

EVALUATING WEB-BASED INSTRUCTION DESIGN

Submitted to:

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by

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Chapter 1: Introduction

The purpose of this research project was to explore design issues associated with the development of Web-Based Instruction (WBI).

The reason design issues for Web-Based Instruction are important is because, as stated by Fox and Mills (1997a): "...We expect Web technologies to totally change distance education...Web-based distance education technologies may improve education and support totally new educational systems, radically changing traditional universities and K-12 schools.

And Fox and Mills (1997b) also supply the problem statement for this paper: "We live in an era of accelerating change which can be expected to lead to major changes in the structure of educational institutions...[with] the establishment of virtual classrooms and virtual universities. Although the qualitative structure of cyberteaching is relatively clear, the essential details are unknown.

Problem Statement

This paper, by reviewing a Web-Based Instruction course with two sets of Web design guidelines, attempts to answer this question: What is good Web-Based Instruction Design? And thus provide some details on how to design useful Web-Based Instruction courses.

Chapter 2: Literature Review

Before describing the reasons why it is necessary to explore how WBI is designed, WBI should be defined.

Definition of Web-Based Instruction

Khan (1997) defines Web-Based Instruction (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.

Relan and Gillami (1997a) define WBI as: "...the application of a repertoire of cognitively oriented instructional strategies within a constructivist and collaborative learning environment, utilizing the attributes and resources of the World Wide Web.

Web-Based Instruction, also called Web-Based Training, is defined by Clark (1996) 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. Web-based

training can be updated very rapidly, and access to training controlled by the training provider.

Though the above definitions are not identical, there is a common theme, which is that WBI takes advantage of the Internet and World Wide Web to deliver information.

Importance of Web-Based Instruction

WBI, which is an emerging field in education, is nevertheless, a part of the rapid growth that is the Internet. Reasons for the growth of WBI include: promotes growth of distance education economically (reliable and inexpensive source) as compared to computer based training, live broadcasts, video tapes, and so on, (Relan and Gillani, 1997b and Santi, 1997), enables learners who prefer or are required to learn outside traditional classrooms to attend classes at their homes or offices, (Bannan and Milheim, 1997), and provides delivery medium, content provider, and subject matter in one package, unlike other mediums, such as computer based training, that require a separate delivery mechanism (McManus, 1996).

Nichols (1995) predicts that: "The potential benefit from formulating evaluation methodologies for the Web [for instructional materials] depends on whether or not the Web will become a permanent medium or a passing fad? In fact, the Web will likely soon become the most popular medium for the delivery of distance education type materials."

Web-Based Instruction Design Issues

The literature supports the assertion that WBI is a growing trend. The literature also indicates that a critical factor to the success of WBI is the incorporation of usability design into the development process. The design issues gleaned from the literature review include: transfer of existing course material, as is, to WBI, without considering using the medium's capabilities, such as graphics or communications, like listservers (Parson, 1997); ignore the forms and styles required by the medium, such as using the structure of a traditional lecture course as the structure for a WBI course (Peraya, 1994) and use existing course material and while ignoring features without restructuring

existing material to fit the features, which can lead to the student learning less (Alexander, 1996).

The above examples describe how the content of instructional materials can be underutilized by simply "porting" the materials from one medium to another without considering whether the medium requires a different design approach. And along these lines, usability design is also a critical factor for successful WBI design.

Usability issues in the design of WBI include: lack of interest in interface design since authoring systems are expected to provide attractive and easy to user interfaces (Squires and Preece, 1996); need to replicate the best of the classroom environment and distance education but improve on those environments by taking advantage of Web capabilities (Welsh, 1997), focus on learners and their tasks, not just the content to be taught (Dillon and Zhu, 1997); use of Web characteristics that are unlike traditional software applications, such as access to interfaces which cannot be controlled by the application (Pernici and Casati, 1997), and the incorporation of screen and interface

design at the same time the course is being designed and developed (Jones and Okey, 1995).

Boling and Sousa (1993) state that: "If people cannot use what is being delivered to them, or if they will not use it because it fails to support them in crucial ways, the promise of technology is subverted before it can begin to be fulfilled...training groups with direct responsibility for learning outcomes can not afford to lose a measure of learner motivation to poor interface decisions, or to a lack of awareness that these design issues must be addressed."

