

Enhancing Freshman Engineering Mathematics Courses with Web-Based Material

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Abstract

The internet provides access to a wide-variety of valuable resources which can be used to enhance college-level courses. In addition, it provides many new opportunities for connecting with and supporting students. One convenient way to organize and access these resources and opportunities is through the use of web-based course management software. This paper will outline the experiences of mathematics faculty at Louisiana Tech University who have used course-based web sites for the freshman integrated engineering mathematics sequence.

The College of Engineering and Science at Louisiana Tech has replaced the traditional curriculum for freshman and sophomores engineering majors with an integrated curriculum¹ which incorporates mathematics, engineering and science. Using web-based course management software, the authors have developed and used course-specific web sites for students enrolled in the integrated freshman mathematics sequence². These sites contain content on both required assignments and optional supporting material. Assignments range from traditional problem sets to exercises requiring and / or utilizing specific web sites. Supporting material includes items such as syllabi, review sheets, course documents and links to text-specific web-based tutorial material. The instructors also made use of optional communication tools, such as e-mail and the virtual classroom.

Tracking was used to collect data on student use, and students were surveyed at the end of each term to assess the strengths and weaknesses of the sites, interest in options not utilized in the course, ease of access to the site, etc. Improvements were then made to the sites, incorporating the student feedback and instructor experiences. Based on the feedback from this and other similar projects, plans are to seek funding to expand and implement a web-based system for use in integrated curriculum courses.

Introduction

The College of Engineering and Science at Louisiana Tech has replaced the traditional curriculum for freshman and sophomores engineering majors with an integrated curriculum which incorporates mathematics, engineering and science. The curriculum integrates topics across the disciplines and incorporates active/cooperative learning, various technologies, freshman and sophomore design projects, and hands-on-laboratories. During the freshman year, the mathematics portion of the integrated curriculum focuses on differential and some integral

calculus with precalculus algebra and trigonometry presented in a just-in-time format, and an introduction to elementary differential equations.

Using web-based course management software, the authors have developed and used course-specific web sites for students enrolled in selected sections of the integrated freshman mathematics courses. These sections generally consist of 30 – 50 freshman students each. The students are expected to access the sites outside of class (although an initial in-class demonstration is presented to the students) using either the multi-purpose computer labs on campus or their own personal computer. Students in the integrated curriculum are grouped each term into student teams. Most teams have at least one member with access to a personal computer.

Content

The web sites have been primarily used in the following three ways: to provide supporting material for the course, to make required assignments, and to communicate with the class.

Supporting Material - The course web sites contain copies, and in many cases downloadable files, of items such as the course syllabus, suggested homework assignments, instructor information, as well as other course documents (guidelines for homework format, instructions for journal papers, etc.). Most of this material is also given to students in class the first few days of the term, since first-time freshman and transfer students generally do not have an active network account. Other documents, such as review sheets for exams, lecture notes, and answers to homework questions, are only made available on the web sites. Links to text-specific tutorial material were also included in these sites.

Required Assignments - In some cases, the web sites are used to make required class assignments. These assignments include group projects, web-based assignments, assignments with supporting web-based material, as well as individual assignments. All information about the assignments, including format, due dates, etc., is posted on the web site. These assignments are formally announced in class, but students are instructed to refer to the web site for all necessary information. Central announcements (regarding the assignments and where on the site to go for further information) are also posted on the site.

Communication - The course web sites have made use of a variety of available communication tools, although there is room for growth in this area. As noted above, the ability to post central announcements is used to remind students of upcoming exams, due dates, and other pertinent information. Student e-mail is used to communicate with students (collectively or individually) between classes. The Virtual Classroom feature is used for additional office hours, such as the evening before an exam. It provides the capability for students to pose questions to the instructor, communicate with other students via the discussion board, as well as draw graphs, work equations, etc., in the scrolling whiteboard window. Some end-of-the-term student assessment surveys are administered using the web site. The site capability to post student grades has also been used.

Pros and Cons

As with any tool, there are advantages and disadvantages. The information presented here incorporates feedback from end-of-term student surveys, as well as student comments to instructors and instructor observations.

