

Framework for the Information Literate Student: A Review of the Literature on Evaluating Internet Information

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Introduction

Evaluating Internet information requires critical thinking skills and is crucial in the development of the information literate student. A review of the literature documents the need for information literacy skills in a world with an exponentially increasing volume of information. Traditional evaluation methods to judge the quality of print materials are not sufficient for the evaluation of Internet information. This literature review will examine the challenges presented by student use of Internet information and will also examine how Internet information differs from traditional print materials. Misinformation is fully present in many forms on the Internet. The review will examine types, causes, and purposes of misinformation, and will present strategies to detect misinformation. Evaluation strategies to judge information quality will be presented. The review of the literature will include theoretical articles, and qualitative studies conducted in the K-12 and college and university settings. Student use of the Internet and student perceptions of Internet use will be examined along with teacher expectations.

The review will also examine the role of the teacher in the student evaluation of Internet information and the importance of engaging students in the construction of knowledge. As students construct knowledge and develop critical thinking skills in utilizing Internet information, the use of an evaluation model can structure the evaluation process by providing step-by-step procedures for students use to conduct Internet evaluation. This systematic approach to the evaluation of Internet information can match the information need with the learner's modality and with practice can result in development of an intuitive approach.

Information literacy is the ability to locate, evaluate and utilize information. The American Association of School Librarians (AASL) and the Association for Educational Communications and Technology (AECT) (1998) collaborated to produce information literacy standards for student learning. AASL and AECT (1998) standard two states "the student who is information literate evaluates information critically and competently" (p. 14). McKenzie (1997) stated that evaluation of information sources is a major challenge for students. With over 350 million documents on the Web alone, skill in finding relevant information and being able to critically evaluate it is imperative (Schrock, 1998/1999). Jones (1996) indicates that we need to teach learners to be their own librarian. Because student researchers often work without the guidance and assistance of information professionals, student information literacy skills need to be developed beyond minimal levels. Russell, Weems, Brem, and Leonard (2001), in making an observation about the power of knowledge, stated, "We point out, however, that information, the raw material of knowledge, although plentiful on the Internet, may not lead to power. It must first be evaluated" (p. 44). Similarly, Harris (2000) stated "reliable information is power" (p. 59).

Topics in the review will be presented in three sections: Reality, Expectations and Critical Thinking, Frameworks for Evaluation, and Summary, Conclusions and Implications. The first section, Reality, Expectations and Critical Thinking, will discuss the need to evaluate Internet information and will include topics such as the differences between traditional publishing and Internet publishing and the wide range of information quality on the Internet. The next topic covered will be student overconfidence in their Internet abilities and the gap between instructor expectations and student products. This section will continue with a look at the use of unauthenticated resources and the need to incorporate critical thinking into the learning process. The concluding topics in this section are a look at the need to use a variety of resources along with a summary of the types of information for which the Internet is most useful.

The second section, Frameworks for Evaluation, will consider criteria for evaluation, approaches to evaluation, and the use of rating forms. The final section, Summary, Conclusions and Implications, will provide a synthesis of the content presented, the conclusions of the author, and implications for further study.

Librarians and consumers alike, often utilize written reviews to determine the relative quality of information (Rettig, 1995). While many traditional print review sources have begun to include Website reviews, the number of reviews provided is very small in comparison to the number of new Websites being published (Symons,

1997). To locate recommended Websites, Symons suggests visiting the home pages of school and public libraries. Commercial review sites on the Internet vary in type and application of criteria for evaluation. Similarly, evaluative search engines utilize selection criteria in order to provide results. Criteria vary greatly in type, application, effectiveness, and quality. Reviewed Websites, recommended Websites, and evaluative search engines, are valuable resources and tools, however, further discussion of these topics is outside the scope of this review.

Reality, Expectations and Critical Thinking

Anyone can publish almost anything on the Internet, often bypassing the quality assurance benefits offered by traditional publishing (Brandt, 1996). Traditional publishing benefits include issuance by an authoritative source, editorial or peer review, and evaluation by experts. There is little or no editorial review of material and no official agency, specialist, or review process for Internet subject matter (Schrock, 1997). No one has to approve the content of a web page before it is published, thus Internet information is available in a wide range of quality and reliability (Harris, 2000). McKenzie (1997) called the information age a time of info-glut and info-garbage Rettig (1995) described the Internet as a proverbial fire hose of information. Symons (1997) stated that the amount of useless content on the Web is mind-boggling and that librarians would never select more than 1% for the print collection.

