Use of Web-Supported Material in Teaching
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Abstract—This paper describes the use of web-supported course offering for undergraduate students at Texas A&M University at Qatar (TAMUQ). Courses are made available online using Blackboard (Bb) Vista. Bb vista learning system is an e-learning software that allows educational institutions to create and host courses on the Internet [2]. Complete web-supported courses were offered to undergraduate students across all levels. Two case studies are presented in this paper, a sophomore course ECEN 214, Electric Circuit Theory, offered to second year students and ECEN 455, Digital Communications, offered to final year students. In this paper, the many tools offered by Bb Vista are discussed, such as interactive homework submission system, grade book, and anonymous survey submission and chat tool. In addition this paper will discuss the use of the ‘Assignment’ tool to create customized homework problems for each individual student, each student in the class is presented with a set of unique problems, generated by Bb Vista. Web-supported course delivery was evaluated in terms of academic performance and in terms of student acceptance. In general the web-supported method of course delivery was a more successful compared to the lecture-only delivery, both in terms of academic results and in terms of student acceptance. On average, students in the combined lecture and web-supported delivery method performed better academically than students in traditional lecture-based course offering. This approach presented in this paper can be implemented by any course in the Electrical and Computer Engineering (ECEN) Program and more generally can be extended to be used in any educational institution.

I. INTRODUCTION
The WWW provides educators with an outstanding opportunity to deliver courses or to supplement existing courses. There are many advantages to providing educational material on-line including time and location-independent delivery, the ability to self-pace, the ability to tailor the educational experience to one’s background and knowledge level, the ability to communicate with other students regardless of location, the opportunity to reach a larger audience at roughly the same cost, the opportunity for student self-evaluation, and practice through online exercises, and more.

These opportunities for educators have lead to the development of a large number of web-supported courses and other training resources [4], [5]. The ECEN Program at TAMUQ has taken advantage of the educational opportunities presented by the WWW by adopting a web-supported learning system offered by Blackboard Vista (Bb Vista) e-learning system. For this reason, the ECEN program at TAMUQ put great effort in incorporating web-supported teaching in their courses with particular reference to the courses ECEN 214 and ECEN 455. Course contents were made available online. An automated homework system was implemented for ECEN 214 along with other tools such as grade book and chat.

It was our intention from the beginning not to simply adopt web-supported offering, but also to measure the effectiveness of the web-supported learning and its level of student acceptance as a teaching resource. Web-supported courses have been in place since 2005 and have proved great success. Continuous development and exploring new methodologies are investigated to facilitate teaching and bring up-to-date technology to our staff and students.

II. ONLINE COURSE STRUCTURE
ECEN 214, Electric Circuit Theory, is a required course for sophomore students undertaking Electrical and Electronic Engineering at the TAMUQ. The course provides fundamental knowledge of electric circuits, their analysis using different techniques, as well as measurement of different parameters such as voltage, current, power etc. The course comprises of a laboratory to expose students to measurement equipment, simulation of circuits, and verification of their design on electronic boards. Traditionally, this course has been offered in a regular lecture format (three hours per week) to roughly 30 students. Students’ evaluation consists of lab experiments, one midterm exam, homework assignments, and a final exam. Being a required course makes this course particularly suitable for web-supported offering as the majority of students must take it as part of the degree requirement. In this case, a quality wise course can be available in comparison to conventional lecture based offering.

On the other hand, ECEN 455, Digital Communications is a senior year elective course. It has been developed to enable students understand basic concepts in digital communications techniques. In particular, students will examine topics in digital transmission of information, source coding, sampling, quantization, BER measurement and others. The course laboratory includes a software component enabling students to conduct their experiments remotely via Internet access.

Mode of Presentation for this course consists of two lectures...
a week and a weekly laboratory session. Student Evaluation consists of homework assignments, quizzes, laboratory experiment, a project and a final exam.

The author has been teaching ECEN 214 and ECEN 455 courses for the last two years, and has consistently enjoyed many top ranking students.

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Use of the web-supported learning system software allows instructors to create and host courses on the Internet. Courses created with this software can serve as entire online courses or as a supplement to traditional classroom courses.

The usage of this web system requires simply access to the internet, knowledge on how to use an internet browser, basic word processing skills, and basic computer file management skills. Knowledge of HTML or computer programming is not required for use of this system. Depending on one’s role, this software can be used in different ways, as a designer, as an instructor and most importantly as a student.

Using a web page for a course allows the instructors to make available all course-related material through a centralized homepage. The home page is divided into several sections assignments. This environment presents several advantages over regular web pages and other web-supported teaching applications since it is fully integrated with the university databases and allows instructors to build their courses without the need of advanced knowledge of any programming language. Furthermore, access is monitored and controlled through the university gateway. Instructors can control access to allow access to only students enrolled at a particular course through their university identification (ID) number and password access. Furthermore, instructor can customize access to other students and supporting teaching staff as they perceive necessary.