Chapter 3: Methodology Design

This paper focused on the user interface design of the WBI courses. Although the literature review revealed many issues in WBI design, such as can existing materials be "ported" to a WBI course without change, the literature review also revealed that many educators take user interface design for granted or are ill-prepared to create computer based training since educators often work alone or lack formal training (Bickerstaff, 1993). Additionally, poor interface design can prevent students from learning (Boling and Sousa, 1993).

Another, less obvious reason for this emphasis on user interface design, is that a WBI course, can be considered a software application and also a Web Site. As McManus states: "The Web [and WBI] is delivery medium, content provider, and subject matter all in one." And like any well-designed software application or Web Site, good user interface design is crucial.

The methodology proposed for this project is to review one WBI course using two sets of metrics: Nielsen's Top Ten Web Design Mistakes and Jones'es and

Okey's Interface Design for Computer-Based Learning Environments.

Top Ten Web Design Mistakes

Nielsen's Top Ten Web Design Mistakes are adapted from Nielsen's Alertbox (Nielsen, 1996). These design guides were used to evaluate the user interface of the WBI.

Note: The following is an succinct explanation of each item.

Using Frames. Frames are not to be used as frames make it hard to correctly set a bookmark.

Gratuitous Use of Bleeding-Edge Technology. Like avoiding to many fonts, new technology, such as three-dimensional designs should only be used if the content dictates use, such as a web site for maps.

Scrolling Text, Marquees, and Constantly Running Animations. Do not include any element that constantly is moving because this distracts the reader.

Complex User Resource Locations (URLs). Users may want to type in a URL directly within their browser or may use the URL as bookmark. Therefore URL should make

sense and use lower case characters to make entering the data easier.

Orphan Pages. Each page should have a link to the home page (index page). A page that does not allow you to navigate from the page is considered orphaned. Or a page that causes the Web Browser to display a message stating the link is no longer valid.

Long Scrolling Pages. Nielsen (1996) states that "Only 10 percent of users scroll beyond the information that is visible on the screen when a page comes up." Therefore, if a page must be longer than one page, then the most important information must be displayed at the top of the page.

Lack of Navigation Support. A map must be provided of how to access information on a web site and also each page should include a link to get to the next page or the previous page. Additionally, a search engine should be provided to enable users to search any page on a web site.

Non-Standard Link Colors. Nielsen (1996) states that: "Links to pages that have not been seen by the user are blue; links to previously seen pages are

purple or red.". This is typical throughout the World Wide Web community.

Outdated Information. Information must be kept updated as information on the World Wide Web is often outdated, within days. Information considered 'old' by users may lead the user's to believe all of the information is outdated.

Overly Long Download Times. Nielsen (1996) states that: "Traditional human factors guidelines indicate 10 seconds as the maximum response time before users lose interest. On the web, users have been trained to endure so much suffering that it may be acceptable to increase this limit to 15 seconds for a few pages."

Interface Design for Computer-based Learning Environments

Interface Design for Computer-Based Learning Environments by Jones and Okey, 1995. The Jones and Okey Interface Design includes a set of User Interface Design Guidelines that incorporate five concepts from literature in the fields of computer based instruction, computer based learning environments, and human-computer interaction. Each concept represents sub-

concepts such as for the concept browsing, there are sub-concepts such as closure, progressive closure, changes in state, and selection indicators. Each concept includes a number of items used to evaluate the WBI design. For instance, under browsing, an item to evaluate is "provide maps so that users can find where they are and allow provisions to jump to other information of interest from the map." (Jones and Okey, 1995).

The five concepts include: browsing (seven items); media integration (four items); metaphors (four items); information access (two items); and unfamiliar territory (six items).

Note: The Interface Design for Computer-based Learning Environments by Jones and Okey, 1995 is not a proven set of metrics; instead it is a set of metrics based on multidisciplinary research and is meant to be used as a guideline for evaluating the design of Computer-Based Learning Environments.

Measurement Scores

To assign measurement scores to Nielsen's Top Ten Web Design Mistakes and Jones's and Okey's Interface

Design for Computer-based Learning Environments, Nielsen's and Mack's (1994), Severity Rating Scale of 0 to 4 will be used along with observations. The scale includes 0 which represents no usability problem to 4 which represents a problem that must be fixed to make the product usable or before shipping the product.