While a lack of authority and professional review brings the quality and reliability of Internet information into question, there is also a great deal of actual misinformation. Fitzgerald (1997b) has compiled the following causes of misinformation on the Internet: hardware and software problems, Internet architecture problems, and traditional problems that transfer from print publication. Hardware and software problems include corruption or data damage causing incomplete information that could mislead the reader, and translation errors such as those resulting from scanning technology. Internet architecture problems stem from the design of the Internet, resulting, for example, in a lack of central authority, an issue noted by Schrock (1997). Fitzgerald also includes data malleability as an additional Internet architecture problem. Data malleability includes the short duration of usability or impermanence of the universal resource locator (URL), and the vulnerability of the information to alteration (Fitzgerald, 1997b). Fitzgerald citing the 1995 research of Stephens, and the 1995 research of Cautorie, noted the vulnerability of information to unauthorized and often undetected alteration by hackers. Davis and Cohen (2001), discussing the impermanence of the URL and citing the 2000 research of Carvajal, noted that URL impermanence caused writers to move back to a time when authors did not cite their sources. Davis and Cohen, citing the 1996 research of Shafer et al., indicated that URL impermanence threatens scholarship.

Fitzgerald described traditional problems similar to those found with print sources and also found in a new form in Internet resources as "human error, misconduct, removal of information from context, lack of currency and bias" (1997b, p. 11). Human error may cause unintentional misinformation. While misinformation from misconduct may result from a joke or prank, it may be motivated by avarice or other intentions. Fitzgerald, citing the 1995 research of Herson and Altman, indicated scholarly misconduct may be driven by the "research mill" requiring scientists and scholars to produce research and publish findings at a rapid pace, sometimes resulting in "sloppy research" and falsification (para. 14). Another traditional source of misinformation that also occurs in the Internet arena is the removal of information from context. The online environment makes it easy to select, copy and reconstruct electronic text. This would be a problem, for example, in the use of information gained from an online discussion group. An online discussion group may discuss topics in a nonlinear approach or over a period of time. Information retrieved out of the context of the complete discussion would be misinformation. Search engines can also create situations in which the information seeker retrieves information out of context (Alexander & Tate, 1999). The use of hyperlinks in the Web environment can also lead to a loss context, and thus, misinformation. For example, if the reader moves rapidly from one document to another, a loss of information context may occur (Fitzgerald, 1997b).

In addition to the removal of information from context, Fitzgerald (1997b) also addresses issues of a lack of currency and bias. While the Internet environment provides opportunity for immediate publication, information gathered and distributed quickly may result in error. Although Internet information has the potential to be updated easily, the updating process is often handled inconsistently. An aspect of lack of currency related to data malleability occurs when Internet publishers do not update information when their site location is changed.

The Internet information seeker should also be alert to the possibility of bias. Information based on opinion rather than fact may be biased. To identify bias the information seeker should consider the author, sponsor, political or social agenda, and purpose of the publication (Fitzgerald, 1997b).

Other researchers have also discussed misinformation. Elaborating on the concept of correctly discerning the intent, content, and purpose of information, Kirk (2001) provided definitions of three types of counterfeit information: propaganda, misinformation and disinformation. The difference between propaganda and misinformation is that propaganda may be based on facts but is presented to create a desired response. One example of propaganda would be a press release for a political party that describes the opposing party as the party responsible for creating problems (destructive behavior) while the publishing party is described as repairing the situation (constructive behavior). Mis information is based on erroneous or incorrect information. Urban legends are listed as a type of misinformation. Another type of counterfeit information is disinformation. Disinformation is the deliberate dissemination of false information. Kirk cites the anti-Semitic speeches written by the Nazi party in Germany as examples of disinformation. The information user should seek to validate the trustworthiness of the information by obtaining knowledge about the individual, organization or group responsible for the informational source (Kirk, 2001).

Fitzgerald (1997a) conducted a study of graduate students, all experienced Internet users, to examine the evaluative strategies employed by sophisticated adult Internet users to detect misinformation in authentic Web information. The study procedure involved a pre-interview, an interactive evaluative task session during which participants evaluated two Web documents for misinformation, and a post-interview. The post-interview questions were designed to determine the reasoning processes of the participants and use of evaluative criteria. Three evaluation "styles" emerged from the study, the checklist approach, the affective approach and the global approach. The checklist approach will be covered in the frameworks for evaluation section of this paper. The affective approach utilized the reaction of the evaluator to the tone and underlying emotions of the document. With the global approach the evaluator examined the whole document and attempted to compare the good elements and bad elements to make an overall judgment. All participants (N6) agreed that any use of a misinformation device was damaging to the credibility of the document. Limitations of the study include a small sample, technology expertise of the participants, knowledge by the participants of the inclusion of misinformation in the study documents, and the difficulty of applying the results to children.

