What Do First-Year Students Know about Information Research? And What Can We Teach Them?

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First-year students have long been a primary focus of academic librarians' research and assessment efforts. From these studies, and even more particularly from the unempirically based library literature, there emerges a picture of first-year students. These first-year students are extreme examples of their collegiate peers: "lazy, procrastinating, plagiarizing patrons of the glut of information that has come to be known as the Internet" (Thompson 2003).

- They rely heavily upon the Internet for meeting their information needs, sometimes even changing their research topics to match the information available electronically (Bartsch and Tydlacka 2003; Jones 2002; Laskowski 2002; Lombardo and Miree 2003; Macdonald and Dunkelberger 2000; Pask and Snow 1995; Seamans 2002; Thompson 2003).
- They ignore library information resources and services (Bao 2002; Jones 2002; Thompson 2003; San Jose Mercury News 2003; Seamans 2002).
- They act on the "principle of least effort" in researching (Associated Press 2004; Bates 2003; Debrowski 2001; Young and Von Seggern 2001). They often seek to get the highest grade with the least expenditure of time and effort (Burton and Chadwick 2000; Harley, Dreger, and Knobloch 2001; Valentine 2001), and they sometimes unthinkingly use the first few information sources they find (Hammond 1999; Tenopir et al. 2003).
- They use unsophisticated searching techniques, which unbeknownst to them are inadequate for finding the needed information (Associated Press 2004; Bates 2003; Cockrell and Jayne 2002; Debrowski 2001; Dyckman 1995; Grimes and Boening 2001; Kunkel, Weaver, and Cook 1996; Nowicki 2003; Pask and Snow 1995; Seiden, Szymborski and Norelli 1997; Spink and Gunar 2001; Sutcliffe, Ennis, and Watkinson 2000; Tenopir et al. 2003; Thaxton, Faccioli, and Mosby 2004; Valentine 2001).
- They accept uncritically information sources from the Web, largely because they are unaware either of the existence of misinformation on the Web or of criteria for evaluating Web resources (Bodi 2002; Burton and Chadwick 2000; Grimes and Boening 2001; Harley, Dreger, and Knobloch 2001; Herring 2001; Jones and Barajas 2004; Kunkel, Weaver, and Cook 1996; Lorenzen 2001; Pask and Snow 1995; Stepp 2002; Weiler 2001).

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• They are disrespectful of others' intellectual property, routinely engaging in cut-and-paste plagiarism and in downloading copyrighted files over the Internet (Mittermeyer and Quiron 2003; Roig 1997; San Jose Mercury News 2003).

Looking at this composite picture, one is tempted to wonder, as Christen Thompson (2003) did, whether these students are "information illiterate" or "lazy." Do they produce papers citing the first few electronic resources they come to—however marginal these resources may be—because they know no better, or because they will not work to find more appropriate sources? Most of the extant literature strongly implies that while "lack of effort" (often glossed as time pressure, cf. Bodi 2002) is involved, "information illiteracy" is at the root of the problem. Students must be taught, this literature concludes, positioning the above problems as the results of failures of knowledge (see figure 1).

In part, the conclusion that students are "information illiterate" reflects the reality that "information illiteracy" is a more remediable problem than "laziness": "If it is simply a matter of students being lazy then perhaps there is nothing that librarians can do to correct this problem. However, if college students are lacking the necessary information literacy skills, this clearly signals a need for both faculty and librarians to address the shortcomings that have lead to such a crisis" (Thompson 2003, 260). "Information illiteracy" is even more strongly suggested by studies that find improvements in students' information research skills following library instruction (e.g., Lombardo and Miree 2003; Weiler 2001).

The research and assessment project described herein, however, has rather different findings to report about students' presumed (lack of) knowledge of information resources and about the efficacy of library instruction in increasing their knowledge. During the 2003–2004 academic year, 2,877 first-year students in a four-credit, introductory English composition course, required at New Mexico State University of those not awarded Advanced Placement credit in English, took pre- and

Figure 1. The Language of "Teaching" Presumes Lack of Knowledge as the Problem: Some Examples

- "This indicates that it is not only how to find information on the web that must be taught to college students, but also how to evaluate the information once it has been found." (Thompson 2003, 261)
- "Teach students how to critically evaluate sources of information. While doing so, teach them to be more concerned with determining the meaning and value of an information package and less concerned with finding an answer in that item." (Harley, Dreger, and Knobloch 2001, 31)
- "I think people aren't trained very well to use the search engines," said information science researcher Amanda Spink quoted in Associated Press 2004.
- "This may mean that librarians need to focus their training on subscription databases, advanced Internet search skills, and useful curricula-related Web resources." (Bao 2002, 258)
- "academic library professionals should be proactive in working with teaching faculty to develop course-related training aimed at enabling students to find Web-based information effectively and to evaluate its quality, authority, and credibility. … Special emphasis should be placed on effective search techniques." (Herring 2001, 257)
- "Our findings show that students cannot gain this knowledge through experience alone. It must be taught …" (Seiden, Szymborski, and Norelli 1997)
- "There is a real need to do instruction with high school students now and when they get to college to help them learn when to avoid the Web as a source of information" (Lorenzen 2001, 162)
- "These results clearly illustrate the need for information literacy and computer literacy training for students." (Nowicki 2003, 512)
- "However, in addition to attempting to improve general writing skills, more attention needs to be paid to teaching students the proper skills to avoid plagiarism." (Roig 1997)
- "The pedagogical challenge for library management, computer administrators, and faculty is to encourage students to critically evaluate the authority of the sources they use, whatever the information medium." (Smith and Phillips 1999)

Figure 2. Prior Pre- and Post-test Findings

- Carter: Used pre- and post-tests. No mention of findings or statistical significance.
- Fenske: Pre-test score of 19.85 or 68% increased to post-test score of 22.76 or 78%. Statistically significant.
- Henthorn: Pre-item analysis. Statistically significant.
- Kaplowitz: Scores went from 12.49 to 15.23 on usage, 35.50 to 38.34 on attitude, and 18.52 to 22.47 on skills. Statistically significant.
- Knight: Scores and statistical significance discussed on a per-item basis only.
- Lawson: Pre- and post-test scores increasing from 7.4494 to 11.2699 in Fall 1997 and from 7.1635 to 11.9612 in Fall 1998. Statistically significant.
- Ren : Self-efficacy scores increasing from 5.51 to 7.25 and attitude score increasing from 8.52 to 8.54. Statistically significant.
- Samson and Granath: Results listed only on per-question basis. No analysis of statistical significance.
- Thaxton, Faccioli and Mosby: Pre- and post-test scores increased from 3.73 to 6.00 in Spring 2003 and from 3.15 to 5.80 in Fall 2003. Statistically significant.
- Tiefel: Average increase of 9.3% from the pre-test (72.3%) to the post-test (81.6%). Statistically significant.
- Vidmar: Pre- and post-testing tied to affective domain. Per-item discussion. Statistically significant.
- Ware and Morganti: Mean gain of 3.4 points from pre- to post-test. Statistically significant.

