Using the Web for Supplementation and Evaluation:
A View from the Front Line

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Abstract

This paper describes the use of the World Wide Web to supplement instruction in two core Freshman Engineering courses at the University of Wyoming. The structure of the information and forums provided are described as well as instructor and student response to these on-line materials.

1. Introduction

The College of Engineering at the University of Wyoming has undertaken an experiment in the utilization of World Wide Web resources in two introductory engineering classes. The Web pages provide on-line access to standard review materials such as a current course syllabus, old exams and homework solutions, while also providing an on-line forum for instructor--student, student--instructor and student--student interaction. Aspects of this forum include a "bulletin board" area to which instructors can post timely notices and provide hypertext links to supplemental information, student driven databases for establishing study groups and out-of-class contacts, as well as a feedback area to which students can post anonymous messages to the instructor. In addition, the conventional course and instructor evaluations, typically relegated to a handwritten or computer readable "bubble-sheet," can now be completed in an anonymous, electronically summarized manner.

This paper briefly describes the features and "development costs" of the Web-based resources, investigates student reactions regarding the usefulness of the forums, and summarizes instructors' views regarding the tangible benefits derived. One of the courses involved is a required one credit hour *Orientation to Engineering Study*. In this case, the electronic forum enhances communication and information transfer. The other course, *Introduction to Engineering Computing*, seeks to introduce students to the ways in which engineers utilize computer tools. Here, the addition of Internet and Web utilization is a natural extension of the conventional applications of word processors, spreadsheets, equation solvers and drawing packages.

2. Scanning the Topic

The incorporation of Internet resources in engineering, math and science education has become a popular item of discussion at recent conferences and in educational journals and transactions. Specific topics of discussion include an introduction to the capabilities of various Internet and Web delivery mechanisms ([1]---[6]), the application of these technologies to specific courses ([7]---[13]), and software subsystems created specifically for on-line coursework presentation

and student evaluation ([14]---[16]). Innovation in this area is happening daily, and what follows is yet another description of an effort to supplement conventional educational processes with Web resources.

The goals established for the Web resources developed at the University of Wyoming College of Engineering are briefly described in Section 3. In Section 4, we examine the "resource tree" provided via World Wide Web capabilities for each of the courses which were "Webbed." A summary of student and faculty reactions to these resources are summarized in Section 5, with concluding remarks given in Section 6.

3. The Goals

The primary goal for Web utilization in the introductory courses was to provide a flexible means for communication: i.e., a dynamic, on-line resource for course assignments and announcements, posting of supplementary information, and around-the-clock communication between class members (students and responsible faculty). The final point is critical: the Web forum allows for student and faculty access at any time. Information can be generated and "distributed" to all parties in a real-time fashion. With the growing popularity of Web access, many incoming students have some exposure to using Internet communication, and indeed many have this capability from their dorm rooms or apartments.

4. The On-Line Resource Structure

The "home page" for the *Introduction to Engineering Computing* course is shown in Figure 1, while a summary resource tree for the links provided from this starting point is provided in Figure 2. The structure for the *Introduction to Engineering* course is quite similar. Curious readers are encouraged to investigate the links accessible at
`http://wwweng.uwyo.edu/classes/`.

The default page design takes advantage of the "frames" capability of web browsers such as Netscape, however most resources can be accessed with a "non-frame-savvy" browser. The bulk of the information is in standard HTML3.0 with a few documents provided in Adobe Acrobat form. Interactive pages, including the on-line evaluation forum and various data bases, incorporate both document embedded JavaScript and server CGI programming in C. Features of the resources are as follows:

Purpose of Site Brief description of the goals and intended audience.

Instructors On-line catalog of instructor information for multiple section courses. Annotates office hours, e-mail address and telephone number as demonstrated in Figure 1.

Syllabus Current syllabus for course.

Policies General course policies regarding homework and grading.

Schedule Current topic schedule for each course instructor, updated dynamically with reading assignments and fluctuations in topic coverage.

Help Sessions   Current schedule for Teaching Assistant help sessions.

Homework Solutions   On-line listings of graded homework assignment solutions.

Previous Exams   On-line listings of previous semester examinations and solutions.

Bulletin Board   Posting area for each instructor, providing real-time response to student queries and immediate update of information.

Student Data Base   Forum for student interaction for establishing study groups (eases task of identifying students with similar schedules and topics of interest).

Helpful Links   Hypertext links to materials associated with class topics.

Instructor Evaluations   On-line, secure, anonymous course and instructor evaluations.