Note: Neither Nielsen nor Jones nor Okey suggest assigning scores to their guidelines; hence the assignment of scores is strictly arbitrary, but when coupled with observations, both taken together should provide an accurate and objective usability assessment.

Anticipated Results

The anticipated result is an objective evaluation of a WBI course using the two metrics described above. The project report contains a list with each metric that includes observations and a usability score. Additionally, a summary of improvements is include

From the usability metrics and suggested improvements, a reader should be able to access the WBI course, review the usability metrics and suggested

improvements, and then make determination as to whether the usability review was conducted objectively and whether the usability metrics applied were sensible for the WBI design.

Selection of the Web-Based Instruction Course

The Web-Based Instruction Course chosen for review was the HTML 3 Interactive Course by the Waite Publishing Group. This course was chosen for these reasons: cost, system requirements, subject matter, relevance to Web-Based Instruction, and conceptual use of the Internet for delivering education.

1. Cost-course was included as part of the purchase price of the textbook, HTML 3 Interactive Course. When you purchase the textbook, you are entitled to take a Web-Based Instruction Course that utilizes the book as part of the course materials. Therefore, expenditures to enroll and participate in a Web-Based Instruction course were limited to the price of the textbook, which was \$39.99 (U.S. dollars).

2. System requirements-only requirement was access to the Internet and a Web Browser. Another Web-Based

Instruction course that was considered required the use of NetScape 2.00 or greater and a plug-in, called Bamba, and also sound card. The author of this report desired minimum system requirements in order to focus on evaluation.

3. Subject matter-HTML is familiar to the author of this paper and therefore required little preparation. The author of this paper felt that knowledge of the subject matter would help the author to focus on reviewing the design of the Web-Based Instruction.

4. Relevance-the publishers, the Waite Group Press and Sams Publishing, which are leading publishers of computer technology textbooks, advertise on the backcover of the HTML 3 Interactive Course that: "HTML 3 Interactive Course includes enrollment in the eZone-a complete Web-based Internet learning center-making this a powerful and comprehensive HTML training system." Therefore, a review of a "Internet learning center" seemed quite appropriate for this paper.

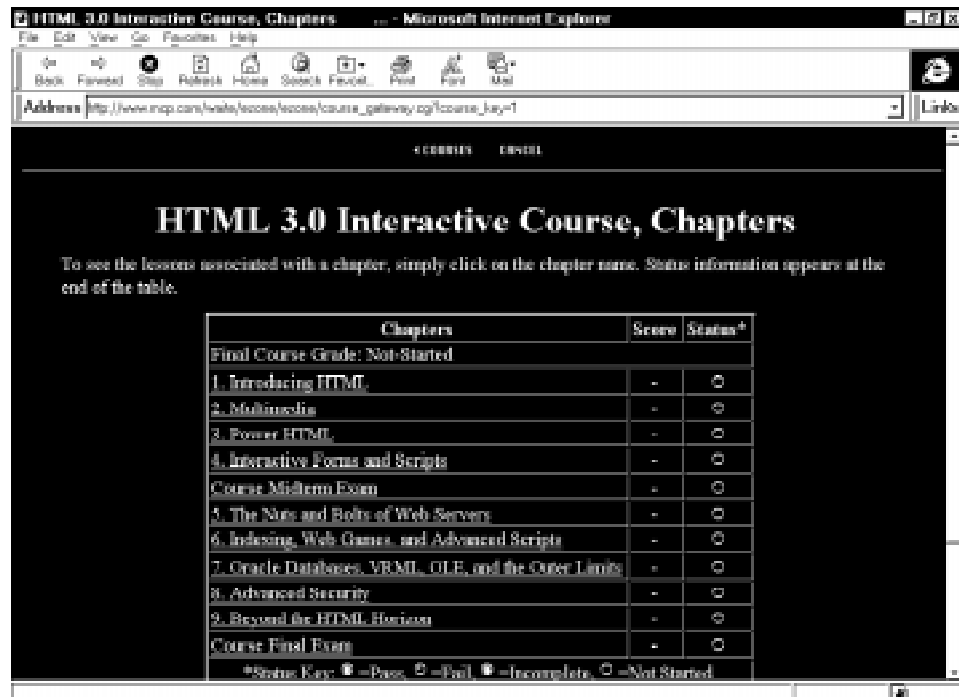
5. Conceptual-the HTML 3 Interactive Course is an interesting concept in that the textbook and the Web-Based Instruction course are married together. There

are 96 lessons (actually called sessions, echoing online computer education) with accompanying quizzes. You can complete all 96 lessons and accompanying quizzes without using the Web-Based Instruction course. But the Web-Based Instruction provides on-line quizzes which are scored automatically and a running total is maintained for all quiz scores. Additionally, there are also mid-terms and final examinations available. After you successfully complete and pass all of the quizzes and examinations, you can earn a certificate that states you successfully completed the course.