post-tests as one means of assessing their learning from a library instruction module integrated into their course (ENGL 111). The testing instruments gathered both quantitative demographic information as well as qualitative information about students' knowledge of information sources, search strategies, and differences between the library and the Web. Students' responses to constructed-response questions about differences between and uses of various information resources; strategies for effective searching; and differences between library resources and those found on the "free Web" were coded and analyzed using *The Ethnograph* v5.0. Two key findings emerge from data analysis: (1) students can articulate savvy explanations for searching and evaluating strategies and (2) misinformation about the use of information sources persists even after instruction. Both findings have implications for other assessment projects.

Methodology

Use of pre- and post-tests to measure student learning is a common experimental methodology within library instruction. (See Figure 2.) Pre- and post-tests are intended to measure changes in students' attitudes, knowledge, or behaviors in relation to the interventive "treatment" of library instruction. Virtually all prior pre- and post-test instruments have been used in quantitative research and have forced student-subjects to choose from among a narrow range of options. Most prior pre- and post-testing projects have found approximately ten percent improvement between the pre- and post-test scores, and sometimes this improvement has been statistically significant.

The current research and assessment project grew out of concern about the narrow range of choices on prior selected-response pre- and post-tests, many of which were not piloted prior to use and do not have established validity or reliability. It was thought that the choices on these instruments might not adequately measure the ways in which students think about information-seeking and use. This study specifically sought to learn more about in which words students would articulate their own understandings of information sources and search strategies, as well as what demographic factors contribute to student learning—or nonlearning—in library instruction.

Both pre- and post-test instruments were locally constructed in order to match the questions with institutional learning objectives. Time to completion was another concern motivating local construction of testing instruments. Pre- and post-tests were intended to take no more than 5–10 minutes of students' time,

but most standardized tests of information literacy are lengthier. These pre- and post-tests were, however, reviewed prior to use for content or face validity by ten instruction librarians at North American universities who were provided with both the sample instruments and a statement of student learning objectives. They were also pilot tested in spring 2003 with a group of 40 randomly selected students from the target population. Pilot testing revealed the instruments had test-retest reliability and criterion-related validity at statistically significant levels (1.571 and 2.026 respectively, $p<.05$). 2,884 students, in total, completed the pre- and post-tests in AY 2003–2004: 833 completed the pre-test and 916 completed the post-test in fall 2003, while 528 completed the pre-test and 607 completed the post-test in spring 2004. The fact that pre-tests were completed by students on their own time, returned to their ENGL 111 course instructors, and then forwarded to the library helps to explain why fewer pre-tests were completed in both fall and spring. Some students were absent on the days their instructors collected these, and a few instructors misplaced some students' pre-tests. Because pre- and post-test answers were largely compared in aggregate and not matched at the level of individual students' responses, the slight differences in numbers of pre- and post-tests completed had little impact on findings.

Assessment instruments combined constructed-response and selected-response questions, as well as demographic ones. The pre-test was not absolutely identical to the post-test because each collected different demographic data. The pre-test asked for students' instructor and section number; their research topic; their prior experience with public, high school, and university libraries; their level of comfort with using the library; and their prior experiences with library instruction at the university they were then attending. The post-test asked how their instructor had prepared the class for the library instruction session and how well the librarian had presented the session. The questions that measured student learning were the same on both pre- and post-tests, though. These questions included a mix of selected- and constructed-response questions. Pre-tests were published as part of the students' ENGL 111 course packs, and students completed them prior to their ENGL 111 library sessions. Post-tests were separate documents completed by students at the end of their library instruction sessions. Anywhere between 1 and 5 weeks passed between students' completion of pre-tests and their taking of post-tests. While some caution that as many as 10 weeks are needed between pre- and post-tests to guard against sensitization effects, others argue that a week can be sufficient to decrease the influence of the pre-test on post-test achievement (Asher 1976, 102). A shorter interval between pre- and post-test also guards against maturation effects, which results from gains in student learning due to other influences (e.g., other coursework) with the passage of time. The longer the interval between pre- and post-tests, the higher the possibility of maturation effects. Assessing students' learning immediately after their library instruction sessions undoubtedly inflated estimates of this learning. Had the students completed the post-test on the last day of their ENGL 111 course, their learning gains would likely have seemed less. Doing so was not possible for logistical reasons, however, and failure to do so does not vitiate the findings of this study. Overall, this study is more interested in students' responses on the pre-tests, or what they knew prior to library instruction; moreover, its conclusions about students' learning gains from library instruction is that these gains are less than desirable—even when students' learning is measured at its highest point (right after the instruction session).

Subjects' responses to the constructed-response questions were of particular interest and were subjected to qualitative analysis by coding and use of *The Ethnograph* v5.0, a qualitative data analysis software available from Qualis Research. *The Ethnogaph* works upon computer-readable text by attaching code words to segments of the text, which are identified by line numbers. Each section of text can have up to twelve code words with *The Ethnograph*, and codes can overlap and be nested. Once the text is coded, *The Ethnograph* allows users to search data files to retrieve segments identified by code(s); users can search up to five code simultaneously using Boolean operators to look for co-occurrence. Two individuals coded each response, one a librarian and the other not, and inter-rater reliability was 98 percent. Students' responses to selected-response question and demographic questions were also subjected to quantitative analyses, especially those testing for statistical significance. These findings are alluded to here, but not discussed in detail, because of space constraints.

Table 1. Knowledge of What the Library Catalog Contains: Raw numbers and percentages correct

	Fall 2003			Spring 2004		
Type of information source	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Books	99% N = 828	99% N=909	+0%	99% N=524	98% N=596	-1%
Magazine articles	6% N =51	40.2% N= 368	+34.2%	5.7% N=30	30.3% N=184	+24.3%
Videocassettes	70% N = 582	86.2% N=790	+16.2%	65% N=343	82.5% N=501	+17.5%
Sound recordings	55.4% N = 462	82.8% N=758	+27.4%	50% N=263	77.3% N=469	+27.3%
Government documents	69.9% N = 582	92.6% N=848	+22.7%	74.8% N=395	87.6% N=532	+12.8%

Findings

Knowledge of information resources

Three questions—two selected-response and one constructed-response—sought to measure students' knowledge of library-based information sources, although their responses to two other constructed-response questions on other topics also revealed additional aspects of this knowledge. Students initially had a fairly good understanding of what a library catalog contains. (See Table 1.) Fifty percent, or more, of students in both fall and spring knew before their library instruction sessions that the catalog listed books, video cassettes, sound recordings, and government documents. The only significant misunderstandings surrounded whether the catalog listed magazine articles. Only 6 percent of students in fall and 5.7 percent of students in spring knew that the library's catalog excluded magazine articles. This finding confirms that of other researchers, who have also found that students expect to find periodical articles in library catalogs (Cockrell and Jayne 2002; Kunkel, Weaver and Cook, 1996; Mittermeyer and Quiron 2003).

