Preparing for Web-based Instruction: An exercise in planning and design

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Abstract
This paper reviews existing models and research developed for Web-based Instruction (WBI) and traditional instruction. It focuses on a close examination of the major elements of planning and designing for WBI for higher education including: design models, motivation, methods of creating WBI, graphical user interface design issues and evaluation methods. A comparison of traditional instructional design and Web-based models of instructional design is discussed which concludes with a list of commonalties. Planning and designing motivation for the learner is especially important in distance education. Thus, models of motivation design and methods of incorporating motivation into WBI are included. A "how-to" technical section discusses design topics when creating a web site. Computer based and computer mediated testing techniques are included within the discussion of evaluation.
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Introduction

In an attempt to instruct learners from a distance, educators have utilized many different methods. From the delivery of instruction via the U.S. mail to the use of radio, film and instructional television, institutions have tried to incorporate instructional technology into distance education. These past attempts have failed widely due to accessibility and implementation (Cuban, 1986). The mediums are quite limited which must also have contributed to their failure; radio, film and instructional TV are static in nature. Students merely sit quietly and listen and/or watch. Very little interactivity occurs between the learner and the medium. So how does Web-based Instruction (WBI) expect to be any different? McManus (1995) differentiates Internet delivered instruction from other forms of instructional technology:

The Internet can deliver video, but not as quickly as videotape, television, or CD-ROM. It can carry real-time personal interaction, but not as well as telephone or video conferencing. It can display textual information, but not as simply as a book or magazine. Why then should the Internet ever be used? The Net has two real advantages over other media. It combines advantages of other media so that it conveys video and sound better than a book, is more interactive than a videotape and, unlike CD-ROM, it can link people from around the world cheaply. The second advantage...is that it can also be a content provider....this sort of immediate access to information and resources can not be found with any other medium. (p. 1)

With Internet delivered instruction, the world becomes the classroom. Learners can access the class from anywhere, anytime, and because the Web is cross-platform
capable, from any Internet connected computer. Given this type of flexibility and power, many schools are trading in their slow mail delivered instruction for Web-based Instruction (WBI). However, the Internet is such a new medium, it has left educators scrambling to figure out how to use it appropriately and effectively. How does one go about creating a course for delivery via the Internet? Fortunately, a compilation of traditional models with new models of instructional design, motivational design, and evaluation can provide the direction and guidance educators seek. This review analyzes some of the traditional models and newer models on which WBI can be built. It also includes a section on three ways one can create a web-based class and major design issues to consider.

Methodology

This paper provides a review of current literature on the major elements of planning and designing for Web-Based Instruction (WBI) for higher education: design models, motivation, methods of creating WBI, graphical user interface design issues and evaluation methods. Traditional instructional design and graphical user interface design have a lot to offer WBI. Granted, WBI is a new medium for delivering instruction, but it can draw upon the strong precedence set by traditional design methods. The review of traditional models in comparison to newer models for WBI offers an excellent way to present the similarities among the major elements of planning and designing for the two methods of instruction. A great deal has been written on methods of developing instruction for the classroom and much information is available on the World Wide Web on WBI. But few attempts have been made to synthesize the planning and design models for both types of instruction.
The organization of the paper follows the order of the systematic process of instructional design. It begins with a review of a traditional instructional design model and compares and contrasts it to instructional design models for WBI. This section concludes with commonalities among the two. The paper next defines the two basic types of motivation and compares two models of motivational design. It discusses similarities between a traditional model for motivational design and a model designed for the computer gaming industry. Methods of integrating motivational factors into WBI are presented. The next step is media selection; options for creating WBI including traditional GUI design issues, general technical rules of thumb and alternatives, such as authoring tools, are reviewed.

Paralleling one of the last steps in the instructional design process, the paper ends with evaluation techniques. Methods of incorporating evaluation and feedback into WBI are discussed. Conclusions and recommendations are offered based upon the review of the literature.

Definition of Terms

Browser – software applications that allow users to view information on the Internet in a multimedia format.

CGI – Common Gateway Interface. Programs that receive and translate data sent to the server.

Computer based testing – testing in which computers are used to deliver, score and record test results.

Computer mediated testing – testing in which computers simply deliver the test and return the student’s answers to the instructor.
Extrinsic motivation – when external factors (environment and/or social) influence the learner.

