Teaching students to critically evaluate the quality of Internet research resources

by: Sally Jo Cunningham

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ABSTRACT: The Internet offers a host of high-quality research material in computer science—and, unfortunately, some very low quality resources as well. As part of learning the research process, students should be taught to critically evaluate the quality of all documents that they use. This paper discusses the application of document evaluation criteria to WWW resources, and describes activities for including quality evaluation in a course on research methods.

INTRODUCTION

The Internet, and particularly the World Wide Web, are popular information resources for computing professionals. A recent study of CS academics notes that for some, the WWW has become the preferred source for performing literature searches and retrieving documents; the Web allows researchers to immediately retrieve articles, rather than having to search bibliographic services for a citation and then hunt up the paper [Cunningham and Connaway, 1996]. Our students are similarly enthusiastic about using the Internet in support of, or sometimes as a substitute for, conventional library resources.

At the same time, there has been a growing concern about the uneven quality of information available over the Internet, and the similarly irregular coverage of many topics (see, for example, [Snyder, 1995]). This paper argues that our students should be formally taught how to critically evaluate Internet-accessible resources, and that one possible spot in the CS curriculum is in a research methods course (such as those described in [Witten and Bell, 1993] and [Fekete, 1996]). This topic dovetails naturally with instruction in conducting a literature search (by incorporating evaluative criteria for *selecting* search engines, indexes, and bibliographic resources with instruction in the mechanics of using these tools) and in critically interpreting research articles (by applying the same interpretive criteria to WWW documents and other Internet-accessible resources as to printed literature).

The next section of this paper discusses one set of evaluation criteria; the final section describes activities and assignments that can be used in teaching critical evaluation of WWW resources in a research methods course.

CRITERIA FOR EVALUATION OF WWW RESOURCES

The evaluation criteria listed below have been synthesized from the considerable literature on selecting and reviewing printed material (particularly [Stevens, 1986] and [Rader et al, 1990]) and from the more recently emerging body of work attempting to tailor these older criteria to electronic documents and resources ([]). This discussion centers around evaluation of resource content, rather than appearance or usability; additional criteria exist to measure those latter qualities, and are listed in many of the evaluative checklists appearing in the appendix.

Finally, the descriptions of the criteria below are framed in terms of the WWW resources that are currently most used to conduct literature searches or to obtain CS research materials: full text research articles available online, bibliographies and searchable indexes, Web page listings of useful links and bookmarks, and repositories of software and data.

Evaluation criteria include an examination of authorship and production details (such as the author's authority and the document's currency), the embedding of the document or resource in its appropriate literature (its relation to other works and its level of refereeing and reviewing), and its substance (its scope, treatment, and content):

authority

One important filter for determining the quality of information is the authority of the author. We usually urge our students to learn who the major players are for a field. If an author's name is unknown, then an author's credentials can often be retrieved from personal or institutional home pages; failing those sources, the document should list a contact address so that the reader can directly request further details on the author's work and professional background. And, of course, conventional sources of information remain: citation indexes, word of mouth from trusted colleagues, and positive mention of a document or author by another person recognized as an authority by the reader.

Similarly, the reputation of any sponsoring organization can also provide clues as to the reliability of a document or resource. Readers tend to place more trust in works produced under the auspices of stable, ongoing organization with a known membership, and to view sceptically resources produced by newly-emerged or struggling groups. Additionally, fledgling organizations may not have the stability necessary to ensure that resources are updated in a timely fashion.

Finally, the affiliations of the document author or sponsor can be a good indicator of potential sources of bias in the information contained in the resource. A commercial organization, for example, may be less objective in reviewing its own software than disinterested parties. More subtly, a person or institution closely associated with particular school of thought will naturally tend to give ideas supporting that system a greater emphasis than others might.

currency

If the document is a static resource (that is, a report or article), what is its date of authorship? Most, but certainly not all, reports will state the date of production in the document header or footer. For some documents, unfortunately, date information is contained in an link pointing to the document (for example, from a

CV or list of departmental publications); if the reader locates the document through a different route, the date can be difficult or impossible to determine. The date of production can be influential in judging the probability that a document is out of date or contains obsolete material—a criteria that obviously depends both on the field of study (with areas of rapid development usually demanding more recently authored material) and the type of document required (for example, a description of a basic programming technique will age slowly).