Description of the HTML 3 Interactive Course

The HTML 3 Interactive Course is accessed at www.waite.com/ezone. To enroll in the course, you must have purchased the HTML 3 Interactive Course textbook. Access to the course is controlled by a registration process that includes: filling out a form and supplying a word (which serves as the password) from a specific page in the textbook. The main menu is then displayed.

The main menu is a table of contents that list the chapters, scores (for quizzes and examinations), and status for each chapter. Below is the main menu:



Chapters	Score	Status*
Final Course Grade: Not Started		
1. Introducing HTML	-	○
2. Multimedia	-	○
3. Power HTML	-	○
4. Interactive Forms and Scripts	-	○
Course Midterm Exam	-	○
5. The Nuts and Bolts of Web Servers	-	○
6. Indexing, Web Games, and Advanced Scripts	-	○
7. Oracle Databases, VRML, DLE, and the Outer Limits	-	○
8. Advanced Security	-	○
9. Beyond the HTML Horizons	-	○
Course Final Exam	-	○

*Status Key: ● = Pass, ○ = Fail, ◻ = Incomplete, ○ = Not Started

Figure 1: HTML 3 Interactive Main Menu

The course contains nine chapters, a mid-term examination, and a final examination. There are a total of 63 quizzes, each quiz usually contains four questions. All questions are multiple choice with typically four choices. All text material is available online or in hardcopy. All quizzes are available online or in hardcopy. All answers to the quizzes are available on-line or in hardcopy. The mid-term and final examinations and accompanying answers are only available online. Users select what percentage of correct answers constitute a passing grade, such as 70 percent. After the course is completed successfully, students can print out a certificate stating they have successfully completed HTML 3 Interactive Course.

Chapter 4: Results

As described in Chapter 3: Methodology, two instruments were used to evaluate the Web-Based Instruction:

1. Nielsen's Top Ten Mistakes in Web Design
2. Jones'es and Okey's Interface Design for Computer-Based Learning.

In the following tables, scores are adapted from Nielsen's and Mack's severity ratings, are given as follows:

Score	Definition
0	No priority. No usability problem. Users can complete task.
1	Lowest priority. Cosmetic change only; not a usability problem. Users can complete task with no difficulty.
2	Low priority, a small usability problem. Users can complete task but with some difficulty.
3	High priority, a major usability problem. Users can complete a task but only with a workaround and with much difficulty.
4	Highest priority, a severe usability problem. Users cannot complete a task.
N/A	Not applicable. Some measurement items do not apply to the course that was reviewed. Comments are given as to why the measurement item was not applicable for this review.

Table 1: Usability Rating Definitions

Below are tables that present the data gathered:

Top Ten Mistakes in Web-Design

Measurement	Score	Comment
Use of Frames	0	Course gives you the choice of whether you want to use frames or not. Since you do not have to use the frame based version, there is no usability issue.
Gratuitous Use of Bleeding Edge Technology	0	Straight-forward use of HTML and CGI scripts.
Scrolling Text, Marquees, and Constantly Running Animations	1	No scrolling text, marquees, or animations are used. The graphical map does use icons with flames shooting off which are somewhat distracting.
Complex URL Names	2	URL names are not very helpful. For instance, the book says to go to <code>www.waite.com</code> but once there, you shift to <code>www.mcp.com</code> , which does not make for a good bookmark. Also, the main index page for the course is called <code>course_gateway.gci</code> , which is useful for a programmer but not for the student. A better name might have been <code>html30_index</code> .
Orphan Pages	0	No orphaned pages were found.