GUI – Graphical User Interface. The screen design which communicates to users.

HTML – HyperText Mark-up Language. The programming language used to develop web pages.

Instruction – “A purposeful interaction to increase a learner’s knowledge or skills in a pre-determined fashion” (Ritchie & Hoffman, 1996, p. 1).

Intrinsic motivation – when an individual undertakes learning for personal interests.

PDF – Portable Document Format. A file format developed by Adobe to give web designers maximum control over the design of their layout.

Web-Based Instruction – the design of information that utilizes the characteristics and resources of the World Wide Web on the Internet or on an Intranet to increase a learner’s knowledge, skills, or abilities and is displayed by a web browser.

Web-Based Instruction Defined

In just a few short years, the Internet has grown in popularity at an astonishing rate. It has connected people together from all over the world. The power and vastness of the Internet has made it a natural companion for distance education. Thus, the race is on for educators to get their courses on-line. The question becomes not why nor when nor what, but how? How does one create a course for delivery via the Internet? What systematic processes can one use? What guidelines are there to follow in such a new field? This paper will examine the major elements of planning and designing for Web-Based Instruction (WBI) for higher education: design models, motivation, methods of creating WBI, graphical user interface design issues and evaluation methods.
Putting one’s syllabus on-line is not WBI. While using the Internet for administrative purposes may be functional, it does not constitute Web-based instruction. So what exactly is Web-based instruction? Khan (cited in Henke, 1997) describes WBI as “...a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported” (p. 1). Clark (cited in Henke, 1997) defines WBI, also sometimes called Web-Based Training, as: “Individualized instruction delivered over public or private computer networks and displayed by a web browser. WBT is not downloaded CBT, but rather on-demand training stored in a server and accessed across a network” (p. 1). Notice that Clark differentiates between WBT and CBT. WBI is not simple, “turn the page” CBT redesigned for the Internet, nor is it downloaded CBT from the Internet. Using a combination of the many definitions of WBI one can derive the following definition: WBI is the design of information which utilizes the characteristics and resources of the World Wide Web on the Internet or on an Intranet to increase a learner’s knowledge, skills, or abilities and is displayed by a web browser. Thus, web-based instruction uses a network to deliver instruction and instructional materials, utilizes the many attributes of the WWW (including linking and multimedia), is viewed through a web browser, and the student learns from the instruction. WBI also uses a “design of information” to accomplish its goals. Inherently, design is assumed to be pre-determined, or intentional. This design refers to the way information is presented, both intellectually and visually. The flow of the course becomes much more important with the physical absence of a professor. In a traditional classroom setting, the professor can control the flow of the course; if a class gets off the topic, the professor can easily recognize it and
gently pull the class back on track. However, in WBI, the flow of the course must be built into the design to direct the learner. Thus, planning for the instruction is the most important step in developing Web-based instruction.

Instructional Design Models

Planning for instruction is synonymous with the instructional design process. The Dick and Carey (1996) method of instructional design begins with a needs assessment and development of the instructional goal. Once the goal is developed, it must be analyzed which includes identifying subordinate skills and entry behaviors. Next, the developer must define the target audience, determine the audience’s prior knowledge of the subject, and estimate the amount of motivation that will be needed. The creation of well-written performance objectives is the vital next step. Pre-tests, post tests, and practice tests based upon those objectives is part of the fifth step. The development of the instructional strategy is a big step, which includes media selection, instructional sequence, chunking information, integrating motivational factors, and determining activities for the objectives. Then the instruction based upon the decisions made in the development of the instructional strategy. Finally, an evaluation of the materials is conducted and revisions are made based on the evaluations. The last step is to conduct a summative evaluation in which an objective person not involved with the creation of the instruction evaluates the course as a whole. Then decisions whether to maintain or adopt the instruction is made. This is a simple overview of a traditional model for instructional development. How can this traditional model be used as a foundation for WBI? We can look to the University of Guelph as an example of one way to combine the old and the new.
The University of Guelph (1997) has created a design team, which works with instructors to get their courses on-line. Their course development does not follow the same sequence of the traditional model but it does use most of the same steps. In their model, the first step is to select teaching and learning strategies. (The needs assessment is assumed to be completed prior to meeting with the design team.) Their first step is part of the traditional development of instructional strategies. Their second step, identify subject competencies, is analogous to the identification of subordinate skills and entry behaviors. The next steps are to develop course learning outcomes (identify performance objectives) and to target activities and assignments (a part of developing instructional strategies). The next process in developing WBI is the incorporation of feedback, or developing assessment methods. The design team and the instructor then select the appropriate technology (media selection) and select and develop learning resources (develop and select instructional materials). The team moves on to develop the framework for the course (instructional strategy) and to create a sample module (instructional materials). All of the last steps are a process of informal and formal evaluation and revision. Thus, while University of Guelph has created a model for a new method of delivering instruction, it is based upon the traditional model of instructional design.