Similarly, between 46 and 63 percent of students, fall and spring, had a fairly good idea of the scope of the library's main full-text article database before their English 111 library instruction session. (See Table 2.)

More striking, however, were students' answers to the constructed-response question of "How are books and articles different (Table 3)? When and how could you use each of these in your research?"

In fall 2003, these differences were initially conceptualized in terms of: level of detail (46.7% of responses), with books having fuller or more detailed information than articles; length (45.2%), with books being longer than articles; types of topics covered (33.9%), with books and articles having basically different types of

Table 2: Knowledge of the Characteristics of Article Databases: Raw numbers and percentages correct

	Fall 2003			Spring 2004		
Database characteristic	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Not all databases entirely full-text	56.1% N=467	84.4% N=773	+28.3%	62.7% N=331	84.2% N=511	+21.5%
Online databases list articles from print periodicals	45.5% N=379	46.3% N=424	+0.8%	49.2% N=260	46.1% N=280	-3.1%
No one database lists all articles	61.3% N=511	54.7% N=501	-6.6%	60.6% N=320	58.6% N=356	-2%

Table 3. Knowledge of information sources: Raw numbers and percentages

	Fall 2003			Spring 2004		
Area of difference	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Authorship	4.4% N=37	2.6% N=24	-1.8%	4.5% N=24	3.0% N=18	-1.5%
Credibility of source	3.8% N=32	4.6% N=42	+0.8%	5.9% N=31	7.7% N=47	+1.8%
Ease of use	4.9% N=41	3.3% N=31	-1.6%	2.3% N=12	3.6% N=22	+1.3%
Length	45.2% N=377	36.9% N=338	-8.3%	39.2% N=207	26.2% N=159	-13%
Level of detail	46.7% N=398	55.6% N=509	+8.9%	38.6% N=204	49.4% N=300	+10.8%
Means of accessing	0% N=0	8.0% N=73	+8.0%	4.0% N=21	14.5% N=82	+10.5%
Part/whole	22.8% N=190	8.0% N=73	-14.8%	21.2% N=112	15.7% N=95	-5.5%
Timeliness of information	11.9% N=99	32.9% N=301	+21%	9.3% N=49	20.4% N=124	+11.1%
Topics covered; approach to topic	33.9% N=282	19.4% N=178	-14.5%	31.1% N=164	17.6% N=107	-13.5%
Other	1.7% N=14	1.5% N=14	-0.2%	2.7% N=14	3.0% N=18	+0.3%
Don't know	0.6% N=5	0.1% N=1	-0.5%	0.9% N=5	0.3% N=2	-0.6%
Blank	0.9% N=8	3.7% N=34	+2.8	3.6% N=19	3.5% N=21	-0.1%

content (e.g., biographies, autobiographies, novels, interviews, etc.); part/whole relationships (22.8%), with articles being part of periodicals; timeliness of their information (11.9%), with books taking longer to publish and articles treating more cutting-edge topics; ease of use (4.9%), with books or articles variously described as easier to find or use; authorship (4.4%), with books and articles being authored by different people; credibility (3.8%), with books invariably described as more credible than articles; other (1.7%); no response (0.9%); and "I don't know" (0.6%). Spring 2004 brought some slight changes in the order and frequency of students' answers to this question on the pre-test: length, 39.2 percent of responses; level of detail, 38.6 percent; topics covered, 31.1 percent; part/whole relationships, 21.2 percent; timeliness of information, 9.3 percent; credibility, with books again seen as more credible than articles, 5.9 percent; authorship, 4.5 percent; means of accessing these sources (e.g, catalog vs. article database, in library vs. online), a category not mentioned in the Fall responses, 4 percent; no response, 3.6 percent; other, 2.7 percent; ease of use, 2.3 percent; and "I don't know," 0.9 percent. Further, many students could accurately describe potential uses for books and articles in their research. Some examples include: "books can be used early in research to obtain a more comprehensive understanding of the subject," "books for general overview and articles for up-to-date research," "books are informative, give lots of details, articles tell a story or give examples. I could use [articles] to show documented research/tests on golf equipment," and "articles have more interviews."

Another interesting finding about students' knowledge of information sources emerged from their answers to the question about strategies for narrowing a search. In these findings, 2.2 percent of students in fall and 2.1 percent of students in spring said that a search could be narrowed by concentrating on a person or organization involved with the area of research. This confirms Rubens' suggestion that "people may be more attuned to institutions and organizations than to libraries and documents" (1991, 281). Also confirmed by these findings are OCLC's earlier findings that contemporary college students are neither unaware of books nor unlikely to use them as information sources (OCLC 2002, 3). In explaining how library sources differed from those on the free Web, students valued library resources as easier to quote and cite (2.3–2.8%); leading to better papers (12.8–13.4%); taking less work to find and use (4.2–4.6%); and more complete and possessed of more information (18.9–20%). Those students who mentioned library sources as leading to better papers were particularly interesting. Generally they either said that "It [the library] allows you to actually get into the research, rather than just clicking away. You could also get a better understanding of the information as you find it rather than just receiving it," or that "library sources are more credible and contribute more to your ethos as a writer."

Knowledge of search techniques

Unobtrusive studies of searchers' behaviors uniformly reveal that the vast majority of searchers use simple searches with one to two keywords (Bates 2003; cf. Associated Press 2004; Nowicki 2003; Seamans 2002; Seiden, Szymborski, and Norelli 1997; Spink and Gunar 2001; Sutcliffe, Ennis, and Watkinson 2000). These searchers are typically described as unable to use keywords effectively (Debrowski 2001; Pask and Snow 1995; Valentine 2001); unwilling to consider synonyms for search terms (Vine 2001); unable to find the right database (Seiden, Szymborski, and Norelli 1997; Valentine 2001); unaware of Boolean operators, or unskilled at using them (Bates 2003; Nowicki 2003; Pask and Snow 1995; Thaxton, Faccioli and Mosby 2004; Vine 2001); unlikely to search with multiple concepts or with subject headings (Seiden, Szymborski, and Norelli 1997); unlikely to use limits (Dyckman 1995); and unlikely to use advanced search features (Nowicki 2003; Spink and Gunar 2001; Sutcliffe, Ennis, and Watkinson 2000; Tenopir et al. 2003). Some even go so far as to attribute searchers' poor search strategies to their use of Web search engines, which supposedly "tend not to encourage good searching techniques" (Williamson 2000, 40).