Fitzgerald has, however, proposed the adaptation of these strategies for use with children in K-12 settings. Fitzgerald suggested skills and strategies (1997a, p. 14-15) that could be employed with students beginning with 3rd grade. These strategies were given descriptive labels: sift and scan the document, what do you see, what is the purpose, identify perspectives, credentials of the author, separating fact from opinion, examine arguments, examine how opposites are used, and examine how feelings are used to discover bias.

The main points covered so far in this review include the quantity and quality of Internet resources, the ease of publishing on the Internet, and the concomitant lack of traditional publishing benefits for Internet publications such as the provision of authoritative sources, and peer and expert review. Misinformation may occur through hardware and software problems such as data damage through file corruption, and translation errors. The lack of central authority of the Internet allows information to be published and changed very easily. Online data is subject to revision, correction or deletion and may often be changed by people other than the author. The unauthorized change of information (hacking) is an area of misinformation. The impermanence of the URL may be problematic for the researcher. Other problems encountered with the Internet are human error, misconduct, removal of information from context, lack of currency, and bias. The effective evaluator must be alert to the possibility of any type of counterfeit information.

Research in how students perceive the Internet is not limited to experimental models as in Fitzgerald (1997a). The topic has also been studied qualitatively through action research. Scott and O'Sullivan (2000), respectively a social studies teacher and a librarian, collaborated in an action research study designed to examine student impressions of the Internet as a learning tool for research. High school students (N309) and student essays (N36) were analyzed to determine student impressions of the Internet. Eighty-five percent of the respondents rated their Internet search skills as either excellent or good. The qualitative data collected countered this and suggested that many students had difficulty navigating to Web sites and experienced a high level of frustration, both in locating and analyzing the information presented. The researchers also reported that students displayed a naive understanding of Internet information content, structure, and kinds of information.

O'Sullivan and Scott (2000), as a part of the action research study mentioned above, developed and implemented an information literacy unit to improve student ability to think critically about using the Internet. The unit included the structure and terminology used on the Internet, URL structure and meaning, and criteria for the evaluation of Internet information. Evaluative criteria included accuracy, authority, objectivity, currency, and coverage. After participating in the literacy unit students reported finding Internet information that was: "...filled with opinions and useless information", "...a lot more junk than there is good info," ... of questionable relevance and

even fraudulent" (Scott & O'Sullivan, 2000, para. 20). This study of the skills of students in grades 9-12 stressed the importance of utilizing a wide variety of quality resources. Students often ignore traditional sources such as the library catalog and subscription databases (Scott & O'Sullivan, 2000; Grimes & Boening, 2001).

Another action research study was conducted with high school students to increase their engagement with technology by strengthening their awareness and ability to critically analyze science topics on the Internet (Russell, et al., 2001). Researchers utilized a Web based science project "Tabloid Trash vs. Serious Science" developed by the University of California Berkeley Graduate School of Education, in several secondary science classes as a warm up activity. The CARS checklist as shown in Table A1, was used to teach students an evaluative framework. Eighty-one participants from a school for girls worked alone or in small groups to evaluate Web resources. The study suggested that students can learn to apply evaluative criteria and many students demonstrated sound reasoning ability. The researchers suggested that the Web-based Integrated Science Environment tools fostered critical thinking and that the project created student awareness of the need to think critically about science topics.

Pierce (1998), in a practicum paper about improving the research strategies of high school students, noted that 69% to 81% of students surveyed felt they had the skills for effective independent Internet research or needed only minimal help. Through interview and a pretest of Internet knowledge, Pierce collected data supporting the assertion that this student view was inaccurate. Preliminary data indicated that students did not utilize a structured approach to research, students were not assessing information for quality and reliability, and students had not been provided a framework to facilitate the assessment of resources. Although students using an unstructured approach to the online research process retrieved numerous resources this "gave them a false sense of having accomplished their task" (Pierce, p. 11). To combat the difficulties students encountered in using the Internet for research Pierce developed an instructional unit for students and conducted an instructional workshop for teachers. The instructional unit focused on subject directories and search engines but also included a form for evaluating information for validity and reliability. Students in the study sample were required to complete an evaluation form for four Internet sources of their choosing. The usefulness of this study to inform research in the area of Internet evaluation may be limited because none of the pretest or posttest questions pertained to evaluation skills and Pierce did not include data on how evaluation forms were analyzed or utilized.