Welsh (1997) created criteria for models of instructional design for WBI; it must be systematic, adaptable, technology independent, and useful in traditional environments. Of course, the model must be reproducible so that anyone could use the process to create instruction for web delivery. The model must be adaptable—meaning it can be used for a variety of subjects. It must also be able to use a wide range of technology and grow as
technology grows. Lastly, it must be able to be implemented in the traditional classroom as well as on the Internet. This last aspect would especially benefit instructors who offer the same class both on and off campus. With these criteria in mind, Welsh created his own model for WBI.

Welsh’s model for developing WBI is called Event-Oriented Design (EOD) (Welsh, 1997). It is a seven-step process that meets his four criteria for any Web-based instructional design model. In the same manner as its traditional partner, the EOD’s first step is to specify the goal(s) and performance objectives. The information must be chunked logically and bundled into modules and then the objectives sequenced and matched with the content into the modules.

These modules must then be divided into a set of “instructional events” or tasks. The activities chosen should support the learning required in order to achieve the performance objectives and, ultimately, the instructional goal(s). Choosing challenging but obtainable modules and objectives will help to increase learner motivation and success. Thus, creating organized and relatively short modules is vital to the design of instruction, especially distance education. Once the activities have been chosen, the event must be categorized into the communication it will require: full or limited synchronous, or asynchronous. Full synchronous communication is defined as all of the class members and the instructor involved in real time. Limited, then, is when two or more members of the class discuss issues in a real time basis. Asynchronous, of course, is when only one person in the class communicates at a time, as in the case of e-mail.

For example, the professor and perhaps the technology staff, chooses to create a presentation as an asynchronous event and delivers it as a PowerPoint file via the Web.
The fifth step in the EOD model is to choose the appropriate technology based on the event. In the case of the presentation, the event would be delivered as a PowerPoint file via the Web. The scenario assumes all class participants have access to the Internet and can click through a PowerPoint presentation. It is important to choose technology in which all members of the class and the instructor have access to and support for. Content, procedures, and help (including help with the technology) must then be developed for each event. For example, the content of the presentation, procedures for what the student is expected to do, and support for how to access and use the presentation must all be developed. As in the traditional method, the last step in the EOD process includes pilot testing, evaluation and revision.

The EOD model incorporates traditional instructional development processes with technology issues. The model is easily reproduced, used for any subject, grows with technology and can be used in the traditional classroom. An instructor who uses this model for an on-campus class can easily convert it into a distance education course. Using this model can greatly reduce the amount of work instructors need to do when they offer the same course both on and off campus. It also helps to promote equal learning opportunities for local and distant learners in that it assures that all learners receive the same instruction.

Many commonalities exist between traditional instructional development and procedures for developing WBI. The most basic commonalities are:

- Development of goals and objectives
- Identification of target audience
- Planning motivation and guidance
• Logically chunking information into modules
• Planning activities for the modules
• Choosing appropriate technology
• Providing practice
• Conducting evaluation and revision

Motivational Design

Planning and designing motivation for the learner is especially important in distance education. Intrinsic and extrinsic motivation are the two ways a learner is motivated (Duchastel, 1997). When an individual undertakes learning for personal interests, the individual is intrinsically motivated; this is when learning is most successful. Students are often extrinsically motivated, in which external factors (environment and/or social) influence the learner. For example, a student enrolls in a course because it is a general education requirement.

