Observations of using Web Page Software to Enhance Learning

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Abstract

This paper discusses the impact of using web page software (WebCT) to enhance teaching and learning for an undergraduate course in Environmental Engineering. Single factor, analyses of variance (ANOVA) were performed on student's overall grades when the course was offered with and without a WebCT web page at the 90 percent and 95 percent confidence level. There was no significant difference between the overall student grades when the course was taught with WebCT compared to when the course was taught without WebCT.

Introduction

In recent years, there has been a public outcry concerning the quality of education at public universities, especially with regard to the lack of quality teaching. The overall sentiment is that professors are not spending quality time in the classroom and that at the larger research universities, unqualified graduate students are teaching many of the core undergraduate engineering courses. As a result, some states such as Florida have encouraged outstanding teaching by implementing a Teaching Incentive Program (TIP) (Najafi, 1997). A faculty member's base salary is increased by $5,000 annually for being a recipient of such an award. With the increased interest in quality education, professors are now using multi-media techniques, computers, slide shows, and Web sites to enhance teaching and learning. This paper reports on some of the trials and tribulations of using WebCT in an Environmental Engineering undergraduate course at the University of South Florida.

WebCT

WebCT is software to set up a web site and course materials to be utilized on the Internet. It is designed to allow professors to establish a web site with relative ease. There is no requirement to be knowledgeable with Hypertext Markup Language (HMTL). Some of the major attributes of WebCT are a home page; links to other important home pages and web sites, student management and tracking capabilities; and on-line testing. A fee is incurred for using the software based on the number of students that have access to the web site.

ENV 4417 Water Quality and Treatment

Water Quality and Treatment is a 4000 senior level course in Environmental Engineering and is required by all incoming graduate students with backgrounds other than Environmental or Civil Engineering. The course is designed to introduce students to the proper selection and design of the unit operations and unit processes required to treat water and wastewater. Normally, the course is taught during the summer term for 10 weeks through the Florida Engineering Education Delivery System (FEEDS), a live televised course with some remote sites that utilize

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videotapes. I have taught the course on numerous occasions and decided to try to enhance student interest and learning by developing a simple web site that students could access at their convenience.

Elements Established for the Web Site

The web site for the course was established to enhance student learning and interaction with the course materials and instructor by providing supplemental information not distributed in-class and through E-mail. Important items included in the site were: course syllabus; course requirements; design project description; topics and requirements for technical paper; example of literature review; and solved homework problems and example problems. The solved homework problems and supplemental examples were only available through the course web site and were not distributed in-class. Figure 1 shows the major icons for the course home page. Other important items were a calendar of events showing topics to be covered with a brief description of the materials to be covered along with important dates and deadlines; and a web page with important links to the Florida Water Environment Association, Water Environment Association, Florida Department of Environmental Protection, and U. S. Environmental Protection Agency. A link was also provided to Netiquette, which presents the proper etiquette that should be followed when E-mailing. A link to the instructor's personal resume to provide students with additional background information about the instructor's research interests and publications was developed. Links to two PowerPoint presentations provided detailed background information on the activated sludge process and temperature interactions in the activated sludge process. The instructor's resume and both PowerPoint presentations were not handed out in-class. These materials were primarily provided for students wanting to know more about the instructor and more about the details of the activated sludge process that were not discussed in-class. All of these could be viewed by students' on- or off-site at their leisure.