Table 2: Top Ten Mistakes in Web Design-Part 1

Long Scrolling Pages	3	There are many long scrolling page as the course uses a book metaphor. There were no links within the long documents to go back to the top of the document or to identify key sections with the chapter. Horizontal lines could have been used to separate major section within chapters.
Lack of Navigation Support	3	The navigation aids appeared at the top of chapters offering a choice to go back to lessons, chapters, courses, or cancel. The cancel button seemed inappropriate as users should probably want to go back to the start or the home page. But cancel implies ending a program. Also, navigation aids only appeared on the first page, which required a user to scroll back to the top of the page to select one of the navigation aids. Also, the names of the navigation aids that appear on the index are not very intuitive, such as Initiate.
Non-Standard Link Colors	0	Links used standard colors.
Outdated Information	3	No information was included to alert the user when the information was last updated.
Overly Long Download Times	0	No overly slow download times were experiences.
Average Score	1.2	As stated from the score, all user tasks were completed. This course design met the objectives of being usable. But improvements in providing better navigation aids could make using this course even easier to complete.

Table 3: Top Ten Mistakes in Web Design-Part 2

Interface Design for Computer-Based Learning

Measurement	Score	Comment
Provide Selectable Areas to Allow Users Access to Information	1	All areas where a user can go are indicated by either an underlined text or by a graphic that can be selected. All index type entries are placed in the middle of the page thus providing a visual clue to users what areas contain information.
Allow Users to Access Information in User Determined Order	3	Index maps both graphical and textual are provided to help users find information. No search engine is provided which could be useful if a user wanted to look up a specific term. But since this course is based on a book metaphor, the user is limited to reading chunks of the book. There are no hypertext links between chunks of information.
Provide Maps so that users can find where they are and allow provisions to jump to other information of interest from the map.	1	Both graphical and textual indexes are provided. And since a book metaphor is used, textual table of contents dominate the pages.

Table 4: Guidelines for Browsing-Part 1

Provide users with feedback to let them know they must wait when significant time delays are required for the program to access information.	N/A	Since this is course is written using HTML and CGI scripts, processing of data and so forth is handled by the Web Browser. Therefore, this course does not need to provide any special indicators when a form is being submitted, such as getting results from a quiz.
Provide users with information that lets them know they are making progress.	0	Each chapter contains a table of contents that includes status for each lesson. The status is indicated by icons for pass, fail, incomplete, or not started. Also provided are quiz scores. Thus it is very easy to keep track of progress towards completing each lesson each chapter, and the entire course.
Arrange information in a non-threatening manner so that users are not overwhelmed by the amount of information contained in a program.	0	Each chapter begins with an introduction and information is chunked up enough that each lesson can be completed in one setting, usually in 15 to 30 minutes.
Provide visual effects to give users visual feedback that their choices have been made and registered by the program.	0	When taking a quiz, the answer is highlighted, and when the quiz is graded, a comment, such as "You get 25% out of a possible 25% for question 2" is provided. A total score for the entire quiz is also provided. Feedback is quick.

Table 5: Guidelines for Browsing-Part 2

Measurement	Score	Comment
Integrate the program information across different media types.	3	No mention is made whether elements, such as sound or video are included in the course.
Provide information for all media types that is relevant, appropriate, and valid so that users know the information is credible.	1	Since this material is based on a book, the validity of the material is assumed to have been proven. Furthermore, since the idea is that this information supplements the hardcopy book, the presentation seems appropriate. (The next section, <i>Guidelines for Use of Metaphor</i> , describes the use of a book metaphor used by this course.)

Table 6: Guidelines for Media Integration-Part 1

Provide access to all types of media in the same manner.	4	Illustrations for some reason are accessed separately from each chapter by use of a hypertext link. To see an illustration, you must select a hypertext link, such as Figure 1-1. Underneath Figure 1-1 is the name of the Illustration. This is odd because the chapters include a graphic at the beginning which is imbedded in the text but yet illustrations must be viewed separately. This causes an inconsistency of how information is displayed throughout the course.
Use similar control icons for all types of media.	3	A variety of icons are used. In some cases, a text string underlined is used, in other cases, a text string with a graphic arrow is used, and in other cases, a graphic is used. Overall, navigation buttons are inconsistently used.

