Undergraduate Search Strategies and Evaluation Criteria: Searching for Credible Sources

Abstract

Purpose – The purpose of this paper is to determine undergraduate students' information seeking behavior and their thought processes involved in, criteria applied to, and methods of evaluating the results of their searches, in determining which information to apply to their research.

Design/methodology/approach – The authors observed, recorded and analyzed the processes and sources used by undergraduate students when seeking information on a given topic.

Findings – Students did not use as many of the criteria necessary for evaluating sources for a research paper as the authors had hoped to observe; therefore, the students identified relatively few scholarly sources.

Practical implications – Even though many of the students had had a course-integrated library instruction session before participating in the study, it did not seem to increase their evaluative skills, leading the authors to think that research skills need to be integrated in the curriculum in more meaningful ways by teaching faculty.

Originality/value – The paper raises awareness of the search strategies and criteria that undergraduate students use to find information for their research papers.

Keywords – Search strategies, evaluation criteria, information literacy, undergraduate students

Paper type – Case study

Introduction

As the availability of online resources has proliferated over the past decade, reference and instruction librarians have found themselves consulting with and teaching undergraduate students who are often satisfied with the "good enough" results they find when exclusively searching Google for research assignments. The reasons that these students initially search Google include: familiarity with it, the ease of access and navigation, convenience, and the use of natural language. In a previous study done at the University of Kansas Libraries (Emde, et al., 2008), the authors observed how undergraduate students search Google compared to a library database for information on an assigned topic. They were interested in studying which interface was preferred by students, the level of student satisfaction with the results of their searches, and which search features the students utilized.

As a result of the findings in that study, the authors became interested in further examining and understanding what criteria (including author credentials, scholarly scope, currency, objectivity, and others), if any, undergraduate students considered as they evaluated citations and determined those that were relevant and useful for their research. Thus, this research study was begun.

This paper reviews the literature related to undergraduate student researchers performing online research. It specifically contributes to the discussion not only of undergraduate students' information seeking behavior but also of their thought processes involved in, criteria applied to, and methods of evaluating the results of their searches, in determining which information to apply to their research. Reference and

instruction librarians must understand and address these behaviors if they are to successfully teach undergraduate students to be savvy, successful researchers.

Literature Review

Head and Eisenberg (2009, p.3) sought to learn how students resolved issues of credibility, authority, relevance, and currency of resources used for course-related research and for "everyday life research". The latter is defined as ongoing information seeking strategies for solving problems that may arise in daily activities. Students reported twice as many frustrations with conducting course-related research as they did with "everyday life research". They also expressed frustration with identifying, accessing, and/or locating resources in the library. Students typically used Google initially, followed by blogs and Wikipedia. Students did not use libraries and did not find library instruction helpful. Burton and Chadwick (2000, pp.5-6) designed a survey and queried students regarding the criteria used when they evaluated sources on the Internet and in the library. Students in this study said that the most desirable source for them was a source that is easy to find, easy to access, easy to understand, and available when it is needed. They also placed a high value on up-to-date information, primary sources, reputation of the publication and the author, but they were not concerned about publisher reputation. Most of the students claimed to understand the definition of "peer-reviewed" or "refereed" but they did not seem to recognize the value of citations in references for finding additional information (Burton, 2000, pp.10-12). In a study on the source selection criteria identified by 13 undergraduate students, Twait (2005, pp.569-572) found that students primarily valued the content of the source, but also ranked familiarity and availability as important. Very few students ranked reputation/credibility as important. There was little difference in the students' rankings based on class status. Twait concluded that evaluation skills are lacking in and needed by undergraduate students.

Van Scoyoc and Cason (2006, pp.51-56) examined undergraduate students' research habits in the campus electronic library environment. The authors were intrigued when they discovered that students used WebCT/class web sites almost as frequently as they used the Internet when doing research. Are instructors creating mini-libraries through WebCT/class web sites which directly link students to library databases? If so, students will have even less opportunity to critically select, use, and evaluate information resources on their own.