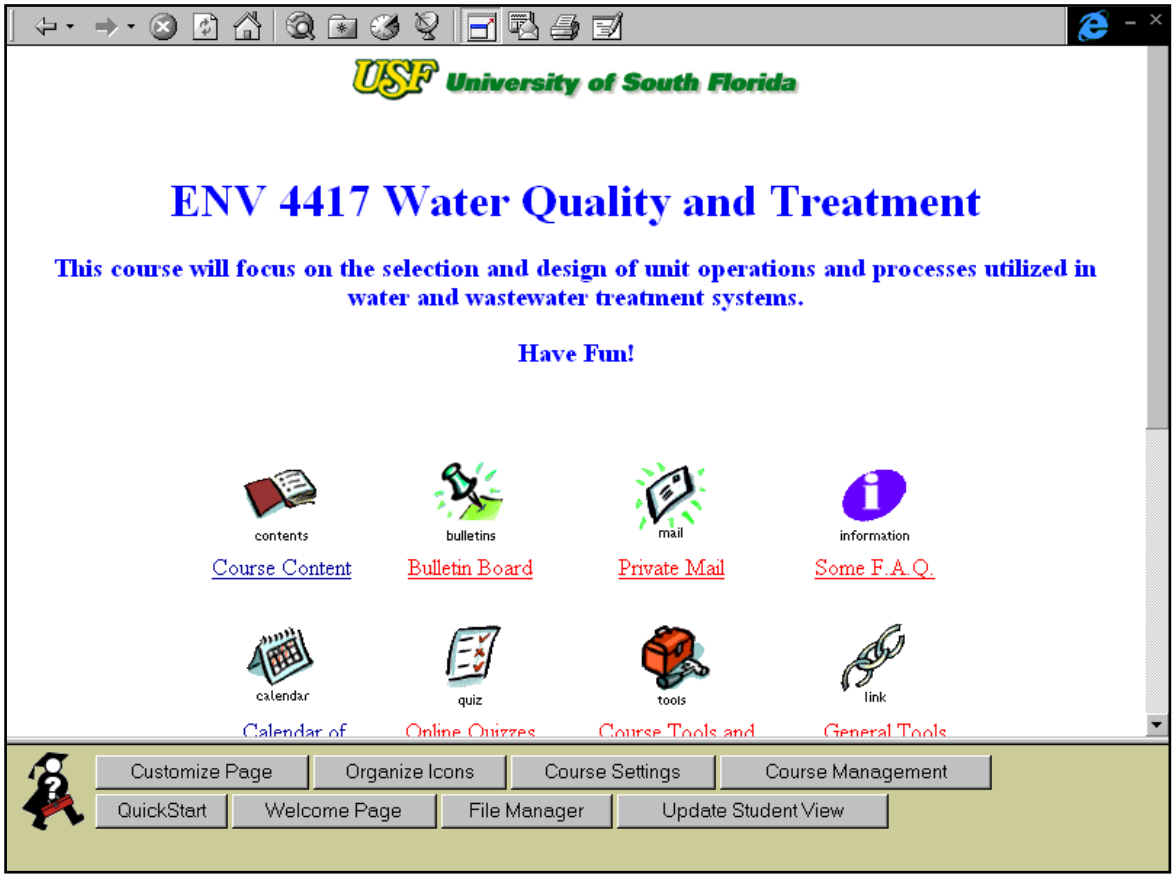

Figure 1. Home Page

WebCT also has the capability to do on-line testing, however, this was not utilized in the course. Student grades and student tracking can be accomplished with WebCT; however, these capabilities were not fully utilized during the course. Internal E-mail is also included in the software for WebCT and the software has the ability to use threaded discussions to increase interaction between students and the instructor.

Methodology and Results

A comparison of student grades was made between two classes, one from the summer of 1995 when ENV 4417 was offered through FEEDS without WebCT and from the summer of 1998 when WebCT was incorporated into the ENV 4417 course. Course requirements were the same each time the course was taught: 20 percent for library assignment; 20 percent for design project; 30 percent for mid-term exam; and 30 percent for the final exam. The mid-term and final exams were open book and open notes, multiple choice examinations, similar to the format utilized by the Fundamentals of Engineering (FE) Exam. One way analysis of variances (ANOVA) were performed at the 90 and 95 percent confidence level to determine if there were significant differences between student grades when the course was offered with and without WebCT incorporated into the course and to determine if student performance on-campus was different from student performance off-campus. The statistical analyses were set up according to the methods presented by (Freund, Livermore, and Miller, 1960) and were performed using the data analysis tools in EXCEL.

Comparison of Student Grades With and Without WebCT

The total number of students enrolled in ENV 4417 during Session C of the 1998 summer term at the University of South Florida in Tampa was 36. Twenty-five of these students attended class in Tampa at the FEEDS studio in the Engineering Building II. Two students viewed the course live in Lakeland, Florida; two viewed the course live in Sarasota, Florida; one student viewed the course live in Key West, one student viewed the course live in St. Lucie, Florida, and one student viewed the course live in Pinellas Park, Florida. There were another four students who were located at remote sites at the University of North Florida in Jacksonville; Florida State University in Tallahassee, Pratt and Whitney and South Florida Water Management District in West Palm Beach, Florida. At times, the students at the remote sites were 1 to 2 weeks behind the students in Tampa due to technical difficulties with the FEEDS staff getting the video tapes out to the remote sites. The overall average grade for the course was 2.43 based on a 4.0 scale. The overall average for the Tampa students was 2.36 compared to 2.60 for all of the remote sites. The overall average for the students at the live remote sites was 2.50 compared to 2.75 for the video tape sites. The students that took the course off-campus appear to perform slightly better than those on-campus. Perhaps some of this can be attributed to students at the remote sites being able to view the tapes at their leisure and using the web site more frequently than the students in Tampa. One off-campus student who viewed the course live received a satisfactory grade since this student took the course on a Satisfactory/ Unsatisfactory (S/U) basis.

