

# Web Design for Information Problem-Solving: Maximizing Value for Users

by  
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Web page creation is becoming commonplace. With the development of hypertext editing packages and export tools for word processing and other applications, HTML coding is getting easier and easier. However, while writing HTML is relatively simple, creating valuable Web pages is not. Just as the spread of desktop publishing software led to hodgepodge combinations of typestyles (referred to by some as "ransom note typography"), so the ease of Web page creation has resulted in some Web pages of dubious design and questionable value.

As the World Wide Web matures, people are paying more attention to the development of well-designed pages. Many designers agree on a basic set of recommendations, such as minimizing download time, avoiding flashing text or insufficient color contrast, keeping pages short with important content near the top, and so on. (Several Web style guide resources are listed in the sidebar.) In addition, well-designed pages focus on meeting the needs of their potential audiences.

Some Web pages are designed for a very specific purpose and audience: the students in a course or the user of a specific piece of software, for example. Many pages must be designed for a broader—and often unknown—audience. But even this less predictable audience often approaches the Web with a fact to find or a problem to solve. Regardless of whether we are designing for a very narrow user group with a

well-defined purpose or for a general audience with broader needs, it is valuable to think of our users as approaching our pages in an information-seeking or problem-solving mode.

This article introduces the concept of designing Web pages that facilitate information seeking and problem-solving. We describe a model for information problem-solving and techniques for applying the model to Web page design. In addition, we examine some implications of applying the model beyond Web technology.

## *An Information Problem-Solving Model*

Research and practice show that successful problem-solving involves a series of steps or stages (e.g., Kuhlthau, 1993). The Eisenberg-Berkowitz Model of Information Problem-Solving proposes that all successful information problem-solving includes six steps, known colloquially as the Big Six (Eisenberg and Berkowitz, 1990). These steps are listed on the following page.

Although its stages often occur in the order listed, the Information Problem-Solving model is flexible enough to allow jumping between stages or looping back to previous steps as needed. Most people find the model sensible and unsurprising—almost modest in scope. This simplicity belies the depth of the model. The Big Six is comprehensive enough to adequately describe nearly any information problem, decision, or task. Since it's intuitive enough to

▼

*When you design  
your Web pages, are  
you really keeping  
your potential  
users in mind?*

1. **Task Definition**
  - 1.1 Define the problem
  - 1.2 Identify the information needed
2. **Information-Seeking Strategies**
  - 2.1 Brainstorm all possible sources
  - 2.2 Select the best sources
3. **Location and Access**
  - 3.1 Locate sources (intellectually and physically)
  - 3.2 Find information within sources
4. **Use of Information**
  - 4.1 Engage (read, see, hear)
  - 4.2 Extract relevant information
5. **Synthesis**
  - 5.1 Organize information from multiple sources
  - 5.2 Present the result
6. **Evaluation**
  - 6.1 Judge the result (effectiveness)
  - 6.2 Judge the process (efficiency)

explain to young students, yet inclusive enough to apply to post-secondary and professional problems, the model has been adopted by many school systems as part of the K-12 curriculum.

For example, the model is often introduced to students (young and old) using sample "problems," such as choosing a birthday gift for a friend or deciding what movie to see, then applied to classroom projects, such as writing a book report, designing and carrying out a scientific experiment, or creating a multimedia history report. The Big Six is also used with homework, class activities, and as a guide for taking tests and quizzes. Teachers and library media specialists have developed lessons and exercises to teach and reinforce specific steps in the model; for example, the Trash-N-Treasure Method of Note-Taking (Jansen, 1996), adaptable to almost any grade level, gives students practice in extracting information (step 4 of the model). Older students

might use the model to approach complex tasks such as preparing a term paper or choosing a college.

### *Technology for Information Problem-Solving*

Eisenberg and Johnson (1996) have shown how students can make use of various technologies at each stage in the Information Problem-Solving model. During Task Definition (step 1 of the model), students often use e-mail, listservs, newsgroups, chat, videoconferencing, and other online communication methods to clarify assignments and to brainstorm problems with teachers, fellow students, and others in their school or in the global online community.

During step 2, Information Seeking, students identify and assess computerized electronic resources as they develop strategies to seek useful information for their problem. Software may also be used at this stage to generate timelines, organizational charts, flow charts, or project plans to prioritize and organize complex information problem-solving tasks. -

In step 3, Location and Access, students may rely on online catalogs, searchable indexes of periodicals, electronic encyclopedias, and other full-text sources. They may also search the World Wide Web using Internet search tools such as Yahoo!, Excite, or AltaVista, or they may search gopher or ftp sites to locate relevant information.

Having identified potential sources, students then "engage and extract" the relevant information (step 4, Use of Information) by connecting to and accessing online or locally stored electronic information sources; viewing, downloading, and decompressing files as needed; using copy-and-paste features and word processing software to take notes and record citations; and filtering out nonrelevant information.

