



# WEBUCATION: USING THE WEB AS A CLASSROOM TOOL

John T. Paxton — paxton@cs.montana.edu

Computer Science Department

Montana State University

Bozeman, MT 59717

## INTRODUCTION

The World Wide Web (and the ease with which it can now be accessed through graphical browsers) represents one of the most significant developments in the 15 years that I have been using computers. Graphical browsers are now bringing the power of the Internet to the general public and the general public is responding with enthusiasm. In the near future, many aspects of society will be impacted and changed by the web.

The topic of this paper is to discuss how the web can be used to more effectively teach a particular computer science course in the curriculum of Montana State University that is to be offered in the fall of 1995. This junior level course is the fourth in a four semester sequence of courses that present students with a breadth-first, unified approach to the field of computer science [Paxton, Ross, Starkey 1994], [Tucker 1994]. Many of the ideas that I discuss in this paper can be readily adapted to other courses (computer science or otherwise) [Team Web 1995] [Morris 1995] and so the potential application of ideas in this paper is wide.

The following four sections of this paper are organized as follows. First, a strategy to teach students the skills they will need to effectively use the web is presented. The next section is devoted towards showing how the web can be used as a learning tool to find out about “meatier” computer science topics such as personal computers. The next section discusses both challenges and opportunities of using the web in a classroom setting. Finally, the paper concludes by setting out future directions.

## INTRODUCING THE WEB

In order to use the Web as a classroom tool, it is necessary to make sure that students can use it effectively. To this end, I will devote some of the early class meetings to the following activities:

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1. Day 1. Students will be introduced to the World Wide Web; the manner in which information is stored on it, its history, and its current uses. In order to access the web, I will have students use Netscape as their graphical browser [Moore 1995]. From a pedagogical standpoint, the important choice being made here is not to use Netscape (although I think Netscape is a great browser), but to use a graphical browser. Text based browsers such as lynx not only are unable to take advantage of the pictorial information available, but are also more difficult to use. Because people are visually oriented [Lachman and Lachman 1979], using a graphical browser is a necessity to make learning with the web both informative and enjoyable. The day's homework is for each student to *play* [Kaplan and Kaplan 1982] with Netscape and in the process, learn what some of the menus and toolbars do. Students will also be asked to click on Netscape's handbook button and peruse some of the introductory material that is available at the Netscape site.

2. Day 2. Rather than lecturing on Netscape's menus and toolbars, students in the class will be asked to share with other students the most notable things that they learned regarding the day's topics. Any difficulties that were encountered can also be brought up. Students will be encouraged to answer other students' questions. If no student knows the answer but I (the instructor) do, I will answer. Otherwise, that question will be placed on an agenda of things to find out before the next class meeting.

One of the huge appeals of using the web as a source of information is that it can change the nature of the classroom dynamics. Instead of the traditional “teacher disseminating material” model, the classroom can become a dynamic and exciting place where students share with each other what they have learned. Because each student will approach the day's topic differently, different students will learn different things. Because a student can approach the material according to his or her own interests and style, each student should find the learning experience both more enjoyable and more

motivational than a traditional reading assignment.

Since students should now understand the basics of Netscape, their homework assignment on this day is to learn how to use some of the search mechanisms that are available on the web (such as Lycos, the Webcrawler, Yahoo, and Infoseek search). To make this interesting, I will give the students a list of fun things to find in the manner of a treasure hunt. (Example: How many people have visited baseball's Hall of Fame?) The success and utility of this course ultimately hinges on each student's ability to locate information on the web. It is thus important to introduce students to searching mechanisms very early in the term.

3. Day 3. During class, we will talk about students' experiences using the common search mechanisms to locate information and then talk about tips and tricks to aid this process. We will also discuss some of the pitfalls of the information itself, such as being inaccurate or difficult to find. The homework assignment will be to start learning about the hypertext markup language (HTML). In order to do this, students need to know how to look at the source of a document, as well as where some HTML documents are located. Two good beginning HTML documents are *A Beginner's Guide to HTML* (<http://www.ncsa.uiuc.edu/demoweb/html-primer.html>) and *Composing Good HTML* (<http://www.willamette.edu/html-composition/strict-html.html>).
4. Day 4. The classroom discussion will center around fundamental HTML commands. The homework will be to surf the net [Gates 1995] in search of cool pages. Anytime a cool feature is found, the student should learn the HTML necessary to do it. Students will also be asked to keep a sharp lookout for different types of files (such as GIF or AU) that are commonly referenced in an HTML document. A very good place to surf for information is in the *Cool Site of the Day* archives (<http://www.infi.net/cool.html>).
5. Days 5 and 6. Classroom discussion will continue to focus on learning to use HTML. Anytime that someone has discovered something new that no one knows how to do (such as the ability to follow a link by clicking on a picture), that particular skill will be placed on the homework agenda for the entire class to learn about. Outside of class, students will also access resources such as *Mirsky's Worst of the Web* (<http://turnpike.net/metro/mirsky/Worst.html>), a humorous site that shows by example what NOT to do with HTML and *The HTML Writer's Guild* (<http://www.mindspring.com/guild>), a site that

gives the ins and outs of writing HTML code that will look good under most browsers.