I also taught the course during Session C of the 1995 Summer Term when WebCT had not been incorporated into the course. A total of fifty students were enrolled in the course. Fourteen students took the course off-campus through the FEEDS network. Five students were enrolled through the FEEDS videotape program at Eglin AFB near Ft. Walton Beach, Florida and the University of West Florida, in Pensacola. Nine students viewed the course live off-site: two at McDill AFB in Tampa, and two in St. Lucie, one student at USF in Sarasota and another four students at USF in Lakeland, Florida. The overall student grade average was 2.86. The overall average of the students in Tampa was 2.89 compared to 2.79 for the students off-site. Students in Tampa tended to perform slightly better than the students off-site, which did not occur during the summer of 1998. The overall average grade for the students taking the course off-site by videotape versus live were 2.78 and 2.80, respectively. There appears to be no significant difference in student grades between the off-site video based instruction versus live instruction delivery.

Table 1 shows the results of the analysis of variance (ANOVA) statistical analyses on student grades from the summers of 1995 and 1998. Table 2 shows the ANOVAS performed on student grades related to accessing the web site.

Table 1. Analysis of Variance Summers 95 and 98

Category	F	$F_{critical}$	df	α
Overall Grades	6.05	3.96	1,83	0.05
Overall Grades	6.05	6.95	1,83	0.01
On-Campus	6.19	4.00	1,59	0.05
On-Campus	6.19	7.08	1,59	0.01
Live Off-Campus	0.40	4.67	1,13	0.05
Live Off-Campus	0.28	9.07	1,13	0.01
Overall Off-Campus	0.35	4.30	1,22	0.05
Video Tape	0.01	5.59	1,7	0.05

Table 2. Analysis of Variance for Students Accessing Site

Category	F	$F_{critical}$	df	α
Accessed On-vs. Off-Campus	1.05	4.23	1,26	0.05
Accessed vs. Nonaccessed	6.67	4.14	1,33	0.05
Nonaccessed	0.22	6.61	1,5	0.05

At an alpha value of 0.05 or 95 percent confidence level, there was a significant difference between the overall student grades between the summers of 1995 and 1998. However, no significant difference was observed at the 90 percent confidence level. The same phenomenon was observed for students that took the course on-campus versus those who took the course off-campus. A significant difference was observed at an α value of 0.05 but no difference was observed at an α value of 0.01. No significant differences in student grades were observed for students taking the course off-campus between the two summers for both the 90 and 95 percent confidence levels. Overall student grades off-campus (live and videotape sites) were no different for the two courses at an alpha value of 0.05. Students taking the course by videotape received essentially the same grade whether or not WebCT was incorporated into the course.

Students Accessing Web Site

A direct correlation between student grades and the number of times a student accessed the web site could not be ascertained. However, statistical analyses using analysis of variance did indicate there was some relationship between student grade and accessing the web site. For those students accessing the web site, there was no significant difference in student grades for on-campus versus off-campus students at a alpha value of 0.05. On-campus and off-campus students that did not access the web site received the same grade based on an analysis of variance at the 95-confidence level. As intuition would suggest, students that accessed the web site did tend to have better grades, based on the ANOVA performed at an alpha value of 0.05. The average number of hits for the web site averaged 21. Only seven students did not access the web site, five of which took the course on-campus and the two remaining were remote live sites.

The major problem that students had was having access to the web site. During the first two to three weeks, both the students and myself had difficulty actually logging on to the web site as the web server could not handle the overwhelming response. This was frustrating to me as well as to the students and resulted in many of them not using the site the rest of the summer semester.

Developing and maintaining a web site can be very time consuming but it does provide students with another opportunity to have access to the professor and additional materials not presented nor discussed in the classroom, which can enhance interest and learning in one's course.

Summary and Conclusions

Based on the above results, it appears that the WebCT course did not have a significant impact on student grades. The two courses were taught essentially the same with the exception of students having access to WebCT during the summer of 1998. A larger sample size may have shown a significant difference. However, the overriding factor that may have contributed to lower overall student grades in 1998 was the large contingent of Chemical Engineering students which represented approximately 68 percent of the enrollment with only 6 percent representing Civil and Environmental engineers. This is an elective course and it is believed that these students did not put as much effort into the course as the students did during the summer of 1995. During the summer of 1995, 57 percent of the students were Civil/Environmental Engineers while Chemical Engineers made up approximately 35 percent of student enrollment. In the future I will utilize subjective evaluations to obtain feedback from the students about the usefulness of WebCT.

References

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