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Enhancing a Residential Safety Course with the Development of an Online Component: A Limited Case Study

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The Internet, and in particular the worldwide web, is changing the way in which education is delivered. Virtually every university and college across North America is now on the web (Saba, 1998). In fact, some universities are questioning whether it makes sense to differentiate between residential instruction and instruction at a distance (Boettcher, 1998). Experts in instructional technology predict that in the 21st century the Internet, or one of its descendants, will become the dominant distribution system for distance education and training across much of the industrialized world (Simonson et al., 1999).

Many faculty are currently expanding their traditional delivery methods (lecture, laboratory, face-to-face discussion) to include educational options ranging from web-based course supplements to the complete delivery of courses online. There are many online choices that faculty may consider in this range. This manuscript describes a case study of implementing a web-based component to supplement the traditional face-to-face instruction of a residential safety course.

Online Education

Factors driving online education include the ability to be more flexible and student-centered while meeting the demands of a more diverse student population and the expanding availability of cost effective Internet access. First, the medium offers tremendous flexibility for both instruction and learning. An online component to a traditionally taught course may be used for synchronous communication (e.g. chat, whiteboard), asynchronous communication (e.g., email, bulletin board), as a repository for reference material, for dissemination and collection of assignments, for lesson delivery, or for examination. Simulations, video clips and sound bites can be included to help explain difficult concepts by providing students with an interactive environment. In addition, web pages can connect to materials stored on a CDROM or in other programs, such as databases. A course that is taught completely online may include all these elements.

Second, online course components can be designed to be much more "student-centered" than traditional face-to-face lecture style classes. Generally, the student has more control over the order and pace of information delivery as well as the time and place of delivery. Critics have worried that online education will make students anonymous, but in fact the opposite is true. Online communication has been shown to be less threatening than face-to-face meetings, is not so easily dominated by one or two more aggressive individuals, and allows time for reflection prior to student response (Brown, 1998; Owen, 1993). Instructors can establish class policies, assignments, and projects that encourage or even require both individual and group interaction online, thus creating learning environments that include much more two-way and group communication than is typically found in a large lecture. Refer to Khan (1997) for a detailed discussion of online pedagogy.

Third, the make-up of the student body is changing. As life-long learning becomes the norm, students return for education who may not necessarily be returning to campus. Full-time employees, single parents, and students with impairments that hinder them from attending traditionally taught courses can participate in online education. In addition, students have more awareness and experience with computers and the Internet, and are therefore beginning to expect online components to their courses, and to see such experiences as useful and necessary training for employment.

Finally, public access to the Internet is growing rapidly and there has been a proliferation of affordable, easy to use web page development programs. By the late 1990s, there were over 10,000 Internet service providers (ISPs) in over 120 countries making it possible for anyone in those nations with a sufficiently powerful computer and a telephone line to access

the Internet for a modest monthly fee (Simonson et al., 1999). These developments have made it more feasible for faculty to create and manage online instruction and more practical for students to access such courses from both on and off campus.

Extent of Electronification

Online delivery of educational material is not an all or nothing proposition. As discussed above, faculty can select their online involvement (i.e., the extent of electronification of their courses) at any point along the continuum from no online material to complete stand-alone online delivery. Some research has shown that students who receive a combination of face-to-face instruction with a web supplement perform better than their counterparts who receive just traditional or just web-based instruction and are much more satisfied with their learning experience (Goldberg, 2000). For a compilation of research studies comparing student performance and satisfaction in a range of course presentation methods, see the TeleEducation New Brunswick web sites *No Significant Difference Phenomenon* (2000a) and *Significant Difference* (2000b). However, determination of student learning based solely on delivery medium should be accepted cautiously. Dealing with human factors and controlling parameters make these types of comparative studies difficult to design and implement (Kadiyala & Crynes, 2000). Joy and Garcia (2000) have identified potential flaws in the research methods of many media comparison studies.