As shown in Figure 2, a secure (password protected) instructor control page is provided to allow the instructors to modify their bulletins and related course information. This interface requires the instructor to have little or no experience with Web page development.
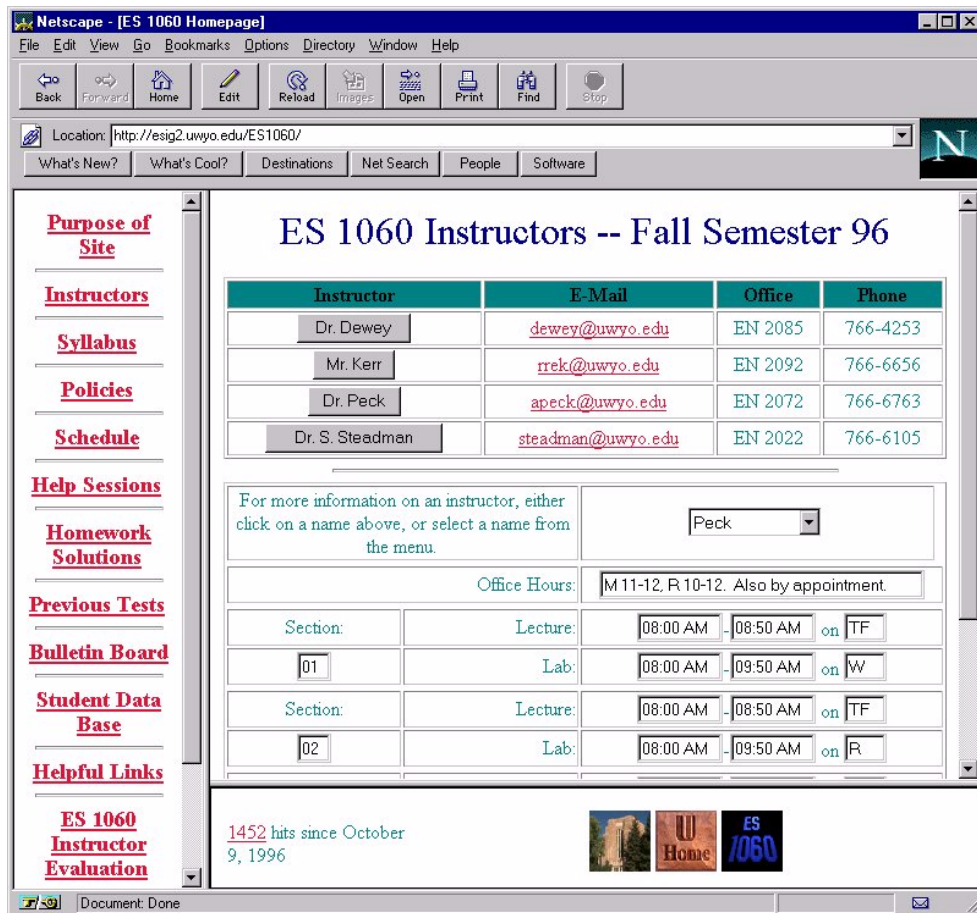

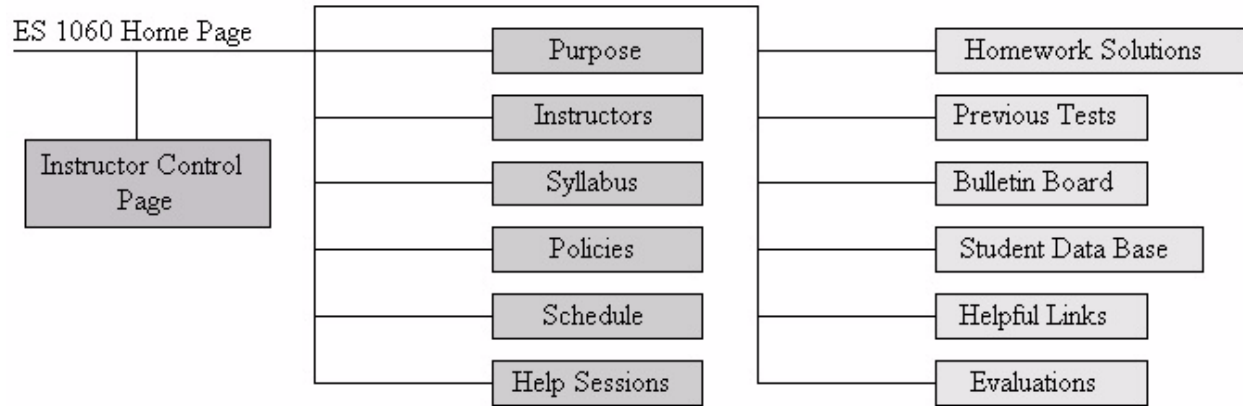**Figure 1:** Home Page for Example Course.

Figure 2: Resource Summary Tree for Home Page of Example Course

5. Reactions

Student reactions to the Web resources have been largely positive. They appreciate the on-line access to course related information and the associated savings in time compared with checking out reserved printed materials at the campus libraries. As mentioned in the Introduction, many of the incoming freshmen are Internet savvy and are tending to expect such on-line resources.

Faculty response is mixed, with many faculty recognizing the benefits to course coordination provided by the Web. In subsequent semesters, College of Engineering courses offered via distance-learning methods (e.g., compressed video across the State of Wyoming) will be supplemented via Web resources based upon those demonstrated in this first experiment.

From a computer systems management perspective, the Web resources have not been inexpensive in development. The bulk of the work, however, including HTML coding, graphics development, CGI programming and JavaScript enhancements, has been completed by undergraduate laboratory assistants under the supervision of the facilities director. The particular assistants have demonstrated uncanny skills in Web development, and their prowess in this regard has been a major contributor to the success of the experiment.

6. Conclusions

This paper has briefly described the experimental use of World Wide Web resources in two core Freshman Engineering courses at the University of Wyoming. The development costs, although not trivial, have been outweighed by the positive reactions to the on-line resources provided. Having "stuck a toe in the water," the effort is continuing, with additional courses being brought on-line. As with any new technology, the benefits to education should be carefully examined. It is our experience that the Web provides a beneficial channel for enhancing communication in even the fundamental engineering courses. It's future appears bright.

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