For the courses considered in this paper, the course homepage was divided into the following sections, as shown in Figure 1:

- Syllabus: course description and information related to course format, assessments and due dates.
- Laboratory: this link leads to the laboratory manual which contains all experiments and related information such as equipment manual and data sheets.
- Help Desk: this link provides contact information of the instructor and supporting teaching staff appointed for the course along with office hours allocated to assist students.
- Surveys: This link directs students to surveys students submit to evaluate the course, teaching methods, and other statistical information of interest.
• Class Handouts, Additional Handouts, Recitation, Homework, and other components of the web page contain course material.

ECEN 214 web page has a similar structure, except that 'Homework' link directs students to automated homework assignment which are assigned at the beginning of the week and are available for one week.

III. Web Course Tools

A. Automated Homework Assignments

The ‘Assignment’ tool from Bb Vista has been utilized to allow students to submit their homework online and have it graded immediately. Figure 2 shows a homework problem sample as seen by the students. The existing software allows the parameter values used to change for each attempt of the homework. The added benefit of this capability is that for large classes of students, each student is presented with an individual set of problems. From an instructor’s point of view, this system has the advantage of tracking students and numerical values of several circuit parameters are changed so that the student must rework formulas with different values to find the correct value requested in the homework problem. After a student has submitted an answer, the student receives a grade and feedback on the correct answer.

B. Grade Book

Grade Book is one of the main course management tools that Section Instructors can use to manage students grades. Records of students marks can be entered and monitored in the Blackboard Learning System and can be made available to students.

Grade Book is a spreadsheet-like tool, in that it contains a grid of rows and columns that can contain data. Unlike a spreadsheet, in Grade Book, each column can only contain a certain type of data, such as numbers or letter grades. This ensures the integrity and standardization of data for export and other operations.

Figure 3 shows the grade book page as viewed by the instructor. Students can monitor their own progress in the course through Grade Book as it will allow each student to view and manage his respective grades without viewing other students' and auditors' grades, as shown in Figure 4.

Figure 2 Homework problems as seen by the student
A Valuable feature of Grade Book is ability to import from spreadsheet. The students grades can be easily uploaded from a spreadsheet program, like excel, if saved as comma or tab-delimited format. For a large number of students, this reduces time to enter grades. Vice versa, the grade book can be downloaded and opened with a spreadsheet program.

C. Chat

The Chat tool allows communication in real time with other users in the course. The Chat tool can be used to engage in real-time conversations with all users or selected users. The Chat tool’s Whiteboard can be used to draw objects, enter text, and import images that can be viewed in real time by other users. This allows for distance learning and communication if necessity arises.

IV. STUDENT FEEDBACK

To assess the effectiveness of web-supportive learning methods, students were asked to submit their response to a survey questionnaire at the conclusion of the course to collect their input related to the course. The survey evaluates many aspect of the course. In the survey, specific reference is...
made use of technology support tools that help enhance students’ learning experience. The survey is disseminated using Blackboard Vista. Bb Vista allows control of availability period of the survey and anonymous submission by students. Here we look at results from the questionnaire completed by all students that participated in the mentioned courses. What follows is a summary of the responses to many of the questions on the questionnaire. Generally, students were satisfied with their course offering. Students felt that their method of course delivery was effective. When asked which components of the web-supported course were most useful, students overwhelmingly cited the interactive exercises, Grade Book and availability of course material electronically. Students guessed that they had learned roughly the same (or perhaps a bit more) than they would have in the lecture-based course. On average, they felt that they had to commit a bit less time than they would have devoted to a lecture-based course. Also, most agreed that taking web-supported courses requires more personal responsibility than a lecture-based course.

The use of ‘Grade Book’ was a popular choice for students. However, chat tool was the least used tool as email system provided by the University to staff and students was effective for communication.

V. CONCLUSION

A discussion of the author’s use of web-supported teaching to deliver a sophomore and a senior course, ECEN 214 and ECEN 455 respectively to undergraduate students at the Texas A&M University, Qatar campus, was presented in this paper. From its early starts, the Electrical Engineering program adopted web-supported techniques in its course offerings. Implementation of web-supported course offering, overall, has been a success. Some of the tools that this paper discussed were the interactive homework submission system, grade book and survey submission. The interactive homework submission system allows a unique homework to be generated for each student. In arriving at conclusions, the reader must remember that this was a limited experiment in terms of the number of students involved (fewer than 50). For larger student base, it is highly possible that increased course quality of web-supported course offering will be more obvious. Course evaluations suggest that the students are more motivated and keen to learn.

This experience opens the door just a little further to an understanding of the trade-offs of lecture-based and combined lecture-based and web-supported course offerings. Some of the most interesting results of this experiment are summarized below:

- The most serious impediment to success in a web-supported offering seems to be self-motivation. Yet other students seemed to thrive on the self-paced nature.
- Further areas of development to follow up this work are automating communication regarding problems and suggestions for the homework. Another tool to embark more on is the chat whiteboard’s tool that can be used for distance teaching. A practical start would be offering recitation and help sessions through whiteboard. Finally, we are currently testing and authoring a website that will run independent of the university database and can be used to link Technical groups of interest to our students and staff.

It is our hope that web-supported learning tools will facilitate further experimentation with Computer Aided Learning for ECEN 214 and ECEN 455 in particular and more generally to Electrical and Computer Engineering.

REFERENCES


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