In order to help students put the HTML that they are learning about into practice, each person will be asked to compose his or her own home page. It is my experience that constructing a home page is highly motivating, educational, and fun. After everyone has had a couple of weeks to work on their home page, there will be a class contest to see who has constructed the "coolest" one.

## THE WEB AS AN INFORMATION SOURCE

After students gain a certain level of competency using the web [Vaneck and Dunsmore 1995], I plan to shift gears and use the web as an information source for the class. Three of the topics that I plan to cover "web-style" are personal computers, compression, and cryptography. This section will discuss how the topic of PCs (a five week topic) can be covered, but much of what will be said extends to other topics as well.

The area of personal computing is of great interest and importance to students. However, due to the rapidly changing nature of the computer industry, it is very hard to find a textbook that provides information on PCs that is both extensive and up-to-date. Fortunately, the web overcomes both of these problems and is free (at least in a university environment) as well!

The course described in this paper meets three times a week. Each meeting lasts 50 minutes. Instead of laying out a class syllabus in advance (as I typically do), I have decided to dynamically unfold the syllabus as the class progresses. The class syllabus will be available on the web and will contain not only each day's topic (e.g. find out about the P6 chip), but also useful web sites related to the day's topic and questions that arose during the previous class meeting that students are responsible for researching. One advantage of using a dynamic syllabus is that if a topic such as the P6 chip turns out to be of particular interest, the class is flexible to spend more time on the topic and cover it in greater depth. Another advantage is that students never need to guess what the day's topic is. A quick check of the class' web syllabus will show what preparation is needed. It is important to note that using a dynamic syllabus does not mean that the class wanders aimlessly from topic to topic. It is up to the instructor to weave together the topics in a manner that makes sense. For this class, I already have mapped out several topics that will be covered. However, I am planning to "go with the flow" with respect to how long we spend on a particular topic, the sequencing of the topics, and incorporating additional (but relevant) subtopics.

During a class meeting, I will try to act more as a facilitator than as a lecturer. At the start of each period, any lingering questions (which students were to have

used the web to research) from the previous class meeting will be discussed. Then students will be asked to explain what the fundamental issues for the day's topic are. Finally, students will be given the opportunity to share any particularly insightful information that they located with their classmates. Throughout the entire class period, students will be encouraged to ask questions, either about the topic at hand or about related topics. If a student can answer another student's question, so much the better. If not, I will attempt to answer it. And if no one knows the answer, the question might be placed on the agenda for the next class meeting. Before that time, students will be expected to use the web to research its answer.

The topic of personal computing allows the class to touch upon a broad spectrum of issues in computer science. These issues include its history, social issues, computer architecture, operating systems, and networks. The goal of this section of the class is to provide students with enough information about PCs so that they can make an informed purchasing decision. (A final paper for this section of the class might be to describe the PC system that a student would buy, given that she has \$3500 to spend and is required to buy the PC new.) The following list shows some of the web sites that will be used to help reach this goal:

- A general introduction to PCs ([http://www.yahoo.com/Computers\\_and\\_Internet/PCs](http://www.yahoo.com/Computers_and_Internet/PCs)): CPUs, memory, the I/O bus, video adapters, IDE and SCSI disks, etc.
- Buying advice for PCs (<http://www.zdnet.com/~ziffnet>).
- The Internet Shopping Network (<http://www6.internet.net/cgi-bin>): a site where you can find product information and prices on computer items ranging from hard drives to games to CD-ROMs.
- Apple Computer (<http://www.apple.com>): its history, corporate information, employment opportunities, and product line.
- Microsoft Corporation (<http://www.microsoft.com>): its history, a company profile, employment opportunities, and the software it markets.
- Intel (<http://www.intel.com>): the chips it produces, what's new, how to select a PC, its history.
- On-line magazines such as *PC Magazine*, *Computer Shopper*, *MacUser* and others (<http://www.zdnet.com>).
- Operating Systems such as OS/2 Warp and Win '95 ([http://www.yahoo.com/Computers\\_and\\_Internet/Operating\\_Systems](http://www.yahoo.com/Computers_and_Internet/Operating_Systems)).

## PEDAGOGICAL ISSUES

Using the World Wide Web as an information source for a class poses its own set of challenges and benefits. To begin with, I would like to discuss some of the challenges.