Hung (2004, pp.5-11) also investigated how undergraduates evaluated five web pages using five evaluation criteria – coverage, accuracy, authority, objectivity, and currency. The study indicated that students usually employ only one or two criteria and use them repeatedly to evaluate all five web sites. They evaluated web sites superficially, even with the criteria spelled out for them. Grimes and Boening (2001, pp.3-9) also found that students evaluated web sites superficially, if at all. The study found that students used unauthenticated web sites and none of them took advantage of the library's resources when left to their own devices. The authors also found that instructors seemed to be unaware that students have had little guidance in evaluating web resources. Martin (2008, p.7) examined the information seeking skills of undergraduate education majors to discern the types of sources these students used to find information for their research and whether library instruction played a role in their choices. Ninety percent of the students used the Internet for personal research and seventy-five percent chose the Internet for class-related research, even though these students realized that library resources were more credible. The students tended to choose the Internet because it was easier to use. Martin also found that students

who attended a library instruction session were proportionately just as likely to use academic and non-academic sources as those students who had not attended a library instruction session (Martin, 2008, pp.9-11). Davis (2003, p.45) conducted a longitudinal study from 1996-2001, which analyzed citations in term papers submitted during those years, and found that book citations dropped dramatically (from 30% in 1996 to 16% of all cited sources in 2001). Journal citations remained constant for the first year, but rose dramatically in 2001 when the professor set minimum requirements for scholarly sources. Magazine use remained relatively constant over the years in the study, but newspaper use increased significantly. The web citations initially showed a significant increase from 1996-1999, but fell in 2001 as the professor provided guidelines on appropriate research sources. Griffiths and Brophy (2005, pp.544-550) reported the results of two user studies conducted in the United Kingdom show that commercial Internet search engines dominated students' information seeking strategy. Search engines were preferred because of their familiarity and student success in finding information on previous occasions.

Methodology

The population selected for this study was undergraduate students at the University of Kansas. The sample size was ten undergraduates, including both library student assistants and those who were not employed by the University Libraries. The library student assistants who participated were newly hired and had little to no library resources training. The authors felt that their responses were not affected or biased by their employment in the Libraries.

Before beginning the observations, the authors applied to the University's Human Subjects Committee for permission to conduct the study, which was granted. They also applied for and received an allocation from the Libraries' Committee for Research and Scholarly Activity to purchase flash-drives as an incentive for participation.

In preparation for the study, the authors developed a pre-search survey to collect demographic data on the student participants, a list of post-search interview questions, and a chart listing criteria (see Appendix A) to be checked off as each student was observed. The observation schedule was set up, with one hour being reserved for each student. At the beginning of each observation, the student was provided with an information statement describing the study and requesting their verbal consent to participate. Each was identified only by number, to protect their identity in the study results. Each was assured of confidentiality and anonymity and that the authors would be non-judgmental during the observation.

After each student gave verbal consent to participate and completed a pre-search survey, the authors set the scenario for their search, as follows:

> *"Your professor has asked you to write a two-page paper on the topic below. You can search for information using Google and a library database, Academic Search Premier (ASP), and you must find three sources of information (two of which must be scholarly) to write your paper. There is no rush. This isn't a test, just an observation. Take your time in determining the search terms you might use. Review the results you get to see if any of them look helpful for your paper. Topic: Please research the allegations that vaccines cause autism in children."*

Post-search questions, discussed in the Observations section below, were presented before students began their searches so that they could consider them during the search process. These questions were generated from the authors' earlier study (Emde, et al., 2008), from discussions related to the objectives of the

current study, and from relevant information in the literature review. Asking these questions allowed the students to explain how they were selecting and evaluating the sources.

The students used a computer with Morae software installed; Morae is a software for web usability testing and has recording capabilities to track on-screen activity (search terms, mouse clicks, strategies, techniques), verbal comments, and video – the latter capability was not utilized for this study. While the Morae software recorded their mouse clicks, tracked the web pages they visited and recorded their verbal comments, the authors viewed the searches on a projector screen and wrote observation notes, but made few oral comments.

