-based education experience using local resources.

Our focus was not distance education (DE). There are many avenues of DE that are not web-based, such as self-study courses using CD-ROM (see the ASME course listings[2]), or synchronous/asynchronous Internet-based courses[3,4]. Our objective was to provide a non-traditional web-based educational environment in conjunction with a traditional course. We refer to this as a Web-Centric type of course. In a web-centric course, a substantial amount of course work is completed via the web (e.g. a quarter or half the work).

The motivation for this transition is facetted. As stated above, it behooves us to improve our educational methods if possible. This evolution in educational methods is driven by an evolution in information technology. Also, it may be possible to facilitate this education in a more efficient manner. The Web-based Education Commission called this 'inspiring'. This inspiration, combined with a general cultural acceptance evidenced by high Internet use, supports investigation into web-based education.

Our intent in the MET Program of CWU is to expand the use of Internet-related education to support our objectives. Criteria for success included: 1)content coverage, 2)appropriate documentation of effort, and 3)acceptance.

Method

A new course was proposed and modified to be web-centric. This upper division elective was called MET483 Ceramics and Composites and offered for the first time in the Spring of 2000. Seven of the thirty meetings were declared virtual, so approximately one-quarter of the course was web-based. Only six students registered for the course, but it was allowed to run. The course was designed to be offered every other year in conjunction with a Plastics and Composites course. This particular group of students consisted of both MET, as well as electrical and industrial technology students.

A virtual educational environment was available at CWU, but it had limited features (it was a local effort). These features included announcements, assignments, and a discussion area. Students were registered remotely (through a technician), and then used a password to gain entry.

The course was taught three days a week over ten weeks from three to five in the afternoon. Therefore, seven Fridays were declared virtual (the others were used for exams). Mondays included a debriefing of the web-based work, and some traditional lecture. Wednesdays were used primarily for laboratory work.

Student web assignments varied in type. The initial assignments concentrated on exposure to the field, nomenclature, gathering sources of material and collecting material properties. Later assignments included specifying test equipment and procedures, developing and specifying coating systems, and designing structures. The last assignments had the students critiquing ceramic designs to elucidate important concepts such as 'size effect' and statistics. These case studies are well suited for use with the Internet and have been discussed elsewhere[5]. A topical list of the core assignments appears below.

3/31/00	Sources of Ceramics	
4/7/00	Obtaining Properties of Ceramics	
4/14/00	Specifying Testing Equipment for Ceramics	
4/28/00	Design and Specification of Ceramic Coating Systems	
5/5/00	Case Study on Ceramic Structures and the Size Effect	
5/12/00	Case Study on Ceramic Structures and Mechanical Behavior	

Results and Discussion

The web-centric course was a success. All three criteria were achieved, and plans have been made to expand the web-centric approach to other appropriate courses.

Course content was scheduled via the Internet in conjunction with the hardcopy schedule. There were no deviations in content delivery. Documentation of the web-based portion of the course was left digital, with samples printed out for other uses. Students had access to the site, and to all of the filed reports of all the students. Student reports were evaluated for content as well as depth of coverage. A profound observation was that some students spent inordinate amounts of time on-line (e.g. 6 hours in one session) while working on the virtual assignments. This compares favorable with typical comments from the students regarding their lack of time spent on reading the text. Students commented on their normal behavior of spending significant time on the Internet. A web-centric course appears to co-opt that behavior into course related effort. Not only did students spend time researching the task, but there were examples of multiple entries by the same student. Students produced original work, but did react to their peers work and at times added to their own.

Other advantages included the variety of work created and information discovered. Some interesting URLs were used (from ceramics.org and killerdesigns.com, to matls.com and efunda.com). There was little overlap in the sites visited or their use. This reflected the variety of students and their interests. Using Internet-based education and resources is an excellent way to generate a wide variety and depth of information and discussion.

A more subjective advantage of web-centric learning is the promotion of 'virtual team' skills. When assignments required cooperation between students, a level of virtual communication became important and something the students had to deal with. This was lightly touched upon in this course, but will be expanded in the future, as the infrastructure permits. Our discussion area could not support small groups.

Internet-based education has expanded our modes of education. Our education pedagogy includes a new dimension of information technology and personnel interaction. Besides the traditional lecture and discussions, or the laboratory exercises and related skills, the third area of research, design and teamwork can include a virtual environment. This is a powerful and relevant tool for education that impacts course development.

It has been extremely popular for the students to have 'Fridays off'. They are now able to have a more flexible schedule concerning work or travel. Of course, there are expectations and responsibilities connected with that freedom. Most students handled those responsibilities well, but some did not. Some students initially did not manage their time to get the work done by Monday, so it became routine to check their work Monday morning, and debrief them that afternoon. Some students responded well to some one-on-one interactions, and some to timely virtual comments.

Another disadvantage, or perhaps simply a difference, was an apparent decrease in personal, in-person interaction. There was a tendency by some students to avoid any personal interaction. This was not the intention of the web-centric aspect of the course. Labs were regularly schedule during the course, but were individual efforts. It may be appropriate to include a number of labs to be done in groups. Our program outcomes address communication and team skills in multiple media and format. This issue was not addressed well during the course, and is an action item for future course planning.

There were technological problems during the course. It took a week for the registration and basic operation to function properly. It took another week for a few specific problems to be addressed. For example, weekly discussion areas had to be initially opened by the professor (so that students had to accommodate that pace). Also, some students had difficulty interacting from computers off-campus versus the on-campus computers. A responsive technical support infrastructure was essential.

That particular software has been succeeded by a commercial package that contains many features helpful to a web-centric course. These features include group areas and test abilities. More students will enter our programs with both experience in, and expectations of the use of these programs[6]. Our approach has been to use Internet-based resources as appropriate, to meet the objectives of our program.

Summary and Future Plans

Implementing a web-centric course in an engineering technology program was successful. All three criteria were met. The web-centric course covered required content, produced appropriate documentation, and was accepted by participants. Advantages include flexible scheduling such as asynchronous teamwork, discussions and research. Significant increases of time-on-task and depth of coverage was noted. The success of this web-centric course has promoted the evolution of other courses in the program.

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