Ultimately, the decision on the extent of electronification should be based on the proper balance to meet the needs of the students, faculty, and university (Thompson & McGrath, 1999) while grounded on sound instructional design strategies. Factors that influence this decision, beyond meeting the needs and expectations of students, include the faculty member's responsibility to ensure effective instruction, and the program's need to satisfy accrediting bodies while fulfilling its mission.

Web-based Software

There are many options available for the development and delivery of web-based educational material. The options range from software designed specifically for online delivery (e.g., WebCT, TopClass, Web Course in a Box, CourseInfo, Lotus Learning Space) to information management systems (e.g., Lotus Notes) to programming everything from scratch using HTML and JAVA. Marshall University's Center for Instructional Technology (1999), Boston University's Office of Information Technology (1999), and the University of the Future (2000) have compiled comparisons of courseware products. The courseware product used by the authors to implement the online course supplement was WebCT (WebCT, 2000b). WebCT was used because it met the authors' needs and was supported by the university[1]. There are also many software programs available to aid in the development of HTML pages (e.g., Adobe PageMill, Microsoft FrontPage, Claris HomePage). However, due to the authors' previous experience in developing web pages, the HTML content pages of the online supplement were programmed directly in HTML using the text editor BBEdit (Bare Bones Software, 2000).

History of WebCT at Iowa State University

In the summer of 1997, the Iowa State University (ISU) Vice-Provost for Extension funded a Distance Education Experiment Grant for the purpose of reviewing web-based online courseware development and delivery software packages. The initial software review team included faculty and staff members from several colleges and computer service centers across campus. After initial review of available commercial products, two packages were selected for a one-year pilot test: TopClass, by WBT Systems in Ireland, and WebCT, from the University of British Columbia in Canada. In the fall of 1998, it was decided by common consent of course developers, computer support staff, and program administrators to continue only with WebCT. A one-year, 3200-user license was purchased for WebCT. When the WebCT license was renewed in December of 1999, ISU switched to a Linux version with unlimited user access and made improvements to the web server. During the Spring 2000 semester, there were 236 WebCT-based courses offered or under development at ISU and more than 5000 student accounts had been created.

Description of WebCT

WebCT (Web Course Tools) is designed for developing, delivering, and managing web-based courses and is currently being used by over 6 million students at 1300 institutions in 55 countries (WebCT, 2000a). The development, management, and use of a WebCT course is done through a web browser, such as Netscape or Internet Explorer, thus eliminating any special software requirements by the student or course instructor. The WebCT program resides on a standard web server.

WebCT was designed for use by non-programmers, though the authors feel that a basic understanding of web page development is essential for effective course development. The package provides an interface that allows the developer to structure the course from an initial home page. The home page typically contains a title banner, introductory paragraph, announcements, menu, and footer information such as the name and logo of the department and school. The menu contains up to five different types of information structures:

1. links to other menus pages (called "tool pages" in WebCT)

[1] The authors themselves did not conduct extensive comparisons of courseware products and thus, it is not the authors' intent to endorse WebCT as being the best courseware product available. Each courseware product has unique strengths and weaknesses that should be considered when selecting a product to meet specific needs. Independent reviews of these products are readily available to interested developers.

2. links to WebCT tools, such as a bulletin board (see Figure 1 for a list of tools)
3. links to external web sites
4. links to single pages
5. links to "paths" (an ordered series of web pages and the learning tools associated with each page)

The tools provided by WebCT can be divided into three categories: designer tools, communication tools, and general learning tools (Figure 1). Detailed information about WebCT is available at the company's home page: <http://www.webct.com/>.

Case Study

Description of Course

Safety in Manufacturing (ITEC 392) is an overview course, averaging 30 resident students per semester, covering broad topic areas in occupational safety and health (Figure 2) with a special emphasis in manufacturing environments. This course is a required course for all industrial technology options at ISU. As the only required occupational safety course for industrial technology students in the manufacturing and in the training and development options, the focus of the course is on safety issues from a management or supervisory role in a manufacturing setting. This course has traditionally been taught as a 3-credit lecture course incorporating cooperative/team-based learning with group assignments and projects.

