

Development and Implementation of Web Based Courses for Engineering Technology

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Distance education in general and on-line courses in particular have an increased presence in university curricula. In 1993, *Peterson's College Guide* noted at least 90 schools that offered on-line educational opportunities while the 1997 Distance Learning guide included over 700 institutions. The increase in interest is attributed to a student population that is increasing in age, and thus, has increasing off-campus demands on students' time. This environment makes off campus learning a desirable alternative.

The Distance Education Division of the Continuing Education Program at the University of Houston (UH) is responding to the needs of the diverse UH student body by offering distance education opportunities. The initial effort was directed at courses delivered in real time via one-way video with two-way audio delivered to remote locations in the greater Houston Metropolitan area and also courses delivered via local cable television in a delayed broadcast mode. In 1996, on line courses delivered via the Internet were added to the distance education opportunities. Within the college of Technology, three course were adapted for on-line delivery: Applied Technical Statistics, Industrial Computer Applications and Control Instrumentation. These courses were initially offered on line in the Spring 1997 semester.

Development Process

On line education involves any form of learning or teaching that utilizes a computer network. For the three UH courses, the Internet was used to deliver the courses in an individualized instruction format. World Wide Web pages were developed for each course and e-mail was used to conduct instructor/student transactions at a distance (e.g., turn in homework, send out homework assignments or special class handouts, etc.). E-mail was also used on a limited basis to simulate class discussions. In the initial development of the course, attention was given to the following considerations:

- Simplicity in development - For our faculty, this was a first attempt at on-line learning and teaching, so it was important to begin with an approach that was simple.
- Simplicity of use - The intent was to design a course web page that would enable students to follow the organizational structure of the course and easily navigate the site.
- Use of the instructional resources on the Internet - It was important to the instructors to take advantage of the unique capabilities of the Internet in course development.

Initial efforts to implement on-line learning included the following:

1. Investigation of other Web sites - There is a mass of course information on the web including outlines, instructional materials, data, and interactive materials. Identification of these resources not only assisted in providing insights regarding how to organize material but also provided course references for the students.
2. Investigation of development tools and procedures - Again the Web provided massive amounts of information and software that provided instruction and development assistance for Web pages. Some of these are referenced at the conclusion of this paper.
3. Curriculum development - Once material was identified and the medium was explored, specific course materials were developed and adapted, consistent with existing course objectives. This process is an on-going one; new materials and ideas that constantly come into focus are readily included in the course materials.
4. Consideration of policy adaptations for distance delivery - The general University policy regarding distance education requires that students meet the same requirements as those enrolled in a traditional course. Thus, the same content was included; however, in some instances course/evaluation procedures were modified to include web-based projects. In addition, some take-home examinations were utilized in conjunction with those administered on campus.

Course Features

The courses were designed to allow students to meet course requirements without attending lectures. The three instructors had different expectations with respect to how much students would have to be on campus to interact. The web sites included materials that were designed to organize and direct independent studies by the students. In developing the course web sites, two of the instructors developed their web sites by using HTML and a word processor while the third used an editor, *Microsoft® Front Page 1.0*. In all cases, it was determined that a baseline understanding of HTML was necessary to successfully develop web material. As Web authoring software increases in capability and flexibility, it seems likely that soon knowledge of HTML will not be necessary for this type of development. Features of the courses included the following:

1. A course syllabus provided a basic organizational framework. In most ways the syllabus was comparable to a traditional course syllabus, providing text book references, homework assignments and dates for course completion. An added feature was links to WEB references, keyed to each topic, that provided additional instruction in the topic.
2. Solutions to selected problems were presented. This feature is probably particularly important for an on-line course where it is not feasible for students to obtain in person assistance every time.
3. Course projects and assignments were developed using web resources Through the web, students have access to numerous government, business and educational data bases; in addition, there are sites that provide information regarding computer applications that are relevant to course assignments and projects.
4. Listserv mailing lists were used as a primary vehicle for communication among students and between the instructor and the students. This resources was used to respond to questions

regarding homework, provide feedback to students regarding course performance, remind students of up coming deadlines and make inquiries regarding missing assignments; it also allowed students to communicate among each other regarding certain assignments.

5. Some course notes were posted directly to the web site; however, recent courses have also included course notes that are PowerPoint® slides. Microsoft® offers a free PowerPoint® reader that students can easily download to read the slides. The slides provide students with insights regarding key points and enable the instructor an opportunity to present important issues in an alternate format.
6. Test Information was provided. The web site was used to provide feedback regarding the examination, and detailed solutions were posted once examinations were completed.
7. The web materials conveyed clearly defined policies regarding submission of homework, testing, and tutorial assistance when required. The goal was to make this communication direct and simple to understand.

Implementation

Student enrollment was completed in a traditional manner, and prior to the first class day students were required to attend an orientation session on campus. In addition to the initial visit to class for orientation, students were required to come to campus for a minimum of one class meeting during the semester (this is a requirement of the Texas Higher Education Coordinating Board). The instructors used on-campus meetings for examinations but also to enable students to use the computer laboratories and specialized software. Tutoring was available in person, via e-mail or on the phone. One useful technique was to set up telephone office hours so that students had specific times to call and receive answers to questions. Another important component was regular contact with the students, initiated by the instructor. E-mail messages were sent in advance of all assignment or test deadlines and if a student was observed to be falling behind, the instructor made personal phone calls to the students.