Problems have been few and, generally, navigable. Initial concerns about problems with student access to adequate computer facilities did not materialize. There were occasional problems due to incompatibility between web browsers and servers/computers. Most of these problems have been corrected by having students log-on using either a different browser and/or a different computer. Some students also had difficulty with their user names and/or passwords. As the instructors had the ability to manage the user files, this was not, in general, difficult to correct *provided* the instructor was alerted to the problem. The software allows for guest access to the sites. As this does not require use of a user id or password, enabling this option allows students having difficulty with their own log-on information to access the site. There were problems at times with the server on which the web sites were maintained. The biggest student complaint was server down time and inability to log-on because of the heavy traffic load. Providing ample lead-time on assignments alleviated most of these problems, although students who waited to the last minute to complete their assignments were not always successful at logging-on. Contacting group members for information seemed to be the preferred solution to this problem. The volume of hits on the sites (one section of 50 students registered over 3300 hits for the term) was a contributor to the server problem, as were unplanned outages, and inexperience of university support personnel in managing the software. Since university support for the software has been excellent, it is anticipated that these problems will be corrected. This situation will be monitored in subsequent terms to determine if inconsistent access continues to be a problem.

Instructor time required to set-up and maintain the site could be considered a disadvantage, but it is minimized if much of the pertinent material is already in electronic form. After setting-up one course, time required to set-up subsequent courses was minimal. There are several instances in which the software could be modified to make data entry and manipulation less time-consuming (posting of grades, addition/removal of users, etc.). Another disadvantage of the particular software program used was the inability to retain spacing and fonts in cut/pasted word-processed documents. Attaching a downloadable file gets around this problem, but may pose problems for students who either do not have the appropriate software to open the file or do not have the capability to print the file.

The advantages to using web-based course management software are varied. For instructors, the ability to decrease both the confusion and class time require to shuffle papers (pass out assignments/handouts, review self-explanatory instructions/announcements, etc.) is an attractive plus. Cost savings (in the form of paper, copier charges, and staff time) can also be realized by not having to duplicate this material. The variety of customizable options available for the course, the ability to easily plug-in existing material, and the university-supplied maintenance/instructor support (loading of student names, user ids and passwords; archiving of old course sites and the creation of new ones) made the web-based course software route considerably more attractive for the instructors than personal web site development and maintenance.

The ability to provide more detailed, varied and frequent communication was seen by students as a strength of the sites. The convenience of twenty-four hour availability was also voiced as an important advantage. Many students felt empowered by the opportunity for increased responsibility for their own learning. Commuter students benefited from the “at home” access of the sites. The layout of the sites generally proved to be user friendly for instructors and students alike

Assessment

Electronic tracking was used for one course to collect data on student use. Students were also surveyed at the end of each term to assess the strengths and weaknesses of the sites, interest in options not utilized in the course, ease of access to the site, etc. For the tracked course, student use peaked in the middle of the week and on Sundays. Afternoons and evenings (until midnight) were the most popular access times, although the log showed that over the course of the term, some students had logged-on every hour of the day/night. Total accesses by user revealed that students in this section registered from 0 to 199 hits per person on the site during the term, with the average number of hits per student being 39 (about 4 per week). There were a variety of students not enrolled in the class, as well as faculty from around the campus, who also logged-on to this course site. In addition, the anonymous guest access, which was enabled for this course, registered 798 hits for the term.

Student surveys indicated that the students used the sites most often to access review sheets, assignments, announcements and external links. Students also expressed a preference for downloadable documents or documents that were both printed in full on the site and available in downloadable form. Students felt confident in their ability to use the site, found sufficient information on posted assignments, and rated most of the online documents to be of high quality. Students had variety of suggestions for additions to the sites. Most frequently mentioned were posting of daily assignments, creating sites for the other integrated curriculum classes, and the addition of a forum-type newsgroup for student exchange and discussion.

Conclusion

Both instructors and students viewed the addition of course-specific web sites as a definite plus. The course-based web management software is a convenient format for providing students with traditional material, such as review sheets and handouts, but also opens up a variety of new formats for keeping students connected to the course between classes. Student use exceeded initial expectations and fears regarding student accessibility did not materialize. Based on the feedback from this and other similar web-based projects, the authors hope to expand the use of these sites and possibly implement a web-based system for use in all integrated curriculum courses.

Bibliography

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