

## Web Design Guidelines for Web-Based Instruction

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Web-based instruction (WBI) is becoming increasingly popular. However, WBI may burden learners with the additional problem of interacting with a computer system during the learning task. Operation of the computer system through the user interface has been shown to affect many cognitive components of the instructional environment, including attending, memorizing, strategizing, problem-solving, and ultimately learning itself (Guttormsen Schar, Schlupe, Schierz, & Krueger, 2000). Danielson, Lockee & Burton (2000) argue that the user interface is the embodiment of the instructional strategy in WBI, and that interface design must be integrated with the traditional instructional design process to ensure the overall effectiveness of the instruction. It is no wonder then that instructional designers who are looking for guidance on good site design, page design, and multimedia for WBI are turning to publicly available Web design guidelines.

There are both advantages and problems with existing sets of Web design guidelines (Boling, Bechelmeyer, Squire & Kirkley, 1997). For instance, many of these guidelines were derived from user-centered design approaches, and consequently they are connected to particular models of user motivations and tasks. A popular book, *Designing Web Usability* (Nielsen, 2000), focuses on informational and commercial Web sites where the user is a “customer”, and the main task is to find information quickly and to obtain a needed service or product. Nielsen describes the importance of Web site designs that will create customer satisfaction, because in a competitive Web environment, users may easily go elsewhere with one click of the mouse. A sample of Nielsen’s guidelines and the user goals they support are shown here:

- Web pages must support user-controlled navigation (so that users can freely shop for information and products.)
- The pages must have a concise writing style with very short pages with secondary information relegated to supporting pages (for readers who frequently scan text.)
- Important information must pop out immediately on the page (so that users can quickly find what they need.)
- Multimedia is used to direct attention to important information and impress readers (so that they will remain at the site.)

Knowing the purpose of the Web-based system that is being designed is critical when selecting existing sets of guidelines to aid Web site design. Some user-centered guidelines may be inappropriate for some instructional purposes. Without a careful examination of the models and assumptions underlying the guidelines, inappropriate guidelines for an instructional Web site may be selected, and the misuse of guidelines may be perpetuated. The guidelines that are selected by the instructional developer should support the instructional goals of the instructional Web site. But, relating instructional goals to site design is more of an art than a science, and some designers are better than other. Design guidelines that are based on research and best practices can be a useful aid for designers at all levels of experience.

### **Comparison of Instructional Web sites to Informational Web sites**

Users of an instructional Web site may be “customers,” but they are more importantly “learners.” Romiszowski (1993) proposes that components of an instructional system differ from an information dissemination system. The design of instructional systems focuses more on the evaluation of learner performance and feedback than on simply providing information. In contrast, information system design focuses more on content, and how it is organized, structured and presented. While the goals of all Web sites may be customer satisfaction and task efficiency, the overarching goal of an instructional site is to provide an environment for optimal learning. But, guidelines that support the important goals of learner satisfaction and effective and efficient learning are not easy to extract from the existing sets of Web design guidelines.

### **Human Factors Guidelines for Effective Learning**

Several categories of Web design guidelines are specifically useful for the design of instructional Web sites. These include: 1) site structure guidelines (to improve navigation and understanding of content organization), 2) page design guidelines (to improve readability, comprehension, and aesthetic appeal), and 3) multimedia guidelines (to support relevance and comprehension). In each of these categories, guidelines can be prioritized in terms of the purposes and goals of an instructional Web site.

#### ***Web Site Structure***

The structure of a Web site refers to the sequencing of pages and relationships between pages that create the physical setup of the site. Guidelines for structuring a Web site are especially helpful when the proposed Web site will contain a large number of pages and when the structure is complex. Several types of Web site structures have been described in guidelines (Lynch & Horton, 1999; Rosenfeld & Morville, 1998), along with discussions of the advantages and disadvantages of each. These structures focus on commercial and institutional Web sites, but their models can be used to analyze instructional Web sites. Although there are many different kinds of Web site structures, there are three structures that are most likely to be used at instructional sites: linear, hierarchical, and web structure.

***Linear Structure.*** The linear structure allows the learner to move only forward or backward through the site. Thus, the learner’s freedom of movement within the site is strictly controlled and severely restricted. While there may be hyperlinks to external Web sites or to links to internal pages, such as a glossary, there is no freedom to deviate from the instructional developer’s plan. Completion of a unit of instruction is required to progress to the next unit. Linear structure simplifies site design, giving the designer complete control of the instructional sequence.

***Hierarchical Structure.*** This structure starts with a home page that allows branching to other instructional units (e.g., lessons and modules). Units are usually chosen from a menu, and often the instructional units may be chosen in any order from a table of contents. Learners have more control over the sequence of instruction within a hierarchical site structure because they can choose the major topics. But, subtopics are usually accessed in a linear fashion.