Armstrong, Tocebe, and Watson, Billings, and Moore and Kearsley (cited in Cornell & Martin, 1997) have found there are three basic factors that estimate the likelihood of a student completing a distance education course: “intention to complete the course, early submission of work, and completion of other distance education courses” (p. 94). Fortunately, there are other factors involved in motivation which designers can control. The design of the course, the degree of interaction incorporated, and the ability to link the information to everyday life will affect the learner’s motivation. Providing short modules with clearly defined objectives and events, frequent summaries, technical and content help and opportunities to practice using the new knowledge aid in motivating the learner and increase confidence.
Keller’s ARCS Model (cited in Duchastel, 1997) for motivational design provides four categories for designers to incorporate into their instruction: Attention, Relevance, Confidence, and Satisfaction. First instructors must gain the attention of the students early and continue to keep their interest throughout the course. This can be accomplished in many ways, depending upon the learners and content. Professors may elect to use several different ways to maintain the student’s interest in order to appeal to a variety of learning styles. For instance, the instructor may incorporate discovery learning or an Internet or Intranet competition between classes.

After attaining the students’ attention, the information or content needs to be relevant to their lives. Relate the information to their goals, to what they already know, or to their everyday life. In order to do this, the instructor will need to know some background information on the student. Have the students submit a short biography including their expectations of themselves and the class, their goals and objectives, their hobbies, e-mail address, phone number, and how comfortable they feel using technology. Use this information to relate the content with their lives. Also use this information to help give the students confidence.

Including a help page on the web site and a site map can increase confidence. Stating any technology prerequisites or other initial expectations immediately can also help students identify their competencies and deficiencies. Encourage those students with more technical experience to assist those who ask for help. A chat room or a net forum can be set up for the students and instructors to post questions and help to. Instructors need to be available to help any student who needs it. Instructors can increase
learner confidence by stating that they will be available for help and listing a variety of ways they can be reached.

Satisfaction is accomplished when students do something well or feel they have achieved something. Providing immediate feedback is very important for student satisfaction, and thus, motivation. The computer can deliver, correct and record tests with multiple choice and/or true-false questions without involving an instructor. Whether practice or graded, these tests provide immediate feedback to the student. Sharing completed projects with the class and other colleges/universities is a great way to increase learner satisfaction.

Keller’s ARCS model deals with similar issues as Malone’s CFC model (cited in Duchastel, 1997) which includes Challenge, Fantasy, and Curiosity. Malone studied the gaming industry but the principles are useful to WBI. As mentioned before, not only should the instruction state goals and objectives, but students should too. Instructors need to help their students set challenging but achievable goals and give them the support they need to obtain the goals. It would be difficult to set up a fantasy situation as well as games do; however, designers can create simulations and other pretend situations that involve the student. Curiosity may seem more directly related to education in that it can take advantage of intrinsic motivation. Allowing students to seek out course related topics utilizes active, discovery-oriented task driven instructional strategies which will significantly increase student motivation. The instructor acts as a facilitator of learning and guides and supports the student’s curiosity. The student and instructor can then create tasks based on the chosen interest. Evaluation is conducted on the outcomes of the tasks, not on the ability of the student to regurgitate information. Using these strategies,
students are forced to take responsibility for their learning. Duchastel (1997) notes the
effort to interest relationship (called the Effin factor) in which a student weighs the
amount of effort involved against his/her level of interest. If students are allowed to
choose the topics and are involved in creating the tasks, their effort should increase. This
seems logical, almost obvious, but is seldom practiced. Designers can use the Effin
factor by incorporating modules where the student can practice experiential learning.
Some modules may provide clear, specific objectives while others may have a general
goal and allow the student to follow their own interests (thus utilizing the Effin factor).

Media Selection

Media selection is extremely important in the development of WBI. Whether an
instructor chooses to use overheads or a PowerPoint show may not be a crucial element
in the overall effectiveness of the instruction. However, in WBI, choosing the
appropriate tools is vital for successful learning to occur. Creating the web site itself can
be a weighty task, involving many decisions. Currently there are three ways to create
WBI:

1. Code all of the programming yourself.
2. Combine the use of several programs.
3. Use a course authoring tool.

Choosing to code the HyperText Mark-up Language (HTML) can be very
rewarding and offers the creator the most control of the three options. However, it can
also be very time consuming and frustrating without the help of a supportive technical
production staff. To create a well designed, comprehensive courses for the Internet from
scratch, help from the following types of specialists are needed: the content expert,
instructional developers, a project manager, user interface designers, programmers, media specialists (graphics, video and sound), and a system administrator. Designing a visually pleasing and user friendly interface for the students is both difficult and extremely important. A well-designed and organized site will increase learner confidence and decrease learner anxiety and frustration. So where does one start?