Nevertheless, when asked "Suppose you did a search on cloning in an article database and got 1 million results. What are ***two*** things you could do to narrow your search and find fewer results?" these students were able to articulate fairly sophisticated search strategies prior to receiving library instruction (Table 4).

While the naïve belief that using just the "right" keywords would be sufficient to focus a search was the most pervasive (81.4% of pre-test responses in fall and 81.2% in spring), students mentioned a range of other strategies for narrowing a search. Some involved focusing on one's search terms: re-wording the search by, for example, using synonyms; adding additional words or phrases to the search; and cutting unnecessary words. Others focused on how the search is done by changing search type; doing a combined search; doing an advanced search; searching for a known item (article, book, or author); searching for a person or organization involved with the issue; using quotation marks and phrase searching; using unspecified Boolean operators; using AND; using NOT; using OR; using +; using -; grouping terms with parentheses; doing subject searches; doing title field searches; truncating; and capitalizing proper names. Yet others explicitly mentioned the use of limits. Several times the limit(s) to be used were unspecified, but at other times, date limits, source type limits, document type limits, language limits, library location or availability limits, limiting to full-text, and limiting by domain name were mentioned. Several suggested changing databases, searching a subset of the database, or following subject headings or sub-headings within the database. Then there were those who suggested using the extant (1 million+) results list by heeding the relevancy rankings; working through the items one by one until something appropriate was found; looking for items listed more than once and either concentrating upon or ignoring these; searching within the initial results set; applying evaluative criteria to the results; just using the first X number of items; and sorting the results. Finally, there were those who suggested asking for help generally,

Table 4. Strategies for Narrowing a Search: Raw numbers and percentages						
	Fall 2003			Spring 2004		
Strategy	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Use specific search terms	81.4% N=678	51.5% N=472	-29.9%	81.2% N=429	51.7% N=314	-29.5%
Change search terms; re-word	8.5% N=71	8.9% N=82	+0.4%	5.7% N=30	10.0% N=60	+4.3%
Add more words, phrases to search	5.5% N=46	16.3% N=150	+10.8%	11.6% N=61	12.9% N=78	+1.3%
Cut unnecessary words	2.2% N=19	1.7% N=16	-0.5%	1.9% N=10	4.3% N=26	+2.4%
Check spelling	0% N=0	0.2% N=2	+0.2%	0% N=0	0.2% N=1	+0.2%
Change search type (unspecified)	0% N=0	0.7% N=6	+0.7%	0.4% N=2	0.8% N=5	+0.4%
Do a combined search	0.4% N=3	4.3% N=39	+3.9%	0% N=0	4.3% N=26	+4.3%
Do an advanced search	1.7% N=14	4.0% N=37	+2.3%	1.3% N=7	5.1% N=31	+3.8%
Search for known item (article, book, author)	5.5% N=46	2.0% N=19	-3.5%	5.3% N=28	2.8% N=17	-2.5%
Focus on person or organization involved with the issue	2.6% N=22	0.4% N=4	-2.2%	2.1% N=11	0.2% N=1	-1.9%
Use quotation marks/ phrase searching	3.8% N=32	15.5% N=142	+11.7%	2.7% N=14	17.1% N=104	+14.4%
Use Boolean operators (unspecified)	0.1% N=1	0.9% N=8	+0.8%	0.4% N=2	0.5% N=3	+0.1%
Use AND	1.6% N=13	14.5% N=133	+12.9%	2.3% N=12	7.6% N=46	+5.3%
Use NOT	0.7% N=6	8.0% N=73	+7.3%	0.9% N=5	4.7% N=29	+3.8%
Use OR	0.7% N=6	8.0% N=73	+7.3%	1.7% N=9	5.8% N=35	+4.1%
Use +	0.7% N=6	7.3% N=67	+6.6%	0.6% N=3	4.4% N=27	+3.8%
Use -	0.2% N=2	0.1% N=1	-0.1%	0% N=0	0.5% N=3	+0.5%
Use parentheses, group terms	0% N=0	1.0% N=10	+1.0%	0.4% N=2	1.5% N=9	+1.1%
Do a subject search	0.6 N=5	3.4% N=31	+2.8%	0.2% N=1	4.9% N=30	+4.7%

Table 4. Strategies for Narrowing a Search: Raw numbers and percentages						
	Fall 2003			Spring 2004		
Strategy	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Do a title search	0.5% N=4	1.9% N=17	+1.4%	1.5% N=8	2.3% N=14	+0.8%
Do a field search	0.2% N=2	0% N=0	-0.2%	0.2% N=1	0% N=0	-0.2%
Use truncation	0.1% N=1	0.1% N=1	+/-0%	0% N=0	0% N=0	+/-0%
Capitalize	0.1% N=1	0% N=0	-0.1%	0% N=0	0% N=0	+/-0%
Use limits (unspecified)	0.8% N=7	2.8% N=26	+2.0%	1.1%=6	3.5% N=21	+2.4%
Limit by date	15.0% N=125	11.1% N=102	-3.9%	18.4% N=97	10.7% N=65	-7.7%
Limit by source type (book, article, Web page, sound recording, etc.)	1.6% N=13	1.4% N=13	-0.2%	2.3% N=12	2.5% N=15	+0.2%
Limit by document type (popular, scholarly; fiction/non-fiction)	1.7% N=14	5.2% N=48	+3.5%	0.9% N=5	4.9% N=30	+4.0%
Limit by language	0.5% N=4	1.0% N=9	+0.5%	0.2% N=1	0.2% N=1	+/-0%
Limit by library location/availability	0.2% N=2	0.2% N=2	+/-0%	0.4% N=2	0.2% N=1	-0.2%
Limit to full-text	0.5% N=4	1.0% N=37	+0.5%	1.1% N=6	0.8% N=5	-0.3%
Limit by domain name (.gov, .edu, etc.)	0.7% N=6	0% N=0	-0.7%	0.6% N=3	0% N=0	-0.6%
Change databases	0.6% N=5	1.2% N=11	+0.6%	2.1% N=11	1.0% N=6	-1.1%
Search a sub-set of the database	0.2% N=2	0.2% N=2	+/-0%	0.8% N=4	0.2% N=1	-0.6%
Follow subject headings & subheadings within the database	0% N=0	5.2% N=48	+5.2%	0.6% N=3	5.3% N=32	-4.7%
Look at those with a certain relevancy ranking	0.4% N=3	0.1% N=1	-0.3%	0% N=0	0% N=0	+/-0%
Work through them one by one	2.2% N=18	0.3% N=3	-1.9%	0.8% N=4	1.8% N=11	+1.0%