***Web Structure.*** This structure provides an almost unlimited number of paths through the site. However, there is no formal page hierarchy and pages may or may not be interconnected. Learners may like the freedom to browse and explore, but the disadvantage is that they may not understand the site’s underlying structure, and can become lost or disoriented. This structure may be good for highly experienced learners seeking higher levels of knowledge, such as understanding complex principles (Golas, 2000).

When designing a complex Web site having a hierarchical or web structure, the interface for navigation is an important related design issue. Many sets of existing guidelines suggest the use of navigational aids, such

as image maps, highlighted links, history lists, and the use of titles and subtitles. This will prevent confusion when navigating a complex site. Each navigational aid, however, should be examined in light of the learner's purpose in navigating the site. If the purpose is browsing to find a specific item, then the learner will require an interface that supports a set of exploratory and scanning activities appropriate for surveying a large amount of information without going into too much detail. If the purpose is to learn the information presented on the site, some navigational aids may be more appropriate than others. For instance, in an empirical study cognitive performance on a study task improved when an extended history list showed the user past navigational choices. Unfortunately, efficiency dropped because users spent more time on the task than they would have without the history list (Guttormsen, Schar, Schlupe, Schierz, & Krueger, 2000). Regardless of the purpose of the Web site, many general human factors principles undoubtedly apply to both commercial and instructional Web sites. Good site design can prevent learner frustration with navigation by eliminating "dead-ends," inappropriate feedback, or navigational elements that are not obvious.

### ***Page Design***

The design of a Web page includes the layout of text and graphics on the screen, typography, and writing style. The *Yale Web Style Manual* suggests that important information on a page should be placed on a diagonal axis with the most important going from left to right and top to bottom to support quick exploration and scanning of text (Lynch & Horton, 1999). Good page design for instructional Web sites should serve slightly different purposes than a commercial Web site. The page design should 1) focus the learner's attention on important information to increase comprehension and memory, and 2) create an aesthetically pleasing environment for learning. Simple page layouts with good balance and proportion, and without too many irrelevant graphics, will serve these purposes. Regardless of what learning activities are guiding page design, design should minimize eyestrain caused by glare, busy backgrounds, and long textual line lengths.

Instructional designers must ask themselves if learners would prefer to have printed pages of instruction or prefer to read them on the screen. Page design becomes more complicated when both printed versions and screen versions of instruction are both required. Screen printing tasks also involve interactions with the computer that do not directly involve instruction, yet they have the potential to affect the instructional process if these tasks become too burdensome for the learner.

### ***Media***

Instructional designers are becoming more interested in multimedia to supplement text and graphical instruction. But, this is more often driven by the capability to use technology rather than educational research and theory (Park & Hannafin, 1993). When considering audio, video, or animation in the design of WBI, the primary purpose of the media should be to enhance learning and retention. Other purposes are to direct attention of the user to important information or to enhance user enjoyment of the site, but these may be of lower priority in WBI. Media should not be used if it distracts the learner from the instructional tasks or when it increases time to complete the tasks (e.g., waiting for downloads).

***Animation.*** Animation has a variety of uses, including showing dynamic changes or illustrating change over time. Animation and 3-D graphics create new visualizations and support more natural interactions with the computer. They can enhance learning if they support perceptual and cognitive processes that are critical to the learning task (Hamel & Ryan-Jones, 1997). Motion or action used primarily to enhance the realism of the presentation does not appear to have a significant effect on learning (Anglin, Towers, & Levie, 1996).

***Video.*** Just as with animation, video will improve instruction when it is important to show movement or a sequence of actions, such as a procedural task (Wetzel, Radtke, and Stern, 1994). There are several reasons why it is better to try to accomplish the same effect with still graphics and text or voice narration: it is more

cost effective, will be more accessible to learners who have less than adequate computer display systems, and will decrease learner wait time.

**Audio.** Audio provides an input modality that is separate from the visual display. Speech output used to provide narration is not very effective when it is simply redundant to text presented on the screen. But, speech output has been shown to greatly enhance learning when it is used to explain complex diagrams or animations that require learners to concentrate on the visuals. Textual explanations require the learner to scan between the visual display and the text, and thus reduce attention to the visual display (Kalyuga, Chandler, & Sweller, 2000; Mayer & Moreno, 2000). Audio is more effective if learners have control of audio output, such as volume, and replay.

### Conclusions

Although publicly available guidelines for Web design are plentiful, they may be at odds with instructional goals as well as research findings. It is important for an instructional designer to carefully examine the original purpose for a set of guidelines as well as support for their pedagogical correctness. In an example provided by Danielson, Lockee & Burton (2000), human interface design guidelines often suggest pull down menus for data entry, rather than text input because text commands must be committed to memory and are subject to spelling errors. But if the instructional goal requires that students memorize the textual inputs because they are terms and definitions that are required learning, then the command input is preferred over menus. Guidelines can aid a designer in improving the quality of instruction, but they can also degrade the quality of instruction if they are inappropriate or incorrect for the instructional goals of a Web site.

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