**Graphical user interface design.**

Guidelines and rules have been researched and tested for developing software interfaces for years. With the onset and subsequent explosion in popularity of web use, there has been little time for research on this new medium. HTML is an easy programming language to learn and, consequently, web pages multiplied dramatically. Unfortunately, weeding through all of the poorly design web pages can frustrate and turn away users. Creating a page is easy; designing a good page takes time. The rules of graphical user interface design apply to web design as well: keep it clear, concise, consistent, simple, put the user in control, and make it accessible to your target audience (Morris & Hinricks, 1996).

Boling (1996) briefly touches on design principles for creating electronic documents. The most important topic she addresses is the necessity of being clear and concise. Galitz (1994) states that good designs are visually, conceptually, and linguistically clear. Relationships among screen elements must prevail; designers should create groupings, align screen elements and groups, and use color effectively and simply. Using these techniques will help the user process the information on the screen. For example, navigational tools should be grouped together and aligned properly—such as all left aligned in a column or centered in a row at the bottom of the page.
Metaphors should be conceptually clear. Choose icons which would be considered standard metaphors (i.e., Don’t use a picture of a piece of paper for a printer icon, instead, use a picture of a printer. Microsoft’s Office Suite uses conceptually well designed metaphors). Likewise, if a theme is being used to create a unifying thread for connected web pages, be sure to use a theme that is understandably related to the information in the page. Remember, the web crosses all national borders, so create pages with clear language. Avoid using slang and technical jargon unless it is appropriate for the target audience.

Boling (1996) points out that it is necessary to remain concise when publishing electronic texts. This is quite true in web page creation. Authors must keep the attention of the reader and usually long textual documents will not accomplish this. People do not like to read a lot of text off of a screen. If they are interested enough, they will print the document and read the hard copy, if not, they will simply move on. It is for this reason that many pages rely heavily upon lists. Unlike long pieces of text, lists are concise bits of information and attract the reader’s eye. This makes them effective in grabbing the reader's attention and providing main points to the viewer.

The viewable area is much more of a concern for designers of electronic media than for designers of printed materials. Of course, monitor sizes are fixed proportions. Authors cannot change a 14-inch monitor into a 17-inch monitor like they could choose between a variety of paper sizes. Font sizes also need to be larger than a printed page to make the text easier to read. Navigational tools will also reduce the usable text area available (Boling, 1996). With all of these factors limiting the space for text, authors must write concisely and choose carefully what content should be included.
Size constraints eventually force authors to choose between creating one long page or several short pages (a combination of the two is the norm, but for contrast purposes, this paper will discuss the two extremes). Both long and short pages have advantages and disadvantages. Long pages are easier to maintain and are easier to create if using one document for both hard copy and online (Lemay, 1995). However, long documents take longer to download and readers must scroll down the page to read the text. Shorter documents load more quickly and can be scanned and read with more ease. Unfortunately, it can be difficult to maintain all of the links, and continuous jumping around can be jarring to the reader. Users may actually spend more time linking than reading (Lemay, 1995). Boling (1996) correctly points out that the more short, interlinked documents (or "chunks") a site contains, the more each chunk must be able to stand alone. More important than the independence of the page is the consistency of the pages.

Consistency is one of the top rules of good graphical user interface (GUI) design. Web pages need to utilize this rule also. Standard elements of the page need to remain consistent; this helps users to navigate through the documents. In a site with many smaller pages, consistency in design helps the user to identify that they are still on pages related to the home page - they have not accidentally linked off the site. When the same buttons reliably have the same effect, users feel more in control over their browsing and come to expect a certain response from the buttons. This expectation is called compatibility in GUI design. Designers should build on the expectations of the viewer and create new, dependable sequences that build expectations for the site. Good web design will use what the viewer already knows from their previous experiences using the
web. For instance, “surfers” usually expect underlined text to be a link to another
document. Authors can use this when creating their links and can avoid using underlined
text or graphics that do not link to other documents. Creating predictable, consistent
pages empowers the viewer and makes them feel more comfortable at the site. Web
designers can be clear, concise, and consistent and still design inaccessible and
ineffective pages.