Table 4. Strategies for Narrowing a Search: Raw numbers and percentages						
	Fall 2003			Spring 2004		
Strategy	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
Look for duplicates	0.4% N=3	0% N=0	-0.4%	0% N=0	0% N=0	+/-0%
Search within results	0.5% N=4	0.2% N=2	-0.3%	0.6% N=3	1.0% N=6	+0.4%
Apply evaluative criteria to results	2.2% N=13	0.4% N=4	-1.8%	0.9% N=5	0.7% N=4	-0.2%
Just use the first X number	1.2% N=10	0% N=0	-1.2%	1.1% N=6	0% N=0	-1.1%
Limit the number of results in searching	0.7% N=6	0.1% N=1	-0.6%	0% N=0	N=0	+/-0%
Sort results	0% N=0	0.2% N=2	+0.2%	0.2% N=1	0% N=0	-0.2%
Ask for help (generally)	0.2% N=2	0.1% N=1	-0.1%	0.2% N=1	0.2% N=1	+/-0%
Ask a librarian	0.5% N=4	0.4% N=4	-0.1%	0.4% N=2	0.3% N=2	-0.1%
Change topic	0% N=0	0.2% N=2	+0.2%	0.6% N=3	0.2% N=1	-0.4%
Blank	2.0% N=17	3.2% N=29	+1.2%	2.7% N=14	4.8% N=29	+2.1%
Don't know	1.0% N=8	0.2% N=2	-0.8%	0.9% N=5	0.7% N=4	-0.2%
Other	0.7% N=6	0.1% N=1	-0.6%	0% N=0	0% N=0	+/-0%

asking a librarian, or changing the topic. A few left the question blank, answered "I don't know," or gave some other answer. With the exception of limiting by date and adding more words, concepts, or phrases to the search (spring results only), none of these strategies appeared in over 10 percent of the pre-test responses. The range and sophistication of many of these suggestions is impressive, though.

The probable reason for the discrepancy between earlier observations that most searches are unsophisticated ones, using one or two keywords, and the range of search strategies mentioned by these students is the disjunction between what people say and what people do. Many research projects have noted self-presentation bias, with subjects giving researchers what subjects think are "socially desirable" responses in order to present themselves in a positive light. Self-presentation bias was likely in operation here, although its effects are perhaps lessened by the fact that the pre-tests were presented to students as just one of many "pre-writings" they were expected to do in their ENGL 111 course packs. It is also probable that some students presented strategies they could not correctly implement. That is, they mentioned using NOT or parentheses to group search terms, but they might use these incorrectly in their own searches. Nevertheless, it seems as if students' failure to employ sophisticated strategies in their searches is ***not*** a result of their ignorance of these.

Knowledge of evaluative criteria

The final constructed-response question concerned

differences between library and free Web resources. It asked, "Why are you expected to use library resources (books, articles, etc.) for college-level research? Why can't you just use free Web resources found using general search engines (such as Google, AskJeeves, or Yahoo)?" In answering this question on their pretests, students displayed a high level of awareness of misinformation on the Internet, as well as of common criteria for evaluating information. The vast majority of responses—68.8 percent in fall and 71.4 percent in spring—mentioned Web-based misinformation as a reason for relying upon library sources (Table 5).

Some students simply alluded to "all that junk out there," but many others mentioned concerns tied specifically to evaluative criteria. Authority and credibility; scope, coverage, and relevance; bias and accuracy; currency/timeliness; navigability; and commercialism were all explicitly mentioned by students. Overall, these comments confirm OCLC's findings that college students "are aware that the web does not meet all of their needs" and particularly "value access to accurate, up-to-date information with easily identifiable authors" (2002, 4). They may also suggest that, librarians' worries to the contrary, students are not fundamentally misguided

Table 5. Why are you expected to use library, not just Web, resources?: Raw numbers and percentages

	Fall 2003			Spring 2004		
Area of difference	**Pretest**	**Post-test**	**% change**	**Pretest**	**Post-test**	**% change**
College-level expectations	7.8% N=65	5.5% N=50	-2.3%	8.9% N=47	5.3% N=32	-3.6%
Copyright	1.9% N=16	1.7% N=16	-0.2%	0.8% N=4	0.7% N=4	-0.1%
Easier to cite & quote	2.8% N=23	2.0% N=19	-0.8%	2.3% N=12	2.0% N=12	-0.3%
Improves your work	12.8% N=107	3.9% N=36	-8.9%	13.4% N=71	6.8% N=41	-6.6%
Learn to use library	8.6% N=72	2.7% N=25	-5.9%	7.0% N=37	2.8% N=17	-4.2%
Library sources take less work	4.6% N=38	3.8% N=35	-0.8%	4.2% N=22	2.8% N=17	-1.4%
Library sources take more work	1.9% N=16	1.0% N=9	-0.9%	2.5% N=13	1.8% N=11	-0.7%
Misinformation on the Web	68.8% N=573	82.8% N=758	+14%	71.4% N=377	72.3% N=439	+0.9%
More information in library sources	20.0% N=167	9.1% N=83	-10.9%	18.9% N=100	14.2% N=86	-4.7%
Prevent plagiarism	3.8% N=32	0.5% N=5	-3.3%	3.2% N=17	0.8% N=5	-2.4%
Superior search capabilities	0% N=0	0.8% N=7	+0.8%	0% N=0	0.2% N=1	+0.2%
Other	0.4% N=3	0.7% N=6	+0.3%	0.9% N=5	1.2% N=7	+0.3%
Don't know	2.0% N=17	0.4% N=4	+1.6%	2.3% N=12	0% N=0	-2.3%
Blank	2.0% N=17	4.7% N=43	+2.7%	2.3% N=12	6.1% N=37	+3.8%

when they report that "they know best what information to accept from the Web" (OCLC 2002, 4)

Other responses mentioned heightened expectations for college-level work; the "fact" that library resources are copyrighted while Web resources are not; library resources being easier to quote and cite; doing better work because of library resources; the need to learn to use the library; library resources taking less work to find; library resources taking more work to find—and thus being required by professors who want to create difficulties for students; library sources having more complete information on more topics than the Web; the ease of plagiarizing Web resources; the superior search capabilities of library resources; other; "I don't know"; and blank.