For the purposes of this study, *scholarly* was defined as a publication that was refereed (reviewed by a group of experts before publication), was written by experts, accompanied with references, and in a formal or technical writing style. It included primary research, scholarly reviews, scholarly literature reviews, but not newsletters. The authors intentionally did not provide this definition to the participants because one of the objectives of this study was to observe which evaluative criteria they were using to identify scholarly resources.

As the students identified citations, articles, and/or web sites that they deemed relevant to this "research paper," they e-mailed the information to the authors for review. The authors later examined these citations using evaluative criteria based on Standard Three of the *Information Literacy Competency Standards for Higher Education* (ALA, 2006) to determine the accuracy of the students' understanding of the scholarship, relevance, validity, or credibility of each.

After each student finished searching and e-mailed citations to the authors, a post-search interview was conducted to allow the authors to gather additional information and feedback. Since the authors had worked in pairs to observe each participant and none had observed every participant first-hand, they later reviewed together all ten sessions as recorded by the Morae software, took further notes, and shared comments and observations during the viewings – this enabled the authors to have similar insights into all students' evaluative processes. They tallied pre- and post-search survey responses and tick-marks on the criteria chart, and summarized survey observation notes. The authors also collected the search terms, use of Boolean operators, and phrases used by the students (see Appendix B).

Observations

From the population of ten students, eight were freshmen, one sophomore, and one junior. The diversity among their majors gave good representation across disciplines. Two of the students had been required to do research less than twice in their college careers, two had done research between two and five times, two between six and ten times, and four students more than ten times. Six students had attended a course-related library instruction session, four had not. The resources that they typically had used for research included books, encyclopedias, Google, Google Scholar, library databases, Wikipedia, and other Internet web sites. Specific library databases that had been used included Academic Search Premier, BioOne, CQ Researcher, Health and Wellness Resource Center, ProQuest Research Library, PsycINFO, Safari, and Wilson OmniFile. One student noted: "I have used databases but with the help of a reference librarian and I don't remember the names."

The four authors reviewed together the Morae recordings to reach a common agreement regarding the criteria that they observed being used by the students to select content. Selection of criteria was based on the comments and searching mechanics observed as the students worked through the exercise of identifying information to support a paper on the allegations that vaccines cause autism in children.

After reading an entry found through Google at the popular site, *About.com*, one student stated that she would read it to get more information but not use it as a source for the paper. She was not sure how credible the site was, therefore applying the "validity" criteria. Another student chose to consult sources from both sides of the argument, which indicates an interest in bias/point of view. A student's method of searching also represented a form of evaluation. Selecting the "limit" feature or scholarly (peer-reviewed) journals in ASP at least indicated an association between the requirements of the assignment (locating at least two scholarly articles) and the features of the database. Instead of using Google, some students switched to Google Scholar to pull up more reliable content. When a student set publication dates to recent years before running a search, it was apparent that she placed a value on the currency of the information.

The students' preliminary search terms and any modifications were recorded and are included in Appendix B. These terms provided interesting insights to the authors as to how students formulated their search queries. Most of the students in this study did not begin their search process identifying the major keywords and they did not connect key concepts with Boolean search tools ("and," "or," "not"). Most often, they searched in phrases or natural language. When poor results were achieved, they sometimes adapted the search strategy into something that increased relevant hits. Clearly, they expected the databases to work in a similar manner as Google and were sometimes frustrated with the results they were getting.

When searching was completed and citations had been selected, each student was asked the following questions during a post-search interview. This gave each the opportunity to verbalize how they evaluated information retrieved when reviewing web sites and citations. The authors continued to document comments and to independently note which criteria had been utilized.