Table 7: Guidelines for Media Intregation-Part 2

Measurement	Score	Comment
<p>Use a metaphor or theme for the program.</p>	<p>2</p>	<p>There are two metaphors used with this course: The Waite Press Group and the HTML 3.0 Interactive Course.</p> <p>The Waite Press Group metaphor seems a mix of game and education, perhaps aiming at a younger audience. The focal point is the eZone, which is the starting point for accessing the course.</p> <p>See Appendix A: Supplemental Data for a full-description of the Waite Press Group metaphor.</p> <p>The other metaphor is that of the course itself, which uses a book metaphor and book icon, where there is a master table of contents followed by separate table of contents for each chapter. Sessions (lessons) and quizzes are provided in sequential, book-like order.</p>

Table 8: Guidelines for Use of Metaphor-Part 1

Make the metaphor obvious to users.	3	The use of metaphors seems to try appeal to two types of users: game players and students. The Mentor metaphor seems the best named and graphically illustrated. The Chill Zone seems most misnamed and also features an image that seems better suited for Doom. It is interesting that book icons and typical book structures are used as the course metaphors while other metaphors, such as God in the Universe, are used to conjure up a view of access to knowledge.
Make the metaphor applicable to the program's interest.	3	The use of a book icon and book structure seems like a good metaphor for a course that supplements a hardcopy book. But the Chill Zone metaphor seems to miss the point that users would not "chill" (relax) but instead would communicate (participate) using the Chill Zone. All told, the metaphors seem to be trying to reach two types of audiences: game players and students. Perhaps this is the correct approach for the Waite Press Group as their audience may indeed be game-playing students.

Table 9: Guidelines for Use of Metaphor-Part 2

Provide navigational tools and interaction styles that allow users to interact with the information contained in the program in a manner that is consistent with the metaphor.	2	The course uses familiar book-like navigational aids such as table of contents. The visual effects, to reinforce the book metaphor, could have been improved by providing a graphical map, such as a page graphic with hotlinks to headings on the page, but overall, the course metaphor works.
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Table 10: Guidelines for Use of Metaphor-Part 3

Measurement	Score	Comment
Allow for guided searches for specific information.	4	No search capabilities are provided. For instance, the only way to generate a list of all lessons, is to go through each chapter to determine what lessons are available. A master table of contents would have been helpful.
Allow users to search for information across different media types.	4	No search capabilities are provided, including even a list of figures.

Table 11: Guidelines for Use of Information Access

Measurement	Score	Comment
Provide cues such as maps and menus as advance organizers that help users conceptualize the organization on the information in the program.	1	The course enables a user to start and stop and return to a lesson. Also, there is a table of contents for the course supplemented by separate table of contents for each chapter.
Use a fixed format of frames to keep information at the same place or screens.	0	Format of screens is consistent.
Provide users with information to let them know where they are in the program.	1	Page layout is used consistently throughout the course. At the end of each lesson (session), users are alerted the lesson is complete by the use of a Quiz or Next Lesson button. At the end of each quiz, users are provided with a Grade My Choice or Clear Test and once a quiz is graded, user is provided with a score sheet. This sequence is repeated for all lessons.

Table 12: Guidelines for Use of Unfamiliar Territory-Part 1

<p>Use location indicators and progress reports to let users know where they are in the program.</p>	<p>1</p>	<p>Each chapter contains a table of contents which includes status for each lesson. The status is indicated by icons for pass, fail, incomplete, or not started. Also provided are quiz scores. Thus it is very easy to keep track of progress towards completing each lesson, each chapter, and the entire course.</p>
<p>Choose specific fonts, font sizes, and font characteristics to represent certain types of information.</p>	<p>1</p>	<p>Fonts are used consistently. Font size for headings are used consistently to indicate importance. List items are indicated by graphic, such as a world globe. Horizontal rules could have been used to further indicate the importance of a section or when a sub-section starts and a new sub-section begins.</p>

Table 13: Guidelines for Use of Unfamiliar Territory-Part 2

<p>Provide users with immediate descriptions of program controls on the same screen as the control.</p>	<p>4</p>	<p>As described earlier, use of navigation aids is inconsistent. A case in point is when a user completes a quiz, the user is instructed, in a sentence, not to use the Web Browser's Back button but instead to select either Lesson or Chapter button. (Actually the buttons are labeled Lessons and Chapters). And for the quiz, there are two additional buttons, Grade My Choices and Clear Test. What is not explained is if you choose Grade My Test, can you then Clear Test and retake the test until you select Lessons or Chapters buttons. This usability problem could have been solved with a Record My Score button and then an instruction to use to select Lessons or Chapters to continue.</p>
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Table 14: Guidelines for use of Unfamiliar Territory-Part 3