As with the findings about searching, there is always the possibility of self-presentation bias, as well as the possibility that students have knowledge of criteria for evaluating Web resources but would be unable to apply correctly these criteria to sources they themselves found. Several prior studies show that this may, in fact, be the case. Grimes and Boening (2001), Bos (2000), and Scholz-Crane (1998) all found that students' use of evaluative criteria or checklists did not always lead to "correct" assessments of sources because criteria were misinterpreted or misapplied (e.g., simply seeking whether the page has an author rather than examining who the author is in relation to the topic). Willingness to apply the criteria to sources they themselves find may also be lacking, and educators know that "cognitive skills cannot develop without the simultaneous development of affective skills" (Nahl 2001). Nevertheless, it seems as if broad concerns that students are unaware of Web-based misinformation or of criteria for evaluation of Web-based information may be misplaced—and overstated (Bodi 2002; Harley, Dreger, and Knobloch 2001; Herring 2001; Jones and Barajas 2004; Kunkel, Weaver, and Cook 1996; Lorenzen 2001; Pask and Snow 1995; Seamans 2002; Stepp 2002; Thompson 2003; Valentine 2001; Weiler 2001). Perhaps librarians' attention should concentrate more upon students' abilities and dispositions to apply these criteria.

Learning from library instruction

Students' learning from library instruction in both fall and spring was less than many librarians had hoped. In aggregate, students did make significant gains in their knowledge of the contents of the library catalog and of the unavailability of all periodical articles in full-text form. Still, even after library instruction and significant improvements in students' post-test scores, less than 50 percent of students realized that periodical articles could not be found in the library catalog. Students also largely failed to increase their knowledge of the relationship between the contents of article databases and print periodicals and of the fact that no one database contains all articles. One of the more distressing areas of student "learning" emerged from their responses to the constructed-response question concerning the differences between books and articles. The largest change here was in the number of students who noted that articles tend to have more current information than books. The number of students giving this response increased by 21 percent in fall and 11.1 percent in spring. These increases would be heartening were it not for the fact that students seem not to have received quite the message that librarians intended. On the post-tests, students invariably mentioned that books were "old" and "out of date," which was a gross simplification of librarians' explanation of the timeframes involved in producing various sources of information and could well lead to students' further devaluing of (print) books in comparison to (electronic) articles. The fact that students persisted in thinking there were fundamental differences in credibility and authorship was also distressing, as librarians ***never*** mentioned these considerations in instruction sessions.

When it came to searching strategies, students did lessen their faith in the magic ability of just the "right" keywords to narrow a search. They also made heartening gains in knowledge of using phrase searching and of following subject headings within the database. Overall, though, librarians' discussion of additional "advanced" search techniques seems to have produced few changes in the search techniques students described. Students knew some search techniques when they came to the class, and they generally left knowing the same ones. The same pattern is largely true of students' knowledge of differences between library and Web resources. Disappointingly, students persisted in certain mistaken beliefs even after library instruction—which certainly did ***not*** present library resources as copyrighted and Web resources as not, or library resources as easier to quote and cite than Web resources. Worse still, students were actually less likely to mention that library resources lead to improved student products and that library resources

have more information than Web resources after library instruction than they were before it.

Several phenomena, largely unexplored in relation to the library literature, help to account for this. Foremost among these is the relation of "prior knowledge, prior learning, and conceptions of the domain to be learned … in constructing new knowledge" (Halttunen 2003, 309). Specifically, students have difficulties learning new materials that do not confirm their prior "knowledge." Geisler (1994) provides an overview of numerous studies by education researchers which found that the only information students acquired from instruction was that which matched, or did not contradict, their prior "knowledge." Even instruction altered to contain explicit refutations of students' misconceptions did little to reduce them. These findings seem related to the finding in this study that many students persisted in mistaken beliefs about the scope and use of library catalogs and databases even after library instruction. The Production Paradox may also have been in operation and help to explain students' generally low level of learning. The Production Paradox consists of "users often not being willing to learn basics, if this learning process seems to hold them up in reaching their primary goal" (Pandia 2002). It is likely to play a heavy role in so-called "point-of-need" library instruction, where the very pressure of need could mitigate students' learning of skills that (could) help to meet the need. That is, students may have relied upon (limited) prior knowledge in conducting their research because taking time to learn and employ new knowledge might have interfered with gathering sources to complete their ENGL 111 research assignments.

Of the demographic factors examined in relation to students' learning from library instruction, examination of matched pairs of 287 students' work from 12 of sections of ENGL 111 suggests that only the course instructor's means of introducing the library instruction session to students, students' prior exposure to college libraries, and students' level of comfort with libraries had a statistically significant impact on student learning (Table 6).

Librarians have long believed that the more actively involved faculty are in library instruction, the more students will learn from it (cf. Smith 2002), and this belief seems to gather some support here. Those students whose instructors prepared for their ENGL 111 library instruction sessions by explaining why the class was coming to the library in terms of course objectives and assignments or by having their students do some preparatory work (research, reading, etc.) ***were*** significantly more likely to learn from the sessions than those students who instructors just told them to report to the library at a given date and time. Students who seldom or never used a college library, or who described themselves as very uncomfortable with doing library research, were significantly more likely to have higher learning gains than their classmates who said they used college libraries some or a lot, or who described themselves as feeling comfortable or very comfortable in using library resources. Perhaps those students who rated their prior experience and knowledge negatively were more primed to learn—because they had recognized these deficiencies—than their classmates.

There was a further, intriguing—but not statically testable—relationship between students' research topic for ENGL 111 and improvements in learning. Students with topics not particularly suited to the library's resources (an admittedly subjective criterion) displayed smaller increases between pre- and post-test scores. Topics such as streaking, the sewage system in Vado, NM, careers in architecture, the history of the trombone, etc. did not result in students' experiencing success with the library's resources—and this lack of success may have lead to students' unconsciously dismissing the utility of the other information presented in the library instruction session. One of the little discussed facts of active learning—especially that which relies upon students' hands-on explorations of topics of their own choosing—is that what and how much students learn is largely a factor of their experiences with their topic. Rita Vine has expressed a similar caution, suggesting that learners need to see "an activity or demonstration that clearly proves your point and can't easy be disputed" (Vine 2001, 20) in order for the learning objectives to be realized. It does little good to emphasize the superior quality of library resources on a topic if students than proceed to research topics where their only sources ***are*** found on the Web.