Grimes and Boening (2001) used a case study approach to determine if students in a college setting were evaluating the resources they used and if the sources the students selected and utilized met the quality expectations of their instructors. Both the students and instructors were interviewed and the Websites that students cited in their research papers were analyzed. Two freshman writing classes, each numbering 25 students, were used as the study sample. The findings indicated that students in the college setting were utilizing resources that they either did not evaluate or evaluated in a superficial manner. Another finding suggested that a gap existed between the expectations of the instructors and what students were delivering. Possible explanations for the existence of this gap included a suggestion that academic instructors had been accustomed to relying on the librarian for guidance to quality resource selection. With the use of online information students had more opportunities to bypass the traditional selection guidance process of the librarian. Students often relied on relevancy ranking of search engines to determine information quality and often did not engage in any further evaluation of the resources. Another explanation for the gap was that students were confused about the expectations of their instructors.

D'Esposito and Gardner (1999) conducted a qualitative study that used focus groups as a means to examine student perceptions of the Internet. The study also examined student criteria for evaluating Internet information. Fourteen university students participated in two different focus groups and shared information about their perceptions, experience and use of the Internet. Students perceived the Internet to be a vast source of information from which they could access almost anything. Student evaluations of sources retrieved using a search engine were often based on the success of their search query to return results. Students also used authorship or page ownership, links to other sites and validation from other sites as their evaluative criteria. Students did not view the Internet as a "library resource" and consequently did not ask a librarian for help. Student rationales for not asking the librarian for help with the Internet included the following: they lacked access to the librarian when searching from home or a computer lab, they did not expect the librarian to know the answer, and they saw themselves as self-sufficient.

Leckie (1996) provided another explanation for the gap between teacher expectations and student work posing the "expert researcher" model evidenced in academic settings. The instructor is an expert researcher with a well-defined knowledge of the subject area, knowledge of how to develop a research idea, and the ability to work independently. Students are novice researchers and with limited background information, and may have no sense of what is important in a topic for research or little idea of how to conduct a search. Because of the cognitive and experiential differences between the novice and the expert, the expert model does not work for the novice. Leckie

suggested that this variance is a source of "disjuncture" between the expert and novice (para. 14). A suggestion for closing the gap was for academic librarians to become faculty bibliographic instruction mentors, assisting faculty to integrate information literacy in their courses. Additionally, these academic librarians should explain the "expert versus novice" model to faculty members to provide understanding and to demonstrate methods of instruction to close the gap that exists between the expert and the novice.

Jones (1996) proposed a model similar to the expert researcher model outlined by Leckie (1996). Jones described academic settings as those in which the expert delivers knowledge to the novice and the novice is expected to apply the knowledge. Selection, evaluation, and acquisition of information sources across an array of subjects is an area of expertise for librarians. The librarian as an information specialist (expert role) needs to teach students (novice role) more than an information literacy skill such as the use of a criteria checklist. Novice information seekers must learn how to operate as their own librarian to become independent users of information skills applied to their own situation and needs. Jones recommended teaching the evaluation process within the knowledge base of the learner, with the learner creating meaning as evidenced in a constructivist framework.

The importance of students learning how to apply an evaluation process is noted in many studies by the tendency of students to select poor quality resources (Gillette & Videon, 1998; Grimes & Boening, 2001). Scott and O'Sullivan (2000) noted that students evidenced a blind acceptance of Internet information. Students preferred using Internet information to traditional sources because of the ease in locating and printing the results from the Internet, and because the Internet provided an "abundance" of information (Grimes & Boening). Grimes and Boening concluded that student evaluation of Internet information was superficial if it existed at all and that it was important for librarians to work with instructors to assist them in teaching students to evaluate information.

Not all researchers are concerned about the quality of student papers based on Internet sources. McBride and Dickstein (1998) stated that the inclusion of Web sites in student writing assignment has not adversely affected the quality of student writing. Instead McBride and Dickstein point to the many learning opportunities provided by the use of the Internet. Student learners utilizing Internet resources have opportunities to become critical readers, thinkers, and writers.