Description of Online Supplement

A web-based component was developed using WebCT to supplement the residential instruction of *Safety in Manufacturing*. This component consisted of outline notes for all course topics, a variety of communication tools, and student tools as shown in Figure 3. The course calendar is used to keep students apprised of daily topics, reading assignments, field trips, and due dates for homework and projects. This information is duplicated from the course syllabus, but is updated during the semester if changes occur. Students can communicate to the instructor or to their classmates using the WebCT email and bulletin board functions. There is a main bulletin board that everyone in the class can access, and private bulletin boards that are assigned to each base group to facilitate within group interaction. WebCT allows students to forward their WebCT email to a different email address should they prefer to receive all of their email at one address. In addition to the communication tools, WebCT is also used to post student grades so that a student can access their current grade at any time. These online components were first used to supplement classroom instruction in the fall 1999 semester.

Case Study Data Collection

To gage the reaction of students to the WebCT supplement for *Safety in Manufacturing*, a student survey instrument was administered. The survey was adapted from work done by the University of Missouri's WebCT Support Team (1999) to meet the authors' needs and address the specific WebCT components implemented. The questionnaire consisted of 13 questions and was administered anonymously along with instructor evaluations at the end of the semester. Being that this was the authors' first attempt at using an online supplement, there was no opportunity to previously validate the survey and thus this administration of the survey should be considered a pilot study from which future evaluations will be based. As such, the results of the survey are presented here as a reflective case study without the typical experimental research structure.

Findings

Thirty-four surveys were completed by students at the end of the Fall 1999 semester. For 53% of the respondents, this was their first experience with a class that used any type of a web site. The majority of the class (70%) indicated that they accessed the WebCT information once a week throughout the semester. The location from which the students most often accessed WebCT was the departmental computer lab (65%) followed by their place of residence (32%). The industrial technology students considered themselves to be competent computer users. Eighty-two percent ranked their computing and information technology proficiency to be a 3 or 4 on a scale from 1=novice to 5=expert. Thus as expected, they were able to quickly master the WebCT environment and indicated very few problems in interacting with WebCT after the first two weeks of the semester. [Note: During the first week of the semester, the student database on the campus WebCT server was overwhelmed as students across campus created new accounts in WebCT courses. Even though this was not directly a WebCT issue (the problem was with the capacity of the server), it did impact the students' ability to access the online information at the beginning of the semester.]

The students preferred the WebCT supplement to previous web-based course materials and indicated that the WebCT course component was valuable and improved their learning experience. Overall, they were satisfied with their WebCT experience and 97% indicated that they would prefer a class with a WebCT component to one without. Table 1 details questions regarding student perceptions.

Conclusions

Based on the work to-date and feedback from participating students, the following conclusions were drawn by the authors:

- WebCT is a powerful tool for delivering and managing web-based courses. Because of the options and features of WebCT, the learning curve for instructors/developers is higher than that of more simplified web-based course tools. However, after learning the structure and capabilities of WebCT, using and maintaining web-based course components with WebCT is no more difficult than using a powerful desktop publishing program.
- The authors believe the real strength of WebCT lies in its management and administrative tools. WebCT provides a structure for managing course content and student communication. WebCT automates administrative functions

such as keeping track of when students access the material, how often, and what part of the course content they are using.
- Students appreciated the web-based supplement to *Safety in Manufacturing* and considered it to be a useful and valuable component to the overall delivery of the course material.
- Students used the web-based material in a variety of ways. For example, some students returned to the content outlines numerous times to aid in studying while others printed the outlines and then annotated them in class rather than taking notes from scratch.
- Students accessed the web-based material from where they had easy access to the web–departmental computer labs or personal computers at their place of residence.

Discussion/Reflection

The authors believe that online education is clearly an important part of the future of higher education and continuing professional education. Whether this has a positive or negative impact on the quality of the educational experience depends on how faculty approach online education. It is clear that the paradigm of teaching online differs from traditional resident classroom instruction (Khan, 1997). It would be a mistake for faculty to base an online course simply on electronic versions of resident instruction material (e.g., PowerPoint presentations, traditional group activities, closed-book exams, etc.). At the same time, there are opportunities for faculty to enhance and improve the educational experience for students through the use of online course components or self-contained online courses, given that they have the time and resources to develop appropriate educational material.