What were you looking for when you were scanning the list of results to determine whether a source was relevant to your topic?
Eight students indicated that they were looking for relevant terminology or keywords, most often in the title and were looking for at least the major keywords, autism and vaccines. One student even commented on whether the keywords searched were "spread out" or "together" in the results. She also noted the relevancy indicator symbol assigned to citations in ASP. Several students reviewed only the first several options on Google since they understood that the most relevant articles were listed first. Five students clicked on links to review the abstracts to determine if the content was relevant, particularly if the article title was not clearly pertinent to the topic. One student skimmed abstracts and if an abstract "didn't catch my eye," he would open the article. The response of another student indicated a misconstrued definition of an abstract. He had limited to abstract as a document type in the ASP advanced search. He believed that if an abstract was available, the information was scholarly, relevant and/or unbiased. Four students actually stated that they were searching for credibility either of an author or a source. One student said that a journal source was credible because "Harvard" was in the title. For web sites, ".gov" and ".org" sites were viewed as potentially credible. Another student selected a site because "pediatrics" was included as an element in the URL. Associations, academic sites, and familiar organizations such as the

Center for Disease Control (CDC) attracted their attention as valid web resources. As to other types of sources, two students referred to the selection of medical sources and to the relevancy of court cases. Interestingly, two students selected interviews with parents as examples of contrasting points of view. The "emotional point of view" appealed to one student. Only one student voiced evaluating the currency of citations. Several others warned against the use of blogs or Wikipedia.

How did you determine if a source was scholarly?
A variety of statements was expressed in response to this question. The authors believe that most of the students did not grasp the relationship between "credibility" and "scholarly;" however, many of the responses did focus on some aspect of scholarly criteria. Two students actually stated that they were looking for peer-reviewed articles. Four students noted the existence and value of references and cited sources. Journals, not magazines or newspapers, were viewed as more scholarly by four students. Several students commented on the prestige of the journal that published the article (e.g. Journal of Biomedical Science) and noted when doctors or university researchers were the authors. One student mentioned a scientific hypothesis at the beginning of an article and she also looked for university departments in the address and/or multiple authors. Three students looked for articles with balanced points of view or objectivity, which is an important aspect in evaluating information but does not necessarily determine that the article is scholarly. Four students believed that searching in a scholarly database leads to scholarly literature. Other comments addressed the sample size of test subjects, "bigger" words in the journal and article title, case studies, court cases, government information, and using library databases instead of Google.

Why didn't you select other sources?
This question resembles the first question of "What were you looking for to determine relevancy?" by explaining why certain citations were not selected. As with that initial question, several students noted lack of relevancy to the topic by the absence of keywords or, as one student stated, "The title didn't catch my eye." Related to those responses were the observations that some of the citations lacked depth, were too brief/general, or only spoke to autism and not vaccines.

Some students rejected popular news magazines as non-scholarly formats. One student passed over articles "written in a way I would write," indicating that the information was less than scholarly. Regarding web sites, three students indicated that they would not use Wikipedia and/or CNN. One student said that she would use library databases more than Internet sources since information on the Internet can be changed randomly. Another student ignored web sites with advertisements and irrelevant photos. Some students viewed case studies, court cases, or government information as scholarly; others would not select these sources. Three students spoke to not selecting articles/sites listed lower on Google pages since they are recognized as less relevant. One student would not choose sources after the first or second page of results.

If there were a perfect source out there for your topic what would it include?
Five students wanted objective sources or articles that stated both sides of the debate. Two students looked for background information providing definitions and information on various vaccines. Several students emphasized that "factual information" must include statistics and graphs. One student's "perfect source" would be a scientific article with multiple doctors as authors, perhaps a medical article or from a government site, and would link to full-text references. Quotations from medical doctors/researchers were also desirable. Another student wanted "lots of credibility from legit sources" and a "header with a good

hook." Other "perfect sources" included government information, links to other sources, court rulings, and abstracts.

