

The Web: It's not just for E-mail Anymore

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Abstract

The World Wide Web is emerging as one of the most popular course enhancing technologies in world history, yet there seems to be much confusion as to the "proper" role that it should play in courses. In this paper we classify Web involvement in courses into four primary roles: *Information, Discovery, Interaction, and Administration*. We show how many web pages are "static", and provide the student only with an information stream. Other pages that include items such as Java and CGI are "dynamic," and allow students to perform self-discovery of topics at their own pace. Other web features such as e-mail and ftp allow the student and instructor to interact more readily. One potentially useful item is to use these same features to administer the course, posting assignments and answers, as well as to conduct business with colleagues and students remotely.

We present several examples from our own courses, which are part of a four-year Computer Science program that stresses a closed-laboratory environment⁶. Yet, all four techniques are applicable to courses that are centered in either open or closed laboratories. We also wish to stress using existing, freely available Web material to reduce workload, and provide a list of useful URLs for the Computer Science curriculum.

I. Introduction

The World Wide Web is history's largest single information repository, currently containing an estimated 36,739,000 hosts at 4,270,000 sites, and perhaps billions of documents¹. So, at first glance, the Web appears like a super-library where students can do all their research quickly and efficiently. Unlike a library, however, the Web is more than just a knowledge repository. The web also allows for many types of interaction. Students can interact with applications, the instructor, and each other. The secret to effective course deployment is using all features of the Web without swamping students with more information than they can assimilate.

For the remainder of this paper, we discuss some of the ideas we have tried in our own courses, along with a discussion of ideas that worked and that did not. We attempt to give a potpourri of ideas that we have tried and found successful. We then classify these ideas into four primary areas of usage.

II. The Web's Informational Role

The one function Web technology is well known for is storing and retrieving information. The informational role of the Web in course preparation is two-fold:

1. Providing an informational repository (that is, "electronic library") for students to use in researching course projects.
2. Giving a centralized starting point for course readings, assignments, and projects.

This second point implies that **every course should have a home page**. This is not merely for the purpose of distance learning as is often implied. All pertinent course information should be available on-line. This serves several purposes. It:

1. answers student questions about current reading and assignments.
2. provides access to assignments (no more "I lost the assignment" excuses).
3. allows students to catch-up after absences.
4. advertises courses to non-students or students choosing courses for future semesters.

Students considering choosing a school can now look over detailed descriptions of all courses in a curriculum. This can be extremely helpful when deciding which major is right for them.

Figure 1 is a typical course homepage. Note the major elements:

1. Instructor name, e-mail address, and office phone number
2. Link to the instructor's schedule (for office hours, etc.)
3. Important course "news" for the week
4. Week's readings and assignments
5. Link to the course syllabus
6. Link to previous readings and assignments

All of these elements are essential to a course homepage. Many of the items are placed on separate pages, which simplifies the page and avoids overwhelming the students with too much data.

Another informational role of the Web is to provide an electronic "library" for students to do research. Unfortunately, there is no card catalog for the Web. Information on the Internet is by its very nature distributed, and often extremely difficult to locate. Search engines and Portals², make finding information easier, but not foolproof. For example, at the time of this writing, placing the query "Teaching Tool" into the HotBot portal³ yields 1,420 results.

Because of the highly unstructured nature of the Web, it is often necessary to help structure the students' Web research. This is especially true at the undergraduate level. We have found that limiting the number of sites can be an essential part of small research assignments. A sample is given below:

COMP 605: Introduction to Operating Systems
Unit 2, Laboratory 1

Go to the following web sites and answer the questions below. Type up your answers using Word. This assignment is due at the end of the lab period. You may submit electronically by e-mailing your answers to ENRIGHTA.

<http://www.anl.gov/ECT/pc/w95nt.html>
<http://www.mcmaster.ca/cis/win95nt/cmpw95nt.html>
<http://www.windowscentral.com/features/reports/95vsNT/>
<http://www.windowscentral.com/features/reports/ntfs/>
<http://www.windowscentral.com/features/reports/fat32/>

What are the minimal hardware requirements for Windows 95? Windows NT Workstation 4.0?

What is the primary disadvantage of Windows NT 4.0 Workstation as compared to Windows 95?

What platforms does Windows NT 4.0 Workstation run on?

What is the design philosophy of Windows NT?

What does NTFS stand for and what is it?

Name at least three differences between Windows 95 and Windows NT.

This assignment was given as a structured, two-hour laboratory. To have told students to just search for this material might have led to confusion and endless searching through portals and dead-links. Limiting the search to a list of sights made the lab doable and prevented much of the discouragement that undergraduates often have when first using the Web as a research tool. We also advise checking the listed web sites immediately before the lab period to ensure that each one is "up" while the students work on the assignment. Having alternate sites listed is also a good idea.