Davis and Cohen (2001) conducted a study in an academic setting to determine if the composition of student research paper citations had changed from 1996 to 1999. The researchers wanted to determine if the URLs cited would still be viable, and if students were using popular resources rather than scholarly ones in cases where Web citations were used. Results of the study indicated that only one out of the 344 random URLs collected in December of 1996 still worked. This finding is amplified by Grimes and Boening, (2001) who reported that approximately 30% of the URLs provided in student papers were not accessible for review three weeks after completion of the papers. The inability to access student Web citations might have been the result of student mistakes in the URL or the inactivity of the sites. Even so, this is troubling because of the inability to substantiate the resources selected and utilized by the students. The demonstrated instability of URLs undermines a vital element in the nature of recorded research, that is, the ability of readers to review the sources upon which the research is based. But that is not the only difficulty. There is also a question as to the type and authority of the sources selected by the students. Davis and Cohen (2001) study provided a comparison of book citations, Web citations and scholarly citations. In 1996 book citations comprised 30% of the total citation while in 1999 book citations fell to 19%. In 1999 Web citations comprised 21% of all citations and the researchers indicated that there was little change in the cited domains from 1996 until 1999. Scholarly citations fell from 6.1 per bibliography in 1996 to 4.6 in 1999 although Web citations were not factored into this part of the analysis. The researchers suggested that professors need to be more prescriptive with the type of resources they want students to consult by setting stricter guidelines, and teaching students how to critically evaluate resources. Another suggestion was to create scholarly portals for authoritative Websites.

Students can be encouraged to select authoritative resources. McBride and Dickstein (1998) noted the importance of teaching students to find information from scholarly sources. One approach incorporated a requirement for students to post their class assignments to an electronic mailing list. Writing assignments showed signs of increased effort when they were made available for peer review through the electronic mailing list. Students also felt that their work was more important and contributed to a scholarly dialogue. The inclusion of the librarian in the electronic mailing list provided visibility, accessibility, and exposure to students seeking assistance to locate and evaluate information.

In addition to the positive effects of peer pressure provided by required electronic posting, more direct instructional approaches may be needed. Students need to learn how to select quality information and how to discard the misinformation (Schrock, 1997). This step in the evaluation process must include preparing students to think critically about the Web. Livengood (1997) located a significant number of electronic publications on the topic of

evaluating Internet resources, with the primary theme being the call for application of critical thinking skills in the evaluation process. Jones (1996) expressed belief that a paradigm shift is necessary to ascribe importance to information literacy. This shift would emphasize a constructivist framework incorporating real world, career applicable learning strategies.

Hancock (1993) called for a shift in teaching and learning to an information-literate environment rich with active, self-directed learning, where the teacher facilitates student engagement through resource-based learning. With this shift students would seek a range of information sources, communicate content, pose questions, use the environment, people, and tools for learning, reflect, assess, and take responsibility for their learning. Hancock also suggested that students would seek information in the local community from businesses, social service agencies, citizens' groups, and mass media.

Not everyone believes that better instruction on Internet use for research is the answer. McKenzie (1995) believed the Internet might be an inefficient research tool and students should consider using other tools that may work more efficiently. A book is a tool that can provide synthesized information and with a sound reasoned argument the author can quickly take the reader to an insight level. The Internet is a good source for current issues rather than questions that have been the focus of scholarly thought. McKenzie stated (1995), "We keep coming back to the book. For certain questions it remains an excellent piece of information technology" (para. 29). Schrock (1997) recommended using the Internet when the information sought was not available in the classroom textbooks or library, was based on data compiled by governments or public interest groups, required specialized knowledge, eyewitness accounts or was currently breaking news. Rettig (1995) recommended the Internet for rapidly changing time-sensitive information. Political information, sports scores, stock market activity, and weather, are subject areas where the Internet is an excellent resource.

In summary, many students were overly confident of their Internet abilities (Scott & O'Sullivan, 2000; Pierce, 1998). Yet the same students often experienced frustration and difficulty using the Internet for research. Instructional units stressing the importance of evaluation skills can help students learn to utilize thinking skills to determine the caliber of information; additional skills are also necessary. Students need to realize the potential strengths and weaknesses inherent in different types of information from different resources. This need can best be addressed through an instructional program powered by the collaborative efforts of teachers and media specialists working to teach students how to select and evaluate and utilize information. Students need to know how to identify the information need, to structure and implement the search, and to select the best source for the need. Teachers can help to further the process by directing students to excellent resources and by providing exacting guidelines outlining their expectations.

Detailed information outlining teacher expectations and providing definitions and examples of good resources would provide an excellent starting place. Additionally, students and teachers need to know that the library media specialist or librarian is a good source for information about Internet information and can assist them in developing information literacy skills. Awareness of a variety of resources including databases, library collections, and Internet resources could be presented to students and teachers through bibliographic instruction.

Frameworks for Evaluation

Alexander and Tate (1999) recommended a model for evaluating Web resources based on an adaptation of the five traditional print evaluation criteria of authority, accuracy, objectivity, currency, and coverage. The first criterion in the Alexander and Tate model is authority (1999). "Authority is the extent to which material is the creation of a person or organization that is recognized as having definitive knowledge of a given subject area," (1999, p. 11). In traditional sources authority is based on the credentials of the author and the quality of the publisher and editor. Authority of Internet sources is more difficult to determine. Many Internet documents are posted without the name of the author, and if an author's name is provided that person might not be the originator of the information. Additionally, credentials of the author may not be provided leaving the information seeker unable to verify who is responsible for the publication.