**Design with browsers in mind.**

Since it is the software program which allows the viewer to read the Internet, or
the browser, that is ultimately responsible for how a web page will look to a user,
designers must become familiar with the differences between the browsers and how they
read HTML. Designers must be aware that their pages will differ from browser to
browser and from platform to platform. Browser preferences will override HTML codes.
Thus, if a web author sets the active links to be yellow and the visited links to be red, but
the browser’s preferences are set to show active links as blue and visited links as purple,
the page will show up with the blue and purple links. This can be problematic if the
chosen background color is blue; the links will not visually stand out as was originally
intended. This can be maddening to designers because they do not have the ultimate
control. The browser window can be resized by the user so designers cannot even
guarantee how wide and tall the page will be. Different browsers simply interpret HTML
differently. For instance, the `<H1>` tag is used to create the largest size heading but one
browser will read it as 18 point Times bold while another browser will read it as 24 point
Helvetica bold (Niederst, 1997). Not only is one going to be six points bigger (which
may transform a one line heading into a two line heading), but also Times is a serif font
while Helvetica is a sans-serif font. Because sans-serif fonts are easily read in short amounts of text, most designers would choose to use a sans-serif font for a heading; however, it is obvious that designers actually have very little control over the font and size which appears on the screen. Users have more control over the font and font sizes because they can change the browser preferences that will control every page they visit. Users often choose to increase the font size to reduce eyestrain when reading the screen. Just as in the case of the heading example, this could dramatically alter the look of the page.

**Graphics and advanced features.**

Fonts and font sizes are only one problem when designing for the web. Graphics create another arena for problems. Designers cannot be sure of how the graphics will align on the reader’s page because the window size may be smaller than what the page was designed for. This can cause the graphics to wrap around onto another line, like text does. It is also quite common that the reader will not see the graphic at all. Users often choose to turn off the graphics in their preferences to increase download times. This can be a problem for a graphics heavy page. Often times designers use a graphic for the background, one for the banner, and graphics for navigational tools. This leaves very little information on the page when the graphics are turned off. Users will simply see an icon where the image should be. Thus, designers should be aware that graphics heavy web pages cause long download times when turned on and may render the page unusable when turned off.

Not all browsers are created equal. Some are text only and some incorporate a plethora of plug-ins which allow full multimedia. Some browsers read frames, tables,
JavaScript, and more, while others freeze up when the advanced features encounter them. Simple designs are often underrated. With all these choices to make, what is a designer to do? Like all design, it depends upon the intent of the design and the target audience. What is the purpose of the page? What is the intended message? Who is the audience? Can it be determined what browser they will be using? What kind of connection does the reader have? Answers to these questions can significantly increase the ease of the design process.

**Coding the HTML: Making web pages accessible.**

Fortunately, there are other methods designers can use to approach design problems. The healthiest choice is to simply accept the limitations of HTML as a part of the medium. Designers need to realize that their page will not look the same on all browsers. Keeping this in mind, there are some general rules web authors can use to control the look of their page. First, authors should use the standard HTML 2.0 (as opposed to HTML 3.2). Tags used in HTML 2.0 are read by almost all browsers. HTML 3.2 uses some tags that are recognized by only the newer browsers.

Second, design for the smaller Macintosh window size; the Mac window defaults to 550 pixels wide as opposed to the 640-pixel PC window (Morris & Hinricks, 1996). Doing this will assure the page will fit on all platforms when first downloaded. After that the user may enlarge the window as they choose.

Third, use the ALT tag: `<img src="bike.gif" ALT="Mountain Bike">` for users who have their graphics turned off or in the case of a bad connection, the computer will display the icon of where the graphic should be and next to it the author's description of the image. Without the ALT tag, users would simply see the icon, giving them no clue as
to what the image might be. The portion that follows the ALT in the image tag should
give a good enough description of the image so that a user knows what the graphic would
be had it loaded. A good description will help the user decide whether or not to load that
image and in cases where the image is part of the navigation, the description will tell the
user where the link would take them.

Fourth, provide a text only version of the page. This will assure the page is
accessible to all Internet users, regardless of which browser they are using. Granted, this
means more work for the author because it is necessary to provide two versions of the
same page. Text only pages are neither fun to design nor exciting to view, but they do
communicate information and download very quickly despite their connection speed, and
are accessible to all. My frame-based pages automatically open a page that directs non-
frame-reading browsers to a non-framed version of the page. While most browsers now
read frames, some of the older versions (such as Microsoft Internet Explorer 2.0 and
Lynx) do not. If important information is being displayed for a large target audience,
then care should be taken to create accessible pages.