III. The Web's Discovery Role

Web information is often static. Dynamic information is available in the form of Java applets and CGI scripts. One of the uses we have found for such applications is in "self-discovery" or directed learning. We have placed these applets on-line as teaching aides. One such example is our "sorts illustrated" page, part of which is depicted in Figure 2. Here, our Algorithms students learn sorting by watching sorts on various size elements. This is a supplement to both the lecture and laboratory material. Another example of a sorting page can be found at ⁴.

The idea in discovery is to place something interactive on-line to let students try different parameters and tests to aid in their understanding of a concept. In highly theoretical courses such as Algorithms and AI, we have found that it is often easier to convey a concept by

providing a working applet on-line than have students write code and test it with different parameters. In the latter case, students have to overcome their own programming bugs as well as a difficult concept. We have the students write code as reinforcement after learning the concept through both lecture and on-line discovery material.

IV. The Web's Interaction Role

Communication with the instructor and approved collaboration among students is a key part of any good course. The web facilitates many types of interaction. We use both e-mail and the course homepage to convey important information such as class cancellation and assignment distribution. We have held office hours while not being on campus through "Talk" utilities, and will experiment soon with course "chat rooms." On a course evaluation, one of the authors was praised by a student for "answering my questions at 3am" through e-mail.

We also communicate with other faculty. At some point soon, we intend to go to a format of "virtual meetings" to reduce department meetings. These meetings consist of a string of e-mail messages, with votes on important issues sent to the Program Chair. In this way, faculty members have more freedom to attend meetings at their convenience, rather than being constrained to a certain hour during the week. The secret is to have a "deadline" on all issues, and notify everyone that all votes must be in by the deadline. E-mail meetings tend to be more concise, because people tend to sit down when they actually have a free moment, and aren't distracted by wanting to be somewhere else. They also don't have to "sit through" parts of the meeting that do not interested them; instead, they can "scan through" these parts.

Video conferencing is fast becoming a viable Web technology. Although used primarily as a distance learning mechanism, we envision two-way video conferencing also being a mechanism for extra-help and student questions.

V. The Web's Administrative Role

The web can also do a great deal of course administration. We have successfully installed a secure grade database for students to request their marks on all previous assignments within the course. Students must enter their student ID and an assigned password to be able to retrieve sensitive information. We have also found that the informational and interactive roles of the Web help defer many student questions, and allow us to spend less time in the office.

We have not yet experimented with interactive testing. This is being proposed by several manufacturers of interactive courseware. We have put sample quizzes and tests on-line, however, and found that this was a big boost to test scores.

VI. The Downside of it All

We have utilized the web in many ways and found it to be a useful tool. However, there are many concerns which arise with Web use:

1. Unapproved collaboration both inside and outside the course. When teaching computer science, we find more and more students each year searching the Web for code rather than writing it themselves. Our colleagues in the humanities departments inform us that many term papers are actually being purchased on-line. These problems have existed since the earliest days of the Internet, and we do not see it going away any time soon. This is why in-class examination is still necessary to distinguish who is really doing the work.
2. Limitations of Hardware and Software. We have found that quite often a lecture can go wrong, or an assignment become undoable because a website goes down at an inopportune moment. The worst case is when the on-campus net goes down, so students cannot go anywhere on the Web. To combat this, we rely on local copies of important information, alternate URLs, and (in the extreme case) paper copies of assignments and information. Often, when attending a closed laboratory, one of the authors will have a floppy and several paper copies of the assignment, just in case.
3. Spamming. A common problem is for students to attempt to overload your e-mail queue to get an excuse not to submit assignments by the due date. This can be accomplished either by sending an extraordinarily large file "accidentally" ("I don't know why I sent you this week's South Park¹ episode"), or sending multiple somewhat large files. This problem may be accompanied by spoofing (see #4, below), so that the sender remains anonymous. The only way we have found to get around this problem is by checking our e-mail very frequently whenever assignments are due.
4. Security problems. When exchanging information via electronic network, security is always a major problem. Spoofing and sniffing⁵ are two major problems faced by instructors using the Web. A spoof consists of someone misrepresenting you or one of your students in an e-mail message or chat. An example would be an e-mail stating "Today's test is cancelled." One way to combat this is to always refer students back to the course homepage and keep that on a secure server. In this case, students should expect to see messages that have "Today's test cancelled (see course homepage for more info.)", and know that if confirmation is not on the homepage something is wrong. Sniffing is used in the labs and in the dorms to attempt to steal assignments or personal information from other students by "lifting" electronic submissions or passwords. Using secure forms and shells, and isolating the dormitory networks seems to be an effective strategy against sniffing.

VII. Summary

We have experimented with many ways of using the Web in our courses and have found it an effective teaching tool. Despite various problems, such as security hazards and hardware limitations, we have found several roles for the Web in our courses. One role is simply informational, using the Web to both present students with information and to have them locate information. Another role is discovery -- where interactive applets and CGI scripts let students learn or reinforce knowledge at their own pace. An additional role is interaction with students and other faculty. Finally, the Web can be an effective tool for mitigating administrative work. More and more roles are becoming appropriate to the Web. These are the ones which we have employed effectively.

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