Evaluation of Sources Selected by Students

Using the criteria chart developed for the observations, the authors reviewed all of the sources identified by the students for writing their paper and determined that only 32% (16 of 50 sources selected) were considered to be scholarly, based on the authors' definition of the term. (Note: each had been asked to find three sources, two of which should be scholarly.) On average each student found four to five sources that they would use for their paper. Only one student stopped searching after finding three sources. Eleven of the sources determined by the authors to be scholarly were found in Academic Search Premier (ASP) and five were found using Google Scholar.

The authors further classified the types of sources and/or content the students were finding under the following categories. Out of a total of 50 articles:

1. Scholarly/Primary research articles (11)
2. Scholarly literature reviews (5)
3. Non-scholarly reviews (2)
4. News and commentaries in scholarly journals (3)
5. Scholarly organization newsletters (2)
6. News (9)
7. News blogs (1)
8. News media transcripts (1)
9. Consumer information (7)
10. Advocacy (4)
11. Commentary and editorials (3)
12. Book citations (1)
13. Abstracts (1)

While all students in the study group indicated that they were looking for what they called "credible" sources, it was clear that they did not have a solid understanding of the term. Students did not differentiate between "credible" and "scholarly" sources. Nine out of ten students thought they were finding scholarly and/or professional sources and were satisfied with the content. Some just liked the "look" of the article or the fact that the keywords they searched were in the title. Only one of the students mentioned that she was looking for the "credentials" of the authors. Even though the date of the publications was noted by only one student during the search process, the authors observed that most of the study group found a good number of recent sources (65% were from the past four years and 90% were from the past 9 years). Twice as many of the sources were found in ASP, rather than in Google or Google Scholar. These students were aware that the library database was more reliable for finding scholarly results and mentioned it throughout their searching. They also liked the familiarity and ease of Google searching, and two students switched over to use Google Scholar in their searches. The authors found it interesting that no one chose Wikipedia as a valid source to begin their research on the assigned topic. This was in contrast to the earlier findings of the authors' usability study comparing interfaces of an academic library database and Google (Emde, et al., 2008). It is note-worthy that eleven of the sources selected were consumer/advocacy related and nine were news resources. Most of the students used only a few criteria to evaluate the sources and then used those same criteria repeatedly, e.g., "credible source." The authors

found that the students sometimes selected valid sources but did not verbalize the specific criteria they were using to evaluate these sources. Some mentioned that they gave credence to statistics, graphs, or charts and several times chose documents that quoted or were written by medical doctors. Most indicated that they were looking for "both sides of the story" and wanted a balanced view of the issue. The evaluative criteria that the authors observed or that the students mentioned most often were balance, content, scholarly/professional, currency, credible source, and references/bibliography. Accessibility and convenience were also noted by the students as important criteria in making decisions about their selection of sources.

Conclusion

The authors were encouraged to see some improvement in the general search strategies used and skills demonstrated by the undergraduate students observed in this study (as compared to their study in 2008). However, it was disappointing to the authors that only 32% of the sources selected were actually scholarly. Students did not use as many of the criteria necessary for evaluating sources for a research paper as the authors had hoped to observe; therefore, the students identified relatively few scholarly sources.

The students in this group were keenly aware that they should look for and select "credible" sources and used certain criteria with which to determine validity or relevance. But even though the students understood the need to find valid or scholarly information, the authors concluded that the students were not skilled in the *application* of evaluative criteria. Indeed, these students articulated only three or four specific criteria they would use to evaluate a source, used them repeatedly, and then could not seem to think of any others. They often used the proper terminology in describing their selection process to the authors, but clearly did not understand the definitions of the terms. For example, while several of the students indicated they wanted to find a "credible" source, they were unable to list many of the specific criteria they could use to determine whether a source was credible or not. There was a surprising number of newspaper sources selected that they viewed as reliable and would cite in their research papers. To their credit, the students in the study *did* know that .com web sites were not to be trusted and reiterated many times that they were looking for information that had a balanced view, along with lots of statistics, charts, and graphs.