Fifth, test the pages on many types of browsers. Before uploading any pages,
authors should check them on Netscape 2.0 and 3.0 and Microsoft Internet Explorer 2.0
and 3.0. Since these are the most widely used browsers today, testing the pages on these
versions will give me an idea of what the pages will look like to most people. After the
testing, revisions are often necessary. Unfortunately, testing is often under utilized. This
procedure not only gives the designer a degree of control over the look of the page, but
also prepares the author for future page design. Using fancy features just because they
are available is not a good enough reason. Because many advanced features work only
with the latest browsers, designers who use them should offer an alternate page for those with older browsers and slower connections.

For designers who choose not to accept the lack of control as an inherent part of the medium, there is currently a way to assure that how a page is designed is how it will be viewed. Using Adobe Acrobat, not HTML, a designer can create a page and save it as a Portable Document Format file (PDF). Although PDF files tend to take up more server space than an HTML document, they do appear exactly as the author created them and cannot be changed by the user. Sounds great right? But PDF files can only be created with Adobe’s software, Acrobat, which must be purchased, and can only be viewed with Adobe Acrobat Reader, which can be downloaded as a plug-in to the browser from the web for free. Thus, this creates another problem. Sometimes readers decide it is too much work or it takes too much time to download a plug-in and then to return to the page. Or they may be working on machines in which they do not have sufficient rights to download. The consequence is that the reader may choose to move on in their “surfing” and may not ever see the PDF page. Thus, using PDF files may limit access to the page. Authors who use PDF files may either use a hypertext link to the file or embed the file. The former is a better choice because it gives the user the option of whether to visit the page and because PDF files typically take longer to load. Another point to keep in mind is that creating all of your documents in Portable Document Format files is not web design (Niederst, 1997). It is in fact a way of getting around web design. However, there are times in which PDF files are a viable alternative. For instance, if a school wanted to create an on-line admissions form, it may be best to do it in a Portable Document Format. Why? Because the admissions form contains a lot of necessary formatting that needs to
remain constant. It would also allow the user to print out the form and it would appear just as it would on the screen. PDF files should be treated in the same manner as other advanced web features - use it when necessary and offer alternatives to make the page accessible to all.

Good GUI design insists that “the user must control the interaction” (Galitz, 1994, p. 26). In web design, authors are forced to give up a certain amount of control over their pages. While this often frustrates the designer, it empowers the viewer. Thus, the rules of graphical user interface design apply to web design as well: keep it clear, concise, consistent, simple, put the user in control, and make it accessible to your target audience.

Alternatives to coding HTML.

Obviously, coding the entire course can be quite a task. In an attempt to reduce production time, developers may elect to combine the use of several programs. For instance, one may use an HTML editor, a JavaScript program, a CGI (Common Gateway Interface) program, graphics software, etc. However, combining the use of several programs may be more costly if all of the programs must be purchased and if developers must learn to use the various software. Schools may decide it is more beneficial to invest in a comprehensive software package.

The software market is being flooded with new course authoring tools. Some of the top contenders in this new market are ToolBook Instructor, TopClass, and WebCT. They all claim to offer everything that a content provider needs to develop a class on-line. What type of tools does a course authoring tool need to include? The most basic element is the ability to include information (Hansen & Frick, 1997) including, text, audio, video, and graphics. It must also be able to include a choice of types of human interaction (full
or limited synchronous or asynchronous). The software package must be able to include assessment, preferably, both computer based and computer mediated. Lastly, it needs to include course management features such as enrollment, reporting grades, tracking student progress, etc.

Once a school finds a program that offers at least all of the aforementioned features, the school must consider even more factors (Hansen & Frick, 1997). Before buying a course authoring tool, it must be determined who will be using it. Will programmers or professor be developing the courses? How much experience do the developers have in creating WBI? What is the learning curve of the software? If it will take the professor he entire semester to learn how to use the program, perhaps an easier program is in order. Of course, cost is always a factor when purchasing new merchandise. Not all course authoring tools charge the same way. Some have a one time fee for the purchase of the program and some charge depending upon how many students will take the class and how many times the class will be offered.