Conclusions

Implementation of the approach made advantages and disadvantages clearly apparent. Experiences led to the following observations.

- Students were not required to come to lectures, a real advantage for (1) students living in the Houston area who must spend an hour or more to drive to campus, (2) students who had work conflicts that prevented them from attending a regularly scheduled class, or (3) students who had class schedule conflicts (i.e., two courses they had to take for graduation were offered at the same time).
- Students could take the course in their own time frame. Time was probably the most important reason students chose to take the course in the on line format. Many of them were attending other courses on campus but they were unable to schedule the course at the time it was offered.
- The numerous resources that are available on line created the opportunity to incorporate a variety of student projects and provide additional learning materials.

- Students who are to be successful with an on-line course must be more committed to completing the material than students in a traditional class. Without a regular class meeting, the students must motivate themselves to initiate study of the material. Experience showed that students who were not committed to completing the material withdrew from the course early; those remaining were generally timely and responsible in their commitment to complete the course.
- On-line course development is time intensive. The instructor must spend a great deal of time developing, identifying and linking resources. There was a significant time investment by the instructor in learning how to develop materials that could be placed on a web site, and in exploring and utilizing the resources that are already available.
- On-line course implementation is time intensive. Instructors must work with students on an individual basis rather than in a group setting. More hours were spent contacting students one-to-one via e-mail and phone than are normally spent as contact hours for a traditional class. Furthermore, maintenance and on-going development of the web site is essential.
- Logistics of implementation may be difficult. For example, in a problem solving course where student work involves algebraic manipulation of complex equations, the best solution to submission of assignments and tests currently seems to be FAX, personal delivery or US mail. It is impractical to expect all students to submit electronically since this would require each student to have access to (perhaps) a scanner or sophisticated software for typing math equations.
- Lack of scheduled direct contact with the students (i.e. formal classes) made it more difficult to assess and address particular student problems. It became important for the instructor to schedule times for contacting students by telephone to discuss their progress. Regular e-mail reminders were helpful but not sufficient. A primary function of these contacts was to motivate students to complete and submit materials in a timely fashion.
- The absence of regular face-to-face contact precluded using typical teacher-class discussions; the distance and the technical requirements inhibited spontaneous insights that are sometimes present in class interactions.
- Because of the individualized nature of the course, it is imperative that instructors provide immediate and detailed feedback to the students. Assignments must be graded and returned immediately in order to keep students on track.
- All three instructors want to investigate and pursue more intensely for future courses techniques that simulate group interactions in an on-line format.

All three instructors agree that on-line instruction is likely to grow in popularity and availability and all are ready to continue course development in this format even though the time investment is significant. They also invite you to peruse their course web sites at
<http://web.tech.uh.edu/classes>.

Resources

The following sites can assist you in the planning and development of your own Web Page.

1. [HTML Goodies](http://www.htmlgoodies.com/) <http://www.htmlgoodies.com/>

Search through balls, lines, buttons, icons, and arrows that can be used on your own pages. In addition, there are hotlinks to at least 50 different topics ranging from simple backgrounds to advanced Java Applets. You will also find information regarding HTML.

2. [Internet Tour](http://www.uh.edu/~jbutler/anon/anonintertour.html#menu) <http://www.uh.edu/~jbutler/anon/anonintertour.html#menu>

This site was written to provide a basic introduction to the Internet using the features of Interactive Internet Browser.

3. [Mining the Internet](http://lrs.ed.uiuc.edu/Mining/index.html) <http://lrs.ed.uiuc.edu/Mining/index.html>

This site provides a selection of columns from Judi Harris' *The Computing Teacher/ Learning and Leading with Technology*. It links numerous articles and other sites related to instruction and the Internet. These columns are part of the Learning Resource Server at the College of Education, University of Illinois, Urbana-Champaign.

4. [Guide to HTML](http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimerP1.html) <http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimerP1.html>

This guide is intended to provide an introduction to using HTML and to creating files for the Web. Links are provided to additional web information.

6. [Web Page Development](http://www.utexas.edu/courses/mis311f/gifs/gifs.htm) <http://www.utexas.edu/courses/mis311f/gifs/gifs.htm>

Developed by John Mote of the University of Texas, this site is designed to assist you in creating your own web site. There are numerous online tools and guidelines. He has also included a sample web page and its HTML source code. Finally, there are a number of links to image files (e.g., buttons, balls, animation's) to help you with your own web pages.

7. [Web Page Editor](http://microsoft.com/frontpage/) <http://microsoft.com/frontpage/>

Download a free copy of the Front Page 98 Beta.

8. [Library of Congress](http://lcweb.loc.gov/global/explore.html) <http://lcweb.loc.gov/global/explore.html>

This site includes and references search tools, topical guides, government resources, and information regarding the Internet.

9. [Ask Eric](http://ericir.syr.edu/) <http://ericir.syr.edu/>

Ask ERIC is a personalized Internet-based service providing education information to teachers, librarians, counselors, administrators, parents, and others.