The second criterion in the Alexander and Tate model is accuracy. Accuracy of a source is traditionally checked through editors, peer review, and fact checkers, and is often done according to a publication style manual. Such procedures determine accuracy of information before electronic publication on the Internet and may be abbreviated or not employed. The third criterion in the Alexander and Tate model is objectivity. Objectivity is the attempt to provide information that is free of bias or distortion. In traditional print resources the purpose of the

publisher, organization, or individual writer is often known or stated allowing the evaluator to determine if the content is bias free. However, determining the purpose behind an Internet publication can often be difficult.

The fourth criterion in the Alexander and Tate model is currency. In print sources, currency is indicated by the publication or copyright date. Some information, such as statistics require more than a date for substantiation of currency. Statistical information should provide the date that the original statistic was gathered. The Internet has not established guidelines for the dating of publications. The ease with which revisions to Internet information can be made presents an additional problem in determining currency. The final criterion in the Alexander and Tate model is coverage. Coverage and intended audience for print materials are often addressed in the introduction or preface, and may be discerned from the table of contents or index. Internet sites often lack introductory material or organizational devices presenting additional challenges for the evaluator.

The Alexander and Tate (1999) model includes methods for identifying the type of Web page as an advocacy, business/marketing, informational, news, personal, or entertainment page and provides a means to evaluate each type of page using the five criteria: authority, accuracy, objectivity, currency, and coverage. This is important because the challenges presented with each type of Web page are varied. For example, market-oriented Web pages blend advertisements with information and entertainment making it difficult to separate the information from advertisement. The model utilizes descriptions that enable the evaluator to identify the type of Web page. Alexander and Tate provide a modified version of the criteria adapted to the type of page being evaluated. The evaluator can utilize the adapted checklist criteria to determine the relative quality. In addition to using the five criteria and considering the type of Web page in the application of the Alexander and Tate model, the researchers recognized additional challenges presented by Web resources including: the use of hypertext links, frames, search engines that retrieve pages out of context, instability of Web pages, and susceptibility of Web pages to alteration (p. 15).

Models like Alexander and Tate provide a prescriptive means to evaluate the advisability of using particular Internet sites as sources for research. It may be, however, that a pre-search approach that prepares the researcher would be more effective in some cases than is application of evaluation criteria after the information is found. Harris (2000) recommended beginning with a pre-evaluation to determine what type of information is required. The information seeker is advised to match the information need with a source that can provide the necessary criteria of quality. Harris believed the process of evaluation to be "something of an art" and stated there is no single perfect indicator of reliability, truthfulness, or value" (p. 60). Harris suggests using the CARS Checklist, (see Table 1) with criteria of credibility, accuracy, reasonableness, and support, provided guidelines for the selection of quality information.

The first criterion in the CARS Checklist is credibility. Credibility is based on a reasoned argument providing compelling evidence, justified arguments and conclusion. Credibility is related to the credentials of the author, including background and experience. Credibility can be strengthened by the provision of biographical information, title, position, organizational affiliation, and reputation among peers. Indicators of a lack of credibility include anonymity, no publisher or editor, negative reviews, bad grammar, or misspelled words. In comparing the criterion of credibility in the Harris model to the Alexander and Tate (1999) model, credibility seems to be a comprised mostly of authority, with some elements of accuracy and objectivity.

The second criterion in the CARS Model is accuracy and is indicated by information that is detailed, exact, comprehensive and up-to-date. Other considerations include timeliness, and audience and purpose. Indicators of a lack of accuracy include no document date, an old document date on information known to change quickly, vague assertions, sweeping statements, or a one-sided view that does not present an opposing viewpoint. Reasonableness, the third criterion, is indicated by fairness of the author to present a balanced view. This includes the ability of the author to control bias, present a moderate view, present consistent information that does not contradict itself, and avoids presenting a distorted world view. Indicators of a lack of reasonableness include an intemperate tone or language, attributing excessive significance to their own work or a conflict of interest. Reasonableness in the CARS model is a mix of objectivity, currency, and coverage in the Alexander and Tate (1999) model.

The fourth criterion in the CARS model is support. Support is indicated through the provision of information source. Citations lend strength to the credibility of the information. It is also important for the researcher to find other sources of information that corroborate or support the information. Triangulation is a term applied to finding at least two sources that provide evidence to support a third source. Indicators of a lack of support include statistics provided without an identified source, or a lack of corroboration. The criterion of support in the CARS model is similar to the criterion of coverage in the Alexander and Tate (1999) model.