Conclusions

Why students learn—or fail to learn—what they do from library instruction sessions will undoubtedly remain of interest to librarians. Many others will wonder, as Laskowski did, whether students' behaviors as shaped by "lack of training, lack of time, lack of discretion, or

Table 6. Correlation of Demographic Factors with Students' Pre- and Post-test Scores		
Null hypothesis	**Result**	**t-statistic**
No difference in student learning outcomes for English instructors who prepared their classes for the library instruction session and those who did not	Reject	2.31
No difference in student learning outcomes for librarians who were rated as presenting clearly and loudly and those who did not	Do not reject	0.38
No difference in student learning outcomes for librarians who were rated as clearly explaining abstract ideas and concepts and those who did not	Do not reject	0.08
No difference in student learning outcomes for students who had library instruction for other courses at NMSU and those who did not	Do not reject	0.68
No difference in student learning outcomes for students who rated themselves as comfortable with library research and those who did not	Reject	2.59
No difference in student learning outcomes for students who rated themselves as having used college libraries a lot and those who did not	Reject	2.96
No difference in student learning outcomes for students who rated themselves as having used public libraries a lot and those who did not	Do not reject	0.08
No difference in student learning outcomes for students who rated themselves as having used high school libraries a lot and those who did not	Do not reject	0.08
No difference in student learning outcomes for those librarians who were rated as making good use of examples and illustrations and those who did not	Do not reject	0.88
No difference in student learning outcomes for those librarians who were rated as allowing ample time for students' questions and those who did not	Do not reject	0.89
No difference in student learning outcomes for those librarians who were rated as fully answering students' questions and concerns and those who did not	Do not reject	0.89
No difference in student learning outcomes for those librarians who were rated as approachable and enthusiastic and those who were not	Do not reject	0.86
* Significant at one percent level. Tests were all t-tests of sample means.		

for some other reason" (Laskowski 2002, 308). Lack of training, lack of time, and lack of discretion have all received plenty of attention in the library literature, and it is the conclusion of this research project that more attention needs to be paid to what these "other reasons" could be. Students clearly know more than librarians often credit them with knowing, and characterizing their failure to apply this knowledge as "laziness"—or "lack of time" or "lack of discretion"—seems an excessively simplistic theorization of people's information seeking behaviors. Is there some predictability as to which searchers will fail to apply such knowledge? Studies of searching "styles" suggest that there might be. The notion of people having searching "styles," derived from and akin to learning styles, has recently emerged from the information science literature. There is, as yet, no canonical taxonomy of searching "styles." Some categorize searchers as process identifiers, source identifiers, searchers, problem formulators, and assessors (Halttunen 2003); others as passive searchers, selective searchers, and dynamic searchers (Jones and Barajas 2004); others as scan and clickers, two-step scanners, deliberate researchers, and 1,2,3 searchers (Hotchkiss 2003), and yet others as fast searchers, broad scanners, and deep divers (Heinström 2002). The relationship between searching styles and student learning would be a productive area of future research, as would be the relationship between students' prior knowledge—and the sources of this prior knowledge—and learning (cf. Bartsch and Tydlacka 2003). Perhaps, too, it is time to

rethink instruction for first-year students that operates on the premise that lack of knowledge is the ***only*** obstacle between them and improved information-seeking and use behaviors.

References

Asher, J. William. 1976. *Educational research and evaluation methods.* Boston: Little, Brown.

Associated Press. 2004. Searcher habits. Available: http://blog.searchenginewatch.com/blog/041026-594a.

Bao, Xue-Ming. 2002. A comparative study of library surveys of Internet users at Seton Hall University in 1998 and 2001. *College & Research Libraries* 63: 251–59.

Bartsch, Robert A., and Bridgette L. Tydlacka. 2003. Student perceptions (and the reality) of percentage of journal articles found through full-text databases. *Research Strategies* 19: 129–34.

Bates, Marcia J. 2003. *Improving user access to library catalog and portal information*. Available: http://www.loc.gov/catdir/bibcontrol/2.3BatesReport6-03.doc.pdf.

Bodi, Sonia. 2002. How do we bridge the gap between what we teach and what they do? Some thoughts on the place of questions in the process of research. *Journal of academic librarianship* 28: 109–14.

Bos, Nathan. 2000. High school students' critical evaluation of scientific resources on the World Wide Web. *Journal of Science Education and Technology* 9: 161–73.

Burton, Vicki Tolar, and Scott A. Chadwick. 2000. Investigating the practices of student researchers: Patterns of use and criteria for use of Internet and library sources. *Computers and Composition* 17: 309–28.

Carter, Elizabeth. 2002. "Doing the best you can with what you have": Lessons learned from outcomes assessment. *Journal of Academic Librarianship* 28: 36–41.

Cockrell Barbara J., and Elaine Anderson Jayne. 2002. How do I find an article? Insights from a Web usability study. *Journal of Academic Librarianship* 28: 122–32.

Debrowski, Shelda. 2001. Wrong way, go back!: An exploration of novice search behaviours while conducting an information search. *Electronic Library* 19: 371–82.

Dyckman, Lise M. 1995. Beyond 'first you push this button, then …': A process-oriented approach to teaching searching skills. *Reference Librarian* no. 51/52: 249–65.

Fenske, Rachel F. 1998. Computer literacy and the library: A new connection. *Reference Services Review* 26: 67–78.

Geisler, Cheryl. 1994. *Academic literacy and the nature of expertise: Reading, writing, and knowing in academic philosophy*. Hillsdale, N.J.: Lawrence Erlbaum.

Grimes, Deborah J., and Carl H. Boening. 2001. Worries about the Web: A look at student use of Web resources. *College & Research Libraries* 62: 11–23.

Halttunen, Kai. 2003. Students' conceptions of information retrieval: Implications for the design for learning environments. *Library & Information Science Research* 25: 307–32.

Harley, Bruce, Megan Dreger, and Patricia Knobloch. 2001. The postmodern condition: Students, the Web, and academic library services. *Reference Services Review* 29: 23–32.

Hammond, Elizabeth D. 1999. "Why are you using the library?" Or, the real goals of library research in the academic curriculum. Available: http://www.ala.org/ala/acrlacrleventshammond99.pdf.

Heinström, Jannica. 2002. *Fast surfers, broad scanners and deep divers: Personality and information-seeking behavior.* Åbo: Åbo Akademis Förlag.

Henthorn, Susan. No Date. Hutchins Library bibliographic instruction program evaluation. Available:http://www.berea.edu/library/BIEVAL/Pre-test-Post-test.html.

Herring, Susan Davis. 2001. Faculty acceptance of the World Wide Web for student research. *College & Research Libraries* 62: 251–58.