1. How does one avoid spending a lot of time surfing the web? On more than one occasion I have started off with high intentions of locating information on the P6 chip, but have ended up pricing CDs and checking out concert tours instead. Surfing is not intrinsically bad (in fact, it's a lot of fun!), but it poses the danger in a classroom setting that students will not come to class prepared to discuss the day's topic. To minimize surfing, I plan to run each day's class in a highly interactive manner. Students will be expected to share interesting information about the day's topic with each other, as well as answering each other's questions. Because I will be acting more as a facilitator than as a lecturer, students will be responsible for their own learning. I hope that this responsibility will provide the incentive to learn about the day's topic before the surfing begins.
2. What does one do to raise the odds that students come to class having found useful information on the day's topic? A crucial factor is to make sure that students understand how to use the search mechanisms available on the web. A second factor is to let students know that not all of the information on the web is reliable. Part of a class period might be spent discussing how to find reliable information. (For example, if one were wanting to find out about the strengths and weaknesses of Windows '95, one should visit not only the Microsoft site, but also perhaps read a critical review of it in a PC magazine.)
3. How is cohesion maintained in the class? Just as it is easy to jump randomly from one topic to another on the web, so it is potentially easy to jump topics in the classroom. It is important that the instructor maintain cohesion both on a particular day's topic (otherwise what students spent their time reading about will not be covered) and from day to day. However, to do this requires a balancing act because too rigid of an agenda will dampen some of the enthusiasm and spontaneity of using the web. I plan to handle this issue in the following manner. On a given day, there will be a preassigned topic such as 'find out about computer monitors'. At the

beginning of class, I might ask students what they think the fundamental ideas are so that everyone understands the basics. Once this is done, I plan to open up the class to comments and questions from students with the only stipulation being that these comments and questions are related to computer monitors. In the course of the day, I would expect other interesting issues to come up. (How does a graphics accelerator work?) If lengthy to address, these additional topics could then be worked into the class at a later date.

4. How should the teacher deal with not being an “expert”? In a traditional class everyone reads the same material. This makes it relatively easy for the teacher to be “prepared” and to answer most questions on the spot. However, when students are culling the web for information, it is guaranteed that they will come across information that the instructor does not know much about. What should the instructor do when these questions arise as they invariably will? First, be open about not knowing. Everyone realizes that it is impossible for one person to know everything! Second, allow students to answer other students’ questions. I plan to give students the first opportunity to answer questions, whether I know the answer or not. By getting students involved in their own education, the classroom will become a more dynamic setting. Third, if something comes up that no one can answer, that issue will be placed on the agenda for a future class meeting. In the intervening time, everyone can use the web to try to locate the answer to this question.
5. How does one construct exams that are fair? This issue is a tricky one because one of the great strengths of this class is that it empowers a student to explore a topic based on his or her own interests. To penalize a student because he explored one aspect and not another would be a great injustice. To deal with this problem, there are several things that can be done. First, there are certain fundamental issues that all students can be expected to have learned in the course of their investigations. For example, if the topic is to learn about CD-ROMs, it is reasonable to expect that students will have learned what it means to be “quad-speed”. Second, more specific knowledge can be tested, but only if it has either been talked about in class or if it appears on the class web site as knowledge that students are responsible for. Third, test questions can ask a student to explain something that he or she learned about a particular topic that was not covered in class. This type of question would reward students for pursuing their interests.

Now that some of the challenges have been discussed,

I would like to mention some of the perceived benefits of using the web.

1. The web provides a hyperlinked, multimedia environment.
2. Student participation during class rises. Instead of a class consisting of 30 students and 1 teacher, the web enables the class to consist of 30 teachers and 1 facilitator. Students enjoy learning from and teaching to one another.
3. Active learning takes place. By its very nature, the web forces one to make choices as to which links to follow and what information to read. Not only does this make interacting with the web more enjoyable than reading a textbook, it also carries over into an active (non-lecture) classroom atmosphere.
4. No matter how much a student already knows about a particular topic, the web provides enough information for the student to learn more. There is no longer any excuse for a student to be ‘bored’ with the day’s material.
5. There is more material to draw upon during class meetings.
6. Anyone who uses the web can see that its current and potential societal impact is enormous. This ‘real world’ aspect makes using the web both motivating and fun.
7. It is fun for the instructor!

## FUTURE DIRECTIONS

In the fall semester of 1995, I will be teaching a junior level course in computer science. The course is the fourth in a series of courses that is designed to provide students with a unified, breadth-first overview of the field of computer science. In this series of courses, students are exposed to data structures and algorithms, computer science theory, computer science topic areas, discrete mathematics, and social and ethical issues. The purpose of this paper has been to present how I intend to teach this class using the World Wide Web as a major (although not exclusive) information source. For topics such as personal computing, compression, and cryptography, I have found the information on the World Wide Web to be more appealing and more comprehensive than information available in any single text.

The future directions for this project are clear. This fall I will teach the class. As the semester progresses, a web syllabus will dynamically unfold that contains the day’s topic, any agenda items that arise, and links to useful sites regarding the day’s topic. Should this paper be accepted, I look forward to sharing the actual

results of teaching this class at the upcoming SIGCSE conference and will compare my anticipated experiences with my actual ones.

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