Harris (2000) provided an additional component to the CARS framework by offering a strategy for use of Web-based resources. Called CAFÉ (challenge, adapt, file and evaluate), the strategy advises the information seeker

to challenge information, adapt the level of skepticism to the requirements of the information need, file new information to think about it prior to using it, and re-evaluate as new information is added. This strategy is in line with Kirk (1996) who advised the information seeker to question the authority and appropriateness of any source of information and to be skeptical of any information that cannot be authenticated.

The criteria suggested by Alexander and Tate seem to be included, although in a different framework, by Harris. But those criteria are not the only ones suggested by researchers and practitioners. Smith (1997) posed several criteria beyond the traditional including workability and cost. Workability is a new criterion that includes ease of use and connectivity. Cost, a traditional criterion, is often overlooked since the Internet is considered to be "free." In addition to the cost of the hardware and software necessary to access and print information are additional costs to consider, such as connection charges including organizational access charges, and the cost of using the information if there is a subscription or license involved. The time spent locating and evaluating information sources is also a cost involved. Smith's toolbox of criteria also included uniqueness, links made to other resources, quality of writing, graphic and multimedia design, reviews, user friendliness, required computing environment, searching, browsability, interactivity, and connectivity.

Still other practitioners offer criteria specifically for use in schools. Schrock (1998/1999) listed twenty-six criteria for the evaluation of Web sites. One unique criterion mentioned was handicapped access. This criterion suggested the importance of including a text only version of Web pages for visually impaired viewers who utilize screen readers. Another criterion important in the school setting was diversity of viewpoint (Symons, 1997). Both handicapped access and diversity of viewpoint address issues important to providing equity of access and diversity of content.

Schrock (1997) provided a web site rating form that is a comprehensive checklist for teachers. The form has four sections: technical and design features, navigation, authorship and authority, and content. The checklist consists of 36 questions with a yes, no or n/a block to check. Three survey forms are targeted for students in elementary, middle and secondary schools. Elementary topics include student appraisal of the appearance of the Website, judgment of what they learned from it, and the composition of a summary paragraph. Middle school topics are similar to the elementary topics but require the composition of a summary paragraph after each section of the survey. High school topics include technical and visual aspects of the page, content, authority, and a narrative evaluation. Schrock also provided an evaluation lesson plan complete with content pages designed to make overhead transparencies to teach the students how to evaluate Web sites.

Employment of criteria checklists and website rating forms are not the only evaluation strategies recommended for use by students. Fitzgerald (1997b) recommended nine strategies for students in the fifth grade through adulthood: adopt critical consciousness for all Internet information, establish prior information through wide browsing, searching and reading, distinguish between fact and opinion, evaluate arguments, compare and contrast related pieces of information from different sites, sources, and search engines, evaluate the reliability of online resources, identify and detect bias, learn to interpret the conventions of the Internet, and examine assumptions.

Many researchers and theorists recommend using frameworks or models for teaching the evaluation process. Researchers (Alexander & Tate, 1999; Grimes & Boening, 2001; Jones, 1996; Livengood, 1997; Smith, 1997) have looked at adapting traditional print evaluation criteria to the evaluation of Internet information. Livengood (1997) pointed out that traditional evaluation criteria were not sufficient for hypermedia and suggested that effective evaluation taxonomy for Internet information would also include criteria taken from the disciplines of graphic design and linguistics. Jones (1996) stated, "Prescribing a checklist of criteria to look for or steps to take will leave the learner unprepared when technology changes" (para. 16). Jones recommended teaching the evaluation process within the knowledge base of the learner. The learner should be responsible to track their own meaning via real world applications that provide an opportunity for the transference of knowledge.

To summarize, it is important to choose a framework for evaluation that is suitable to the task and appropriate for the learner. The framework cited most often in the literature was the Alexander and Tate (1999) model. O'Sullivan and Scott (2000) chose the criteria from the Alexander and Tate Model to create an instructional unit to teach high school students evaluation skills.

The second part of the frameworks section included the CARS model (Harris, 2000). Students need to begin the information search with some background information that will provide an understanding of the information they find and how it can be interpreted in comparison to other sources. Smith (1997) also applied traditional criteria and added a few new criteria of format, workability, cost, browsability, interactivity, and connectivity. Schrock (1998/1999) added handicapped access as a criteria and reminder of the needs of visually impaired researchers. Diversity of viewpoint is also important to consider (Symons, 1997). Web site rating forms can be an effective tool for evaluating Internet information. A variety of evaluation forms and checklists can be

found on the Internet. Fitzgerald (1997b) provided nine strategies to assist students in learning to employ techniques in evaluating Web resources.