A major concern with dynamic resources (such as lists of links) is the frequency of update. Too many Web documents have insufficient organizational support for link maintenance, and quickly succumb to "link rot" as the materials pointed to move or disappear. In addition, new material appearing on the WWW may not be added to a list of links in a timely manner, so that an initially current and comprehensive list falls behind the times. Dates of update should be mentioned in the document, and the document contents should reflect the fact that these updates were indeed carried out. It is particularly reassuring if the document identifies a person or organization as having a commitment to maintain the resource.

relation to other works

An author's awareness of previous relevant literature reveals the author's understanding of current trends in a discipline and the author's general knowledge of the subject. A report or article should contain an appropriate bibliography, and sources should be suitably acknowledged and discussed in the body of the paper.

A resources such as a link index or repository should show awareness of other, similar online resources, and should discuss the differences in coverage or content. Any print counterparts should also be referenced.

refereeing and reviewing

When we read a paper in a journal or conference proceedings, we place some confidence in its contents because we know that it has been scrutinized by referees and editors; when we use an index such as the *ACM Guide to Computing Literature,* we know that the producers of the index have selected the documents to be included on the basis of their quality. These filters are not necessarily in effect for material located over the WWW. For research articles found on the Web, the reader needs to determine the level of refereeing that it has been subject to: is the document a technical report? has it appeared in a journal or conference proceedings? has it received informal criticism through circulation over USENET News? do any other Web pages contain discussion or criticism of the article? Other WWW resources may have been rated or reviewed by one of the numerous WWW review services, or by a professional organization such as a SIG.

scope

The scope of a document includes the breadth and depth of both its *intended* and its *actual* coverage. An evaluation of scope is particularly pertinent for the many WWW sites that attempt to present a comprehensive listing of links pertaining to a given topic: not only must the user determine whether the list of links is complete, but readers should also keep in mind that these lists contain links only to information available on the WWW—which is not necessarily the same thing as all information on that field! This latter point is one of the most common sources of problems encountered by students using the Internet to conduct

Cunningham, S.J., and Connaway, L.S. (1996) "Information searching preferences and practices of computer science researchers", *Proceedings of OZCHI '96* (November 1996, Hamilton, New Zealand).

Fekete, A. (1996) "Preparation for research: instruction in interpreting and evaluating research", *SIGCSE Bulletin* 28(1), pp. 93-97.

Grassian, E. (1996) "Thinking critically about world wide web resources". <http://www.ucla.edu/campus/computing/bruinonline/trainers/critical.html>

Hinchlife, J. (1996) "Resource selection and information evaluation". <http://alexia.lis.uiuc.edu/~janicke /Evaluate.html>

Kirk, E.E. (1996) "Evaluating Information Found on the Internet". <http://milton.mse.jhu.edu:8001/research/education/net.html>

Ormondroyd, J., Engle, M., and Cosgrave, T. (1996) "How to critically analyze information   sources". <http://www.library.cornell.edu/okuref/research/skill26.htm>

Rader, H., Reinhart, B., and Thompson, G. "Evaluating Information: A Basic Checklist", (Item number A127). Chicago: ALA, 1990.

Smith, A. (1996) "Criteria for evaluation of Internet information resources". <http://www.vuw.ac.nz/~agsmith/evaln/index.htm>

Snyder, J. M. (1995). "Research on the Internet: Inside risks", *Communications of the ACM* 38(8), p. 130.

Stevens, N. (1986) "Evaluating reference books in theory and practice", *Reference Librarian* 15, pp. 9-19.

Tillman, H. (1996) "Evaluating Quality on the Net." Presentation at Computers in Libraries   (Arlington,   VA,   Feb.   1996). <http://challenge.tiac.net/users/hope/findqual.html>

Witten, I. and Bell, T. (1993) "Getting research students started—a tale of two courses", *Proceedings of SIGCSE 1993*, pp. 165-169.

At the same time, however, students who only see the highest quality material are not learning valuable lessons about how to detect and interpret the average or poor documents that they are likely to encounter outside the classroom. One simple teaching technique is to include without comment one or two poorly constructed, biased, or inaccurate documents in a set of readings, and then invite discussion. As a teacher, it can be humbling to witness how thoroughly some students have been indoctrinated into an unquestioning acceptance of authority, as they struggle to complement dreadful work they are at fault for not understanding an incomprehensible paper. Some can need quite a bit of encouragement before they believe their own initial judgement of the material.

rating WWW material

A number of checklists are available for rating the quality or usefulness of WWW documents and resources (see appendix). Students can use these rating sheets to analyze a set of related WWW documents, or can adapt the checklists for a particular type of use or subject relevant to their coursework.

