

Evaluating the Effectiveness of Scientific Material Published on the Web

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Scientific publishers, institutions, and corporations increasingly use the Web to present novel research data, interactive tools, and promotional materials. Peer-reviewed scientific journals in all disciplines provide supplementary information for printed articles on Web sites. The information can include highly detailed materials and methods, additional figures not in a printed article, or multimedia data, such as video.

Scientists are also using the Web to go beyond the traditional article format. For instance, the Southern California Earthquake Data Center (SCEDC; www.data.scec.org) provides easy and timely access to data for researchers. Its Web site includes a searchable earthquake archive that provides detailed data on any event, a clickable fault map of southern California, and even a map of recent earthquakes in California and Nevada that provides up-to-the-hour data on seismic events in southern California events and some large events in northern California and around the world.

The National Center for Biotechnology Information hosts not only a database of peer-reviewed publications (PubMed) but many databases of scientific information. For instance, the PubChem BioAssay database provides the chemical structures of compounds that have activity in a given screening assay, shows how they are structurally related, and provides links to appropriate peer-reviewed publications.

The National Oceanic and Atmospheric Administration (NOAA) has created a powerful Web site to disseminate real-time and archival information to researchers and the general public: <http://hubblesite.org>

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is devoted to providing information from the Hubble telescope to educators and the general public. Web Elements (www.webelements.com) is a site originating in the University of Sheffield, England, that provides an interactive periodic table of the elements.

The list of science-related Web sites that provide access to research information through novel tools or simply index traditional print materials is huge and continually expanding. However, although the Web eliminates the costs of print, ink, paper, and postage of traditional print media, Web production is not free. It requires knowledgeable writers, editors, graphic artists, and information-technology specialists. In addition, the Web is a “permissive” rather than “interruptive” medium. Information is not delivered to the target; instead, the target must seek the information. Being published on the Web does not guarantee that your work will be viewed by the right person.

As a Web-site manager, publisher, or editor, how do you know that your Web content does more than just elicit an “Oh, that’s really cool” response from the user? How do you know that your Web materials are reaching the target audience and having the effect you desire?

Before you can evaluate the effectiveness of any print piece, you must know the target audience and the goals of the piece. The same is true of information on the Web. You need to know what you are trying to accomplish with your Web site and online content, whether textual or interactive. Some Web sites have a clearly defined mission. For instance, Shang-Lin Chen, Web manager of the SCEDC Web site, says that its primary goal is to provide data for researchers. Consequently, the Web site consists primarily of applications that provide easier access to the data archives. It also includes catalogs created by researchers from their work. When the

biotechnology company Ambion created its Web site, its goal was to establish itself as the “RNA expert” among companies in the life sciences, so it created a “destination” for scientists looking for information about RNA.

Once you know your target audience and the purpose of your Web-based material, how do you determine whether you are reaching that audience and accomplishing that purpose? What are your metrics for success? Just as the success of a print piece is judged by readers’ response to it, Web content should be judged by users’ responses. Can users understand the piece? Can users remember what the Web site said? How quickly were they able to find the required information? If you publish a database, do users understand how to search it? Could users make the required decision after exploring your Web piece or tool?

One of the easiest metrics to collect for a Web site is “popularity”. All Web servers can interact with programs that cull such information as the most visited Web page or the most downloaded files. For instance, Promega Corporation tracks the popularity of articles downloaded from its Web site to provide an indication of user preferences about content. The SCEDC monitors the number of visits to its Web site and the most frequently visited pages.

Data on frequently visited pages or downloaded files can be tracked with programs created by inhouse information-technology departments or by third-party Web metrics tools, such as Google Analytics (www.google.com/analytics). Remember that if you are tracking popular pages or files, you are tracking *all* the visits or downloads, not just those by your target audience. To aid in interpreting popularity metrics, you can collect such additional data as the average length of time visitors stay on a Web page, where they go from the page, and whether the page has a high “bounce” rate (in a

bounce, a user hits the page but leaves immediately). Web metrics can provide many clues about what works and what doesn't on a Web site, but be careful not to fall into the trap of collecting data simply for the sake of collecting data. Make sure that you are collecting data that answer a specific question and can lead to some useful action.

Another form of content that can provide feedback on user preferences is the e-newsletter. Often, such newsletters or magazines provide information that is available only online. Nature Publishing Group publishes a variety of electronic newsletters, including *Signaling Update*, which highlights new content on Nature's Signaling Gateway. According to Emily Chenette, an editor for *Signaling Update*, content is intended to be timely and is directed toward fields of research that have a high volume of publication or are attracting a lot of expert interest. *Signaling Update* is sent every Friday to subscribers and contains a feature article, research highlights, and news. It is evaluated by looking at what links are followed (click-throughs) when a person opens and reads the e-mail. Data on click-throughs in e-mails can tell the editor or Web manager whether your recipients were interested in the subject, what the most popular content was, or whether position (which controls whether a user needs to scroll to see something) influenced the number of click-throughs for a link in your newsletter.

Perhaps the most informative—but also the most challenging—method for determining effectiveness of Web site content is simply to ask your target users directly in focus groups what works for them. Conversations with your target users can provide information at two levels. First, you can determine whether your Web site is user-friendly. How long does it take for users to find the information they need? Can they easily navigate the Web site? Do they understand how a given database should be searched, and can they understand the results of a search when the Web site returns them? Second, you can find out what content and tools are popular and learn what content and tools your target users would like to see. According to Shang-Lin Chen, the SCEDC receives a great deal of feedback from visitors to the Web site, and it holds a session with Web users during its annual meeting for the center to obtain feedback on the Web site.

A variety of resources on the Web can assist you in determining what tools and information you need to evaluate the effectiveness of your Web materials. The NOAA Coastal Services Center has an excellent tutorial on "Web Content Design and Evaluation" at www.csc.noaa.gov/wcde. Google Analytics presents case studies illustrating how a variety of organizations have used Web metrics to meet specific goals or reach a particular target audience. The Adventures of CyberBee (www.cyberbee.com/guides.html), an educa-

tional Web site directed toward educators, provides two downloadable forms that are useful for evaluating Web-site content and design.

The World Wide Web is truly a powerful tool for communicating science and scientific research data, but it is a web, a tangled one, that can quickly consume writing, editing, graphics, and information-technology resources. Determining the effectiveness of content is as essential for the Web as it is for print media if you want to create effective communication tools and manage costs. The principles are simple: Know the target audience and objectives of any Web content or tool, and evaluate the success of the content or tool on the basis of users' response to it, just as you would for a print piece. Make sure that you know the question you are asking and that the metrics you collect will enable you to make decisions and take action when appropriate.

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