Other factors are equally important. The program should include help or documentation to refer to. Whether the authoring tool is platform dependent or if it is purely web-based can be an important factor if the school uses various platforms. Once the course is developed and ready to deliver via the Internet, sometimes the developer finds out that the students need a plug-in or helper application in order to access the content. This is a bad time to find out that students will have to download and install something onto their computers for access; thus, question the accessibility of the final product before an authoring tool is bought. Also ask the vendor or creators of the product if a specific browser will be necessary for the students to view the site. Since browser
capabilities vary widely, designers will need to decide whether to develop the site for the lowest browser or to require students to use a specific browser. If a course authoring tool will be used, it may be a factor in this decision. One of the most substantial factors to consider when purchasing a comprehensive software package for WBI is its ability to do work for the developer. I.e., will it create the HTML, CGI scripts for tests, Java when needed, etc. The most significant feature of any course authoring tool is its ability to create the programming necessary to complete specific tasks. For instance, if professors want to include a searchable database of terms in their courses, the software should create all of the necessary programming to do so. Real-time chat rooms, bulletin boards, and whiteboards are important features to include in an on-line course (Goldberg, 1997), but creating them can be a nightmare. Fortunately, more and more course authoring tools have the ability to create these features for developers, without developers having extensive programming knowledge. Likewise, development tools are now sophisticated enough to allow non-technical people create on-line timed tests and practice tests.

Incorporating Evaluation

Evaluation and revision are significant, but often ignored, steps in the instructional design process. Proper feedback is important in order for students to learn efficiently, increase confidence and decrease anxiety levels (Cyboran, 1995). Students are most familiar with tests as a form of evaluation. Computers can be used to deliver, score and record tests results (called computer based testing), or they can be used to simply deliver the test and return the student's answers to the instructor (called computer mediated testing). Depending upon the type of test, it can incorporate true/false questions, multiple choice, short answer, essay or any other type of question that a
traditional test can offer. Perhaps a better form of evaluation is task-based, such as written papers, presentations, or completed projects. However, this type of evaluation cannot provide immediate results, as the instructor needs time to read and assess the materials.

Computer based testing can offer immediate feedback, which is very important to confidence and motivation levels. Practice, computer based, tests can take advantage of Gery's (cited in Cyboran, 1995) categories of feedback: acknowledgment, confirmation, prompts or hints, judgment or reinforcement, correction, explanation, consequence and referral. With the use of CGI or Java, students can get immediate results to their answers. For example, if a student answers a multiple choice question wrong, the computer can inform the student s/he was incorrect and allow him/her to guess again, tell him/her the correct answer, explain why the answer was incorrect, or give him/her a hint, etc. The type of category the computer responds with depends upon what the programmer codes into the CGI script or Java applet.

As well as the evaluation of students, the course content and the method of delivery is equally important to evaluate. Create a form for suggestions and/or improvements for the instruction in general, the web site, and the use of technology tools and so on. The learners and instructor should participate in surveys and questionnaires involving reflective learning techniques after each model and after the class. Once all of the evaluations are collected, the instructor and design team can make good decisions on how to revise the course. Evaluation and revision are extremely important in providing improved instruction. Changing and updating WBI is an easy procedure, making it advantageous during the revision process. WBI content, design, and methods of delivery
will need to be continually evaluated, revised, and altered to include new technologies, or it will die.

Conclusions and Recommendations

While web-based instruction is new in education and business, applying traditional methods of instructional design is still effective. Combing new models and old models, the EOD model offers a systematic process for institutions to reproduce when developing WBI. With the use of instructional design models, motivational models and of continual evaluation and revision, it is possible to create instruction for web delivery that is effective and efficient for distance learners. Graphical user interface design issues also affect the effectiveness of instruction and must be incorporated into the overall design of the instruction. Planning for the design and delivery of WBI is the first, and perhaps the most important, step in creating instruction for this new medium.

As WBI becomes more popular and as technology tools become more sophisticated, it would be interesting to compare and contrast the processes in the development of and the effectiveness of Web-based classes. More research is needed on course authoring tools and their suitability for subject matter experts in higher education. In the future, software designers of course authoring tools will need to consult with professors and instructional designers to develop a product for non-programmers to use; but one that will still offer a great deal of options and control for those with more technical expertise. When this combination arrives in a single software package, the world will see a great explosion of Web Based Instruction.
References