To organize and communicate the results (activities in step 5, Synthesis), students frequently use word processing, database management, spreadsheet, and graphics software, and they may distribute their projects via e-mail, Web publishing (creating their own pages), and other electronic media. Finally, students

## Web Page Design Guides for Your Reference

Several useful Web design guides are available online.

- ◆ Tim Berners-Lee's Style Guide for online hypertext (<http://www.w3.org/pub/WWW/Provider/Style>) is a classic: It's concise and readable, with emphasis on structure and style.
- ◆ Another classic is the Web Style Manual ([http://info.med.yale.edu/caim/StyleManual\\_Top.HTML](http://info.med.yale.edu/caim/StyleManual_Top.HTML)) by Patrick J. Lynch. Lynch's strong background in art and design give this guide its strong practical emphasis on design issues (layout, grid use, typography, etc.).
- ◆ Rick Levine's Guide to Web Style (<http://www.sun.com/styleguide>) also provides very good recommendations for content and design.

Useful Web design information can also be found in print format. Typically, these books cover HTML, graphics files, server set-up, and a wide variety of other introductory material, with design considerations typically limited to a chapter or so.

- ◆ *Designing for the Web: Getting Started in a New Medium*, by Jennifer Niederst with Edie Freedman (Sebastopol, CA: O'Reilly & Associates, Inc., 1996), provides a general overview of the Web; of special interest is the final chapter, which provides an outline for Web design.
- ◆ *World Wide Web Design Guide*, by Stephen Wilson (Indianapolis, IN: Hayden Books, 1995), provides an introduction to HTML, sound, and graphics, and includes a chapter on the challenges of Web design.

evaluate the process they used and the product they created, including the impact of the technology they used. At each stage, technology can boost the information problem-solving process.

Beyond using technology in the information problem-solving process, we can use the Information Problem-Solving model to help improve technology-driven systems. Looking at information technology systems such as the Web from a problem-solving perspective provides a framework for effective Web page design. The technology and its application can be refined in light of an awareness of how people will use the Web for information problem-solving.

### *Applying the Model to Web Design*

The Information Problem-Solving model is useful in Web page design because it helps us to focus on and to define the audience for any given Web page. By assuming that the reader is at one of the six Information Problem-Solving steps, we can then use the model to guide the design. The question then becomes, "What can we do in our Web pages to help readers who are at a particular step in the model?" Table 1 summarizes some ways to approach readers who are at each step.

For example, readers who are engaged in the step 1 (Task Definition) activities of defining a problem or identifying potentially useful information are likely to want to know a site's purpose immediately so they can quickly determine if it is worth pursuing. Readers who are evaluating and choosing sources (step 2 activities, Information Seeking) will need to know the scope and organization of the site, as well as the currency and source of the information posted there. They will further appreciate suggested keywords or synonyms, as well as pointers to other potentially useful sites.

Step 3 (Location and Access) readers, who are engaged in locating sources and information within sources, need to find a site easily in the first place. They also need to be able to search for information within a site productively, through either a search tool or a well-defined set of

internal links and pointers. Readers who are ready to retrieve and use information (step 4, Use of Information) will profit from a consistently organized site with minimum distractions and maximum content. They will appreciate quick download speed and commonly used file formats. They also need to know of any restrictions on information use, such as copyright restrictions.

Providing a good example of synthesis in the content and presentation of a site can benefit step 5 (Synthesis) readers who are ready to organize information from multiple sources and to present their results. Readers who have completed their tasks may still evaluate the effectiveness and efficiency of the process they went through (step 6, Evaluation), and their feedback can help

**Table 1:  
Applying the Eisenberg–Berkowitz  
Model to Web Page Design**

User's activity	Useful design features
1. Task Definition	<ul style="list-style-type: none"> <li>• State your site's purpose</li> <li>• Ask users key questions about their needs, and direct accordingly ("if you need x, then see y").</li> </ul>
2. Information Seeking Strategies	<ul style="list-style-type: none"> <li>• Make the scope and organization of the site clear.</li> <li>• Suggest keywords, synonyms</li> <li>• Point to other sources—but be selective (or at least annotate)</li> <li>• Put your information in context; provide label, date, source on each page</li> </ul>
3. Location and Access	<ul style="list-style-type: none"> <li>• Be accessible (get your page listed and pointed to)</li> <li>• Provide internal links and/or search tools to help user find things in your pages</li> <li>• Use headings, "chunks"</li> </ul>
4. Use of Information	<ul style="list-style-type: none"> <li>• Provide consistent, organized design in your pages</li> <li>• Avoid distracting and content-less graphics or backgrounds</li> <li>• Use the best medium for the purpose (sound? video? text?)</li> <li>• Minimize download time for graphics, sound, etc.</li> <li>• Choose common file formats and command sets for easy downloads</li> <li>• Explain any requirements or restrictions on use</li> </ul>
5. Synthesis	<ul style="list-style-type: none"> <li>• Provide a good example of synthesis in your own content and presentation</li> </ul>
6. Evaluation	<ul style="list-style-type: none"> <li>• Provide feedback mechanism for users to get them thinking about evaluating sources and content. Ask leading questions.</li> <li>• If possible, periodically survey users.</li> </ul>

improve a site. Asking specific questions in addition to providing a free-text form or "mail-to" address is an important part of providing feedback mechanisms on a site.