Where do we go from here? In this sample of students, 60% had attended a library instruction session. Yet it was evident that their evaluative skills were not strong. The authors conclude that course-integrated library instruction sessions may not be meeting the needs of undergraduate students in developing search, evaluative, and critical thinking skills. University professors may assume that students already have these skills when they arrive in the classroom. The authors recommend that academic librarians work to establish stronger partnerships with teaching faculty to ensure that research and information literacy skills are integrated into the core course curricula. A closer collaboration between teaching faculty and librarians could result in greater student understanding of the academic research process and perhaps contribute to student success and retention.

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Appendix A – Chart Used in Observations

EVALUATION CRITERIA	OCCURRENCES
Accuracy	0
Audience	4
Author (credentials/institutional affiliation/authority)	1
Bias/point of view	
Balance	8
Objectivity	7
Coverage/scope	
Content	9
Information is understandable or not	3
Scholarly/professional	9
Scientific method	3
Primary sources used	4
Currency/publication date	7
Publisher/publication (reputation of)/peer reviewed/refereed	3
Timeliness	3
Validity	
URL	4
Credible source	10
Bibliography/references/cites others	8
Mechanics	
Accessibility/easy to find	4
Cited references	2
Convenience	4
Availability of source	2
Easy to use	4
Charts and Graphs	4
Organization	3

Appendix B - Search Terms Used by Students

Student	Academic Search Premier (ASP)	Google
No. 1	*Allegations of vaccine causing autism*	Pasted the title of one article found in ASP *"US federal court exculpates vaccines as cause of autism"*
	Autism and vaccines	*Children and autism and vaccines* (Google Scholar)
	Children vaccines and autism, clicked on "find similar results" under smartsearch	Switched to "advanced search," "search all of the words," limited to "publication after 2007"
		Changed to 100 results per page
No. 2	*Autism and vaccines*	*Vaccinations cause autism*
	Vaccines cause autism	*Autism causes*
		Vaccine causes autism
		Autism causes vaccines health article
		Vaccines and autism
		Vaccines and autism medical article
		Autism from vaccines
No. 3	*Autism vaccine*	*Vaccine autism*
	Scholarly articles – autism vaccine, used "advanced search" & "all search terms"	*Autism vaccine link*
No. 4	*Allegations that vaccines cause autism*, used "advanced search", "find any of my terms"	*"Allegations against autism vaccines"*
	Autism vaccines	
	"Do vaccines cause autism?" (used quotes & got no results)	
No. 5	*Autism in children vaccines*	*Vaccines cause autism children* (Google Scholar)
No. 6	*Autism*	*Autism*
	Autism definition	*Autism and vaccines*
	What is autism	*MMR vaccine and autism* (Google Scholar)
	Autism in children	*Thimerosol and autism*
	Causes of autism	
	Causes of autism in children	
	Vaccines and autism	
	Vaccines that cause autism	
	Autism in children	
	Vaccines that cause autism	
No. 7	*Vaccines that cause autism in children*	*Autism in children*
	Allegations that vaccines cause autism in children	*Vaccines that cause autism in children*
	Causes of vaccines autism	*Allegations that vaccines cause autism in children*
		Other vaccines that cause autism in children
No. 8	*Vaccines side effects in children*	*Parents allegations about side effects of vaccines*
	Relationship between vaccines and autism	*Vaccines + autism*
		Allegations about the link of vaccines and autism
No. 9	*Vaccines that cause autism in children*	*Autism in children*
	Allegations that vaccines cause autism in children	*Vaccines that cause autism in children*
	Causes of vaccines autism	*Allegations vaccines that cause autism in children*
		Other vaccines that cause autism in children
		Flu vaccines autism
		Mercury preservative in childhood vaccines and autism
No. 10	*Vaccines autism children*, used "find all terms"	*Vaccines autism children* (Google Scholar)
	Vaccines autism children cause	
	Vaccines may cause autism	*Allegations that vaccines cause autism in children*
	Vaccines and autism, used "find all my search terms," "scholarly/peer-reviewed," selected "abstract" as document type, in advanced search used "search as phrase"	