Interface Design for Computer-Based Learning: Summary

Measurement	Average Score
Guidelines for Browsing (seven items)	0.71
Guidelines for Media Integration (four items)	2.5
Guidelines for Use of Metaphor (four items)	2.5
Guidelines for Use of Information Access (two items)	4.0
Guidelines for Use of Unfamiliar Territory (six items)	1.3
Summary of Scores (total of 23 items)	1.78

Table 15: Summary of Computer-Based Learning Scores

Chapter 5: Conclusions

Summary

Overall, the course was created with the purpose to enable a user to learn about HTML, take examinations and quizzes to test the user's knowledge, perform examples online, and when necessary seek expert help from others through e-mail, chat groups, FAQs, and other WWW references. The evaluation shows that the course is indeed usable and presents no major usability issues.

But the usability of the course, especially in use of navigation aids and metaphor, could be improved upon.

Suggested Changes to Navigation

Here are some suggested changes:

- Horizontal lines and better use of font types and sizes should be included to help identify sections in long Web-Pages.
- A return to the top of the page and a return to index should be included in long Web-Pages.
- A search engine should be provided to enable users to search for specific concepts. (Also a hypertext linked glossary would be useful.)
- Navigation buttons should appear on the top of each Web-Page; not just on top of the first page.
- The Cancel button seems unnecessary as using the Web-Browser Back button provides the same effect.
- Include illustrations as part of the Web-Page and do not force user to select the Illustration separately for viewing.
- Provide consistent visual navigation icons. Icons are not consistently used and do not have

the typical look and feel of most Web-Based applications.

Suggested Changes to Metaphor

Here are some suggested changes:

- The Waite Group Press metaphor could be toned down but this does become an issue of aesthetics. Overall, perhaps renaming some of the areas, such as Chill Zone, might be an improvement.
- The Course metaphor could be improved upon by use of some visuals, such as using a book image and overlaying the table of contents inside the book. The table of contents could be hot links to the chapters. Also, the background of the Web-Pages could be a notepad or a paper like text to further emphasize the book metaphor.
- Another enhancement would be to use video clips with the Mentor or also the use of conferencing software with the Chill Zone.

Further Research

If as Nichols (1995) predicts that: "...the Web will likely soon become the most popular medium for the delivery of distance education type materials.", then much additional research will be needed in this subject area. This project proposal only attempts to review one aspect of WBI design, which is user interface design. Other issues, such as determining what content is suited for WBI and incorporating adult learning theory, such as learning styles, into WBI design, stand out. The author plans to fully engage these issues in subsequent research projects.

References

Alexander, S., Teaching and Learning on the World Wide Web, 1996. [On-Line]. Available:

<http://elmo.scu.edu.sponsored/ausweb/ausweb95/papers/education2/alexander>, pages 1 through 9. [Part of AUSWeb 95 conference.]

Boling, E.S., and Sousa, G., Interface Design Issues in the Future of Business Training, Business Horizons, Volume 36, Number 6, November/December, 1993, page 54.

Bannan, B., and Milheim, W.D., Existing Web-Based Instruction Courses and Their Design. In Khan, B.H., (Ed.), Web-Based Instruction, 1997, Educational Technology Publications, Englewood Cliffs, New Jersey, page 381.

Bickerstaff, D.D., CBT Training of CAI Developers, Conference Record for 1992 IEEE Fifth Conference on Human Factors and Power Plants, 1992, page 432.

Clark, G., Glossary of CBT/WBT Terms, 1996. [One-Line]. Available
<http://www.clark.net/pub/nractive/alt5.htm>, pages 1 and 2.

Dillion, A. and Zhu, E., Designing Web-Based Instruction: A Human-Computer Interaction Perspective. In Khan, B.H., Web-Based Instruction, 1997, Educational Technology Publications, Englewood Cliffs, New Jersey, pages 222 through 223.

Fox, G. and Mills, K. Web Technologies and the Potential for Innovation in Distance Education, International Journal of Modern Physics, Volume 8, Number 1, 1997a, page 107.

Fox, G. and Mills, K. Web Technologies and the Potential for Innovation in Distance Education, International Journal of Modern Physics, Volume 8, Number 1, 1997, page 119.

Jones. M.G., and Okey, J.R., Interface Design for Computer-based Learning Environments, 1995. [On-Line]. Available <http://www.hbg.psu.edu/bsed/intro/docs/idguide>. [Also abridged version appears in Khan. B.H, (Ed.), Web-Based Instruction, 1997, pages 241 and 242.]