Another interesting view of the filtering techniques applied to WWW resources can be gained by having students contact the managers of various collections—such as lists of links, document collections, or software repositories—and inquiring about the methods used to select new objects for inclusion in that resource. Most collection management techniques will be found to be extremely ad hoc, particularly in comparison with those used to construct printed indexes or guides.

comparing WWW and conventional resources

While a number of excellent resources are available over the WWW, conventional library indexes still provide access to material that is not (yet?) accessible over the Internet. Having students search both the WWW and conventional sources for information on a topic will highlight the differences in coverage: the WWW is a superior source for the latest technical reports or data sets, but contains a relatively small proportion of the CS papers that have been formally published in the past few years, and practically none of the older literature; in comparison with printed or CD-ROM indexes provided by libraries, the bibliographies available freely over the Internet tend to be incomplete and of uneven quality (such as the Karlsruhe collection[i]), or to have awkward interfaces and search mechanisms that hinders a thorough literature search (for example, the UnCover bibliographic system[ii]); information about who has built on published work is easier to find out through a citation index than through WWW searches, while comprehensive lists of an individual's publications can often be more quickly found on the researcher's home page than in a printed directory; and so forth. Of course, the topics chosen for students to search can be tailored to uncover the relative strengths and weaknesses of the systems and indexes available to them.

REFERENCES

Alexander, J. and Tate, M. (1996) "Teaching critical evaluation skills for world wide web resources", *Computers in Libraries*, pp. 49-55.

literature searches and reviews: students lack the background and experience to recognize that entire subtopics may be missing or spottily represented in a "definitive" list of WWW resources, or that key papers in a field are not among those available online.

The quality of included links is also an issue: what criteria was employed for selecting links? Were the links evaluated in any way, or does the list simply include all documents matching certain keywords?

treatment

The intended audience of the resource will dictate the level of writing and detail. For students, the most useful distinctions to learn are the differences between scholarly and general materials, and between expert and novice (or tutorial) documents. The treatment will impact the accessibility of the information to the student, the likely degree of currency, and the depth and thoroughness of coverage that can be expected.

content

The most important part of the evaluation process is remains the same whether a resource is disseminated over the WWW or through conventional, printed outlets: a thorough, critical assessment of its content. Criteria for research papers include: accurate details and calculations; thorough documentation of the research method, at a level that would allow the study to be replicated; appropriate methodology chosen for the study; appropriate techniques selected to explore the research question or to test hypotheses; and so on. Criteria for other materials will depend on the type of resource: for example, data repositories should contain accurate, documented data sets that are relevant to a given subject or problem; software repositories should include current program releases; and link indexes should provide appropriate classifications, descriptions, and reviews of links.

TEACHING ACTIVITIES

In teaching students to critically examine Internet resources, the following activities can be helpful:

exposure to varying levels of quality

We often show our students only good examples of work: journal articles and conference papers embodying high standards of research, presenting significant findings, and written in a clear and concise manner. Textbooks are also chosen for their clear and unambiguous presentation, their thorough coverage of a field, and the trustworthiness of their facts and examples.

This approach is highly efficient in terms of time needed to present concepts, since the teacher needs only to build on the written information, rather than to correct or reinterpret it. And since learning a new topic from even the best materials is often difficult, we understandably don't want to muddy the waters for students by forcing them to work harder to learn from poorly written or inaccurate texts.

APPENDIX: CHECKLISTS OF EVALUATION CRITERIA

Alexander, A. and Tate, M. Criteria for evaluating advocacy, business/marketing, informational pages, news, and personal home pages
http://www.science.widener.edu/
~withers/webeval.htm

Scholz, A. "Evaluating World Wide Web Information", a set of general criteria.
<http://thorplus.lib.purdue.edu/research/
classes/gs175/3gs175/evaluation.html>

Schrock, K. "Kathy Schrock's Guide for Educators: Critical Evaluations Surveys", criteria for material used in primary and secondary schools
<http://www.capecod.net/Wixon/eval.htm>

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[i] http://liinwww.ira.uka.de/bibliography
[ii] http://www.carl.org/uncover/brochure.html