Summary, Conclusions, and Implications

Internet publishing techniques result in challenges for effective evaluation of Web resources. New search strategies and evaluative techniques are needed to find the best resources among the vast amount of material available. An effective evaluator must be alert to the possibility of misinformation resulting from hardware and software problems, Internet architecture problems, and problems traditionally associated with print publications that also occur in the Internet environment. The researcher must be aware of counterfeit information in the three forms of propaganda, misinformation, and disinformation.

Findings reported in research and professional-literature lend strength to support the use of Internet instructional units to help students develop thinking skills to become effective evaluators. Teachers and media specialists can collaborate to teach students how to select, evaluate, and utilize information. Teachers can help students by detailing their expectations, and by providing definitions, and examples of good resources. A key element to bridging the gap between teacher expectation and student use of Internet resources lies in awareness of the need to critically evaluate Internet information, the selection of evaluation strategies, styles and criteria, and the education of Internet information users. Both students and teachers need to be knowledgeable about a wide variety of resources and to know what source of information is the best match for the information need.

Evaluative frameworks presented included the work many theorists, practitioners, and researchers. The Alexander and Tate (1999) model is the most comprehensive model studied and was cited in the works of many other researchers on this topic. Many of the other models were also cited in the literature as excellent choices for consideration of criteria for evaluation. Evaluation is an important topic and a crucial one in this day of information overload. While criteria checklists dominated the literature on evaluation of Internet resources, Fitzgerald (1997a) presented two additional evaluation styles, the affective approach, and the global approach. Grade level is an important factor to consider when choosing or creating a checklist, rubric, evaluation form, or evaluation style. These materials should be adapted to match the students' learning modalities, age, interests, and informational purpose.

Development of critical thinking skills must be incorporated in the process of teaching evaluation skills and students must learn to transfer their knowledge and evaluative skills to other areas of research. Critical thinking is a skill that can be learned from peers and teachers (Jones, 1996). Jones noted the importance of authentic tasks incorporated into a constructivist framework for learning. Because technology is moving so rapidly implementation of methods to evaluate technology-based resources will be an evolutionary and ongoing process (Alexander & Tate, 1998). AASL and AECT (1998) stated the following in *Information power: Building partnerships for learning*:

Information availability will undoubtedly continue to mushroom into the next century, which will make a strong school library media program even more essential to help its users acquire the skills they would need to harness and use information for a productive and fulfilling life. (p. 1)

The body of knowledge on the evaluation of Internet information is growing. Although some studies about the evaluation of Internet information published have been conducted with K-12 students, most have been conducted with college or graduate students. Scott and O'Sullivan (2000) citing the 1997 work of Oppenheimer and the 1998 work of Burniske, noted "the paucity of research related to the Internet in secondary and elementary classrooms" (para. 5). More research needs to be conducted at the K-12 level to refine the evaluation process for K-12 students.

Information literacy is a "basic survival skill for the 21st century," (Holloway, Doyle, & Lindsay, 1997, p. 3). The key to unleashing the power of information lies in student knowledge, attainment, and utilization of information literacy "survival" skills. Schrock (1998/1999) believed that the lessons of digital literacy were important and stated, "in the end, is this not the greatest lesson we can teach today's students" (p. 6).

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Appendix A

Summary of The CARS Checklist for Research Source Evaluation

Criterion	Indicator & Goal
Credibility	Trustworthy source, the quality of evidence and argument, author's credentials, evidence of quality control, known or respected authority, organizational support. Goal: an authoritative source, a source that supplies some good evidence that allows you to trust it.
Accuracy	Up-to-date, factual, detailed, exact, comprehensive, audience and purpose reflect intentions of completeness and accuracy. Goal: a source that is correct today (not yesterday), a source that gives the whole truth.
Reasonableness	Fair, balanced, objective, reasoned, no conflict of interest, absence of fallacies or slanted tone. Goal: a source that engages the subject thoughtfully and reasonably; a source concerned with the truth.
Support	Listed sources, contact information, available corroboration, claims supported, documentation supplied. Goal: a source that provides convincing evidence for the claims made, a source you can triangulate (find at least two other sources that support it).

Table A1: Note. From "Evaluating Internet research sources" by Harris, R. (2000). *A guidebook to the Web*. P. 70. Guilford, Connecticut: Dushkin/McGraw-Hill. Copyright 2000 by Dushkin/McGraw-Hill. Reprinted with permission.