The resources, particularly time and software support, required to produce web-based curriculum cannot be overemphasized. Yet, these needs can be minimized when developing web-based supplements to residential classes. During the development of this online supplement, it became clear to

Table 1: Student Perceptions Regarding the Use of WebCT

	Strongly Agree	Agree Somewhat	Neutral	Disagree Somewhat	Disagree Strongly
I found this WebCT based course preferable to other web-based courses I have used in the past.	14	10	10	–	–
The WebCT class site was valuable and improved my learning experience.	12	20	2	–	–
I prefer to have my course-related email separated from my personal email.*	6	9	5	3	6
It is important to have experience using the latest technology applied to my discipline of study.*	19	7	3	–	–
Access to my grade information prompted me to take action, such as visiting my instructor or seeking assistance from members of my base group.*	11	9	8	1	–
I spent too much time learning the technology.*	–	–	7	15	7
In general, I am very satisfied with my overall experience with WebCT.*	15	13	1	–	–

N=34
*Only 29 students completed these questions which were on the back of the questionnaire.

Figure 1: WebCT Tools

Designer Tools	**Communication Tools**	**Learning Tools**	
Account creation/control	WebCT email	Calendar	Progress report
Course backup/transfer	Bulletin board	CD ROM	Quiz/survey
Course interface design	Chat	Glossary	Reference/reading list
Course template	Whiteboard	Gradebook access	Search
Gradebook management		Image database	Self drills
Page tracking		Index	Student homepage
Statistical analysis		Learning goals	Student notebook
Student tracking		Password tool	Student presentations
Welcome page			

the authors that to produce a quality self-contained web-based course was beyond the means of our current resources both financially and in the amount of time that we could devote to its development.

To produce a self-contained online course that is professional in presentation requires a significant commitment in time, technical skills, and financial resources. Furthermore, faculty tend to be topic domain experts and may not have the technical skills or instructional design skills for developing web-based instruction. As an additional compounding factor, the current demands on the time of junior faculty make it difficult to devote the time required to develop technical and paradigm skills required for distance education, particularly when there is no reward mechanism in the tenure and promotion process at research institutions for devoting time to distance education development. A more efficient use of time and resources may be a team development approach where faculty serve as domain experts and the intellectual managers of online education. However, this approach would require institutional commitment to distance education development in support staff and services, release time or rewards for participating faculty, and in addressing intellectual property copyright and ownership issues of online educational materials.

Recommendations

The authors encourage all faculty members to explore the possibilities of web-based components to supplement residential instruction. This exploration may start with simply posting office hours and a syllabus online. Much like students, faculty need to learn to use the web to their advantage and not get caught in the hype or lost among the endless possible variations that the web offers. WebCT is an excellent tool to start this exploration because it allows instructors/designers to use as much, or as little, of the functionality as they desire. This exploration may also spark the desire for faculty to invest the time and resources to develop stand-alone web-based distance education courses.

Figure 2: Topical Content of Safety in Manufacturing (ITEC 392)

Safety and Health Movement	Occupational Injuries	OSHA
Human Factors	Ergonomics	Stress and Safety
Safeguarding	Control of Hazardous Energy	Hand and Power Tools
Slips, Trips, and Falls	Back Safety	Powered Industrial Trucks
Electrical Safety	Fire Safety	Chemical Hazards
Chemical Labeling	Hazard Communication	Confined Spaces
Noise and Vibration	Personal Protective Equipment	Respiratory Standard
Emergency Preparation	Safety Analysis	Workplace Violence
Bloodborne Pathogens	Environmental Safety	Total Safety Management

Figure 3: ITEC 392 Home Page

Web-based distance education is much more likely to be successful and rewarding to faculty who have already developed competencies in delivering material online within the more familiar and controlled environment of their residential courses.

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