### *Introducing the Model to Web Designers*

One of the benefits of applying the Information Problem-Solving model to Web design is that the principles in the model are easily interpreted and applied, even by Web developers who were previously unfamiliar with the model itself. For example, participants at a recent workshop called "Applying Information Theory to Web Design" were invited to suggest ways that Web pages could be designed to aid readers at each step in the model. The 29 workshop participants were familiar with HTML and Web page construction (many maintained institutional Web sites) but were not familiar with information theory or the Big Six model. After reviewing the model, the partici-

pants, who had not yet seen Table 1, were divided into six groups (one for each step) and asked to suggest specific Web page features that would be of help to hypothetical readers at that stage in the information problem-solving process. The participants generated several general Web design guidelines and included many of the features discussed above, but they also generated several additional ideas, as shown in Table 2.

For example, participants suggested that explicitly defining the prospective audience and setting expectations for a site could be useful to readers in step 1 of the model (Task Definition). Participants tended to group steps 2 (Information Seeking) and 3 (Location and Access) together and suggested many of the same strategies for readers in these two stages. Among the strategies suggested were the inclusion of a "subway system" map or guide to the information at a site and the use of intermediary pages forming a "clear path" to the target information. Participants in these groups also suggested that Web

pages should take into account both first-time and repeat visitors.

Participants in the group assigned to step 4 of the model (Use of Information) also suggested providing different versions for different audiences, along with examples of how to apply the information supplied on a page. The importance of general page organization was emphasized by participants working on step 5 (Synthesis). Participants in the group assigned to step 6 (Evaluation) pointed out that readers could be asked to sign an online guest book; they also suggested asking readers directly whether the site was easy to find and whether it answered their needs. In addition, this group suggested that counters and log files be used to obtain quantitative measures of page use.

As these comments indicate, knowledge of the Information Problem-Solving model can improve Web design even by participants who already know the mechanics of creating and publishing Web pages. Evaluations of the workshop, which included several applications of information theory to Web design, were extremely high, with many positive comments on the practicality of the theory.

### *Beyond the Web*

As the World Wide Web is more widely used in educational settings, Web page designers need to address the needs of audiences who have specific information problem-solving needs. Novelty, special effects, and sophisticated HTML and Java programming are not enough: Web page designers need a solid foundation and framework within which to apply their technology.

The Big Six model of Information Problem-Solving provides such a framework. By anticipating the likely information needs of hypothetical readers at each step in the model, designers can increase the usability of their pages even when the exact audience cannot be precisely predicted. Preliminary evidence indicates that application of the Big Six model to Web design is valuable even to established Web site designers.

**Table 2:**  
**Additional Ideas for Applying the Big Six from Workshop Participants Experienced in Web Design**

User's activity	Useful design features
1. Task Definition	<ul style="list-style-type: none"> <li>• Explicitly identify the site's intended audience</li> <li>• Set user's expectations for site</li> </ul>
2. Information Seeking Strategies and 3. Location and Access	<ul style="list-style-type: none"> <li>• Include a "subway system" map or guide to the site</li> <li>• Provide a choice of access points—by audience, by topic, etc.</li> <li>• Use intermediary pages to create a clear path to target information</li> <li>• Design for both first-time and repeat users</li> </ul>
4. Use of Information	<ul style="list-style-type: none"> <li>• Provide different versions for different audiences</li> <li>• Provide useful links</li> <li>• Include examples of how to apply the information you're supplying</li> </ul>
5. Synthesis	<ul style="list-style-type: none"> <li>• General page organization is important (category, task, keywords)</li> </ul>
6. Evaluation	<ul style="list-style-type: none"> <li>• Ask readers to sign online guest book</li> <li>• Maintain counters, log files to quantify use</li> </ul>

The advantage of such a framework is that it remains useful even as the technology itself changes. Resultant utility of the Information Problem-Solving model for improving Web design has been shown here, but when current tools such as HTML and Java have been replaced by newer technologies, the principles of the model will still apply. Regardless of the technology in use, focusing on the audience and anticipating the steps they may be going through will provide insight into the information problem-solving process and will increase the value of the product. ▲

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