Khan, B.H., (Ed.), Web-Based Instruction, 1997, Educational Technology Publications, Englewood Cliffs, New Jersey, page 6.

McManus, T.F., Special Considerations for Designing Internet Based Instruction, 1995. [On-Line]. Available <http://ccwf.cc.utexas.edu/coe/depts/ci>, pages 1 through 7.

McManus, T.F., Delivering Instruction on the World Wide Web, 1996. [On-Line]. Available <http://ccwf.cc.utexas.edu/~Emcmanus/wbi.html>, pages 1 through 13.

Nichols, G., Formative Evaluation of Web Based Training, 1995. [On-Line]. Available <http://www.ucalgary.ca/~nichol/formeval/formeval.htm>, pages 1 through 8. [Similar version appears in Khan. B.H, (Ed.), Web-Based Instruction, 1997, pages 369 through 372.]

Nielsen, J., Top Ten Web Design Mistakes, Jakob Nielsen's Alertbox for May, 1996, (1996b). [On-Line]. Available <http://www.useit.com/alertbox/9605.html>, pages 1 through 3.

Nielsen, J. & Mack, R.L., (Eds.), Usability Inspection Methods, (1994), John Wiley & Sons, New York, NY, page 49.

Parson, R., An Investigation into Instruction Available on the World Wide Web, 1997. [On-Line]

Evaluating Web-Based Instruction - June, 1997

Available <http://www.osie.on.ca/~rparson/outld.htm>, pages 1 through 2. [Part of Master of Education Research Project.]

Pernici, B., and Casati, F., The Design of Distance Education Applications Based on the World Wide Web. In Khan, B.H., Web-Based Instruction, 1997, Educational Technology Publications, Englewood Cliffs, New Jersey, page 246.

Peraya, D., Distance Education and the WWW, 1994. [On-Line]. Available <http://tecfa.unige.ch/edu-ws94/contrib/peraya.fm.htm>, pages 1-9.

Relan, A. and Gillani, B.B., Web-Based Information and the Traditional Classroom: Similarities and Differences. In Khan, B.H., (Ed.), Web-Based Instruction, 1997a, Educational Technology Publications, Englewood Cliffs, New Jersey, page 43.

Relan, A. and Gillani, B.B., Web-Based Information and the Traditional Classroom: Similarities and Differences. In Khan, B.H., (Ed.), Web-Based Instruction, 1997b, Educational Technology Publications, Englewood Cliffs, New Jersey, page 45.

Santi, P.A., Interactive World Wide Web-Based Courseware: Similarities and Differences. In Khan,

B.H., Web-Based Instruction, 1997b, Educational Technology Publications, Englewood Cliffs, New Jersey, page 407.

Squires, D., and Preece, J., Usability and Learning: Evaluating the Potential of Educational Software, Computers Education, Volume 27, Number 1, page 15, 1996.

Welsh, T.M., An Event-Oriented Design Model for Web-Based Instruction. In Khan, B.H., Web-Based Instruction, 1997, Educational Technology Publications, Englewood Cliffs, New Jersey, page 164.

Appendix A: Supplemental Data

Below are comments that supplement some of the data reported in Chapter 3: Results.

From *Table 8: Use of Metaphor-Part 1, Use a metaphor or theme for the program*, here are expanded comments:

The eZone features a picture of "God" pointing out in the universe. This is an odd metaphor that is very abstract in concept and conveys little about what the site provides. The next icon is that of the Learn Zone which features an illustration of a scholar. The purpose of the Learn Zone is to enable a user to start a course or check up on their status, such as number of quizzes completed or chapters left to be completed. This metaphor seems appropriate as it is basically an index of the courses available.

The next metaphor is that of a Mentor, which is represented by a Monk. The Mentor enables users to send e-mail to an expert (mentor), who will answer the question.

The last metaphor is the Chill Zone, which is billed as a student-hangout”

An image of a women with stars shooting from her head is used to denote access to chat, resources, and so forth. This is a chat-room and also a place to subscribe to online magazines.

The last metaphor is that of the course itself, which uses a book metaphor and book icon, where there is a master table of contents followed by separate table of contents for each chapter. Sessions (lessons) and quizzes are provided in sequential, book-like order.