Hotchkiss, Gord. 2003. *In the mind of the searcher*. Available: http://www.seotoday.com/browse.phph/category/articles/id/11/index.php.

Jones, Steve. 2002. *The Internet goes to college*. Available: http://www.pewinternet.org/PDF/r/71/report_display.asp.

Jones, Barbara, and Mario Barajas. 2004, June 7. *Adult learners' information seeking behaviours using the Web*. Available: http://www.elearningeurope.info.

Kaplowitz, Joan. A pre- and post-test evaluation of the English 3-library instruction program at UCLA. *Research Strategies* 4: 11–17.

Knight, Lorrie A. 2002. The role of assessment in library user education. *Reference Services Review* 30: 15–24.

Kunkel, Lilith R., Susan M. Weaver, and Kim N. Cook. 1996. What do they know?: An assessment of undergraduate library skills. *Journal of Academic Librarianship* 22: 430–34.

Laskowski, Mary S. 2002. The role of technology in research: Perspectives from students and instructors. *portal: Libraries and the Academy* 2: 305–19.

Lawson, Mollie D. 1999. Assessment of a college freshman course in information resources. *Library Review* 48.

Lombardo, Shawn M. and Cynthia E. Miree. 2003. Caught in the Web: The impact of library instruction on business students' perceptions and use of print and online resources. *College & Research Libraries* 64: 6–22.

Lorenzen, Michael. 2001. The land of confusion?: High school students and their use of the World Wide Web for research. *Research Strategies* 18: 151–63.

Macdonald, Brad, and Robert Dunkelberger. 2000. Full-text database dependency: An emerging trend among undergraduate library users? *Research Strategies* 16: 301–7.

Mittermeyer, Diane, and Diane Quiron. 2003. *Information literacy: Study of incoming first-year undergraduates in Quebec*. Available: http://crepuq.qc.ca/documents/bibl/formation/studies_ang.pdf.

Nahl, Diane. 2001. A conceptual framework for explaining information behavior. *Studies in Media & Information Literacy Education* 1, no. 2. Available: http://www.utpjournals.com/jour.ihtml?lp=simile/issue2/nahl-fulltext.html.

Nowicki, Stacy. 2003. Student vs. search engine: Undergraduates rank results for relevance. *portal: Libraries and the Academy* 3: 503–15.

OCLC. 2002. How academic librarians can influence college students' web-based information choices. Available: http://www2.oclc.org/oclc/pdf/printondemain/informationhabits.pdf.

Pandia Search Engine News. 2004, June 16. *The web search behavior of adult learners*. Available: http://www.pandia.com/sw-2004/24-socrates.html.

Pask, Judith M. and Carl E. Snow. 1995. Undergraduate instruction and the Internet. *Library Trends* 44: 306–18.

Ren, Wen-Hua. 2000. Library instruction and college student self-efficacy in electronic information searching. *Journal of Academic Librarianship* 26: 323–28.

Roig, Miguel. 1997. Can undergraduate students determine whether text has been plagiarized? *Psychological Record* 47: 113–22.

Rubens, Donna. 1991. Formulation rules for posing good subject questions: Empowerment for the end-user. *Library Trends* 39: 271–98.

Samson, Sue and Kim Granath. 2004. Reading, writing, and research: Added value to university first-year experience programs. *Reference Services Review* 32: 149–56.

Scholz-Crane, Ann. 1998. Evaluating the future: A preliminary student of the process of how undergraduate students evaluate Web sources. *Reference Sources Review* 26: 53–60.

Seamans, Nancy H. 2002. Student perceptions of information literacy: Insights for librarians. *Reference Services Review* 30: 112–23.

Seiden, Peggy, Kris Szymborski, and Barbara Norelli. 1997. *Undergraduate students in the digital library: Information seeking behavior in an heterogeneous environment*. Available: http://www.ala.org/acrl/paperhtm/c26.html.

Smith, Kerry J. 2002. Professor attendance as a factor in perceived library instruction effectiveness: An exploratory study. *Reference Services Review* 30: 43–48.

Smith, Charles, and Chris Phillips. 1999. Are our academic libraries ready for the Internet generation? *Cause/Effect* 22, no. 1. Available: http://www.educause.edu/ir/library/html/cem991a.html.

Spink, Amanda, and Okar Gunar. 2001. E-commerce Web queries: Excite and Ask Jeeves study. *First Monday* 6, no. 7. Available: http://www.firstmonday.org/issues/issue6_7/spink.

Stepp, Laura Sessions. 2002, July 16. Point. Click. Think? As students rely on the Internet for research, teachers try to warn of the Web's snares. *The Washington Post.* Available: http://www.washingtonpost.com/ac2/wp-dyn?pagename=article&mode=contentID=A9729-Jul15&notFound=true.

Sutcliffe, A.G., M. Ennis, and S.J. Watkinson. 2000. Empirical studies of end-user information searching. *Journal of the American Society for Information Science* 51: 1211–31.

Tenopir, Carol et al. 2003. *Use of electronic science journals in the undergraduate curriculum: An observational study*. Available: http://web.utk.edu/~tenopir/nsf/presentations.html.

Thaxton, Lynn, Mary Beth Faccioli, and Anne Page Mosby. 2004. Leveraging collaboration for information literacy in psychology. *Reference Services Review* 32: 185–89.

Thompson, Christen. 2003. Information illiterate or lazy: How college students use the Web for research. *portal: Libraries and the Academy* 3: 259–68.

Tiefel, Virginia. 1989. Evaluating a library user education program: A decade of experience. *College and Research Libraries* 50: 249–59.

Valentine Barbara. 2001. The legitimate effort in research papers: Student commitment versus faculty expectations. *Journal of Academic Librarianship* 27: 107–15.

Vidmar, Dale J. 1998. Affective change: Integrating pre-sessions in the students' classroom prior to library instruction. *Reference Services Review* 26.: 75–95.

Vine, Rita. 2001. Real people don't do Boolean: How to teach end users to find high-quality information on the Internet. *Information Outlook* 5.: 15–23.

Ware, Susan A., and Deena J. Morganti. 1986. A compentency-based approach to assessing workbookeffectiveness. *Research Strategies* 4.: 4–10.

Weiler, Angela. 2001. Two-year college freshmen and the Internet: Do they really "know all that stuff"? *portal: Libraries and the Academy* 1: 161–67.

Williamson, Andrew P. 2000. BUBL Link / 5:15: Smarter than the average search engine. *The Serials Librarian* 37: 37–50.

Young, Nancy J., and Marilyn Von Seggern. 2001. General information seeking in changing times: A focus group study. *Reference & User Services Quarterly* 41: 159–68.