Scholarly Use of Internet-Based Electronic Resources: A Survey Report

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ABSTRACT

THE PURPOSE OF THIS STUDY IS TO CONSTRUCT a baseline of scholarly use of Internet-based electronic resources (e-sources) by surveying a group of library and information science (LIS) scholars. Results reported here include researchers' demographic information, frequency of use of various Internet tools and resources, ways of accessing various Internet tools and applications, strategies of locating e-sources for research, opinions on citing e-sources, evaluation of e-sources, and suggestions for improving scholars' use of e-sources for research.

INTRODUCTION

Internet-based e-sources are increasingly used for scholarly purposes. However, the details regarding scholars' use of these sources are still unclear as are the problems and concerns scholars have when they use e-sources for research. This survey, part of a larger project on scholarly use of Internet-based e-sources, aims to establish a baseline of the use as reported by a group of library and information science researchers. Moreover, this survey investigates how to improve scholarly use of Internet-based e-sources from researchers' perspectives.

SURVEY DESIGN AND ADMINISTRATION

Samples

This survey focuses on the field of library and information science. In a preliminary study, the ten most highly cited print journals (p-journals)

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in LIS, as well as four refereed LIS electronic journals[1] (e-journals), were examined for e-source citing.[2] The journal sample for this study listed below includes the four e-journals and the four p-journals with the greatest number of e-citations from the preliminary study:

Print journals
College & Research Libraries
Journal of Academic Librarianship
Journal of the American Society for Information Science
Library Trends
Electronic journals
EJournal (http://www.hanover.edu/philos/ejournal/)
LIBRES: Library and Information Science Research Electronic Journal (http://aztec.lib.utk.edu/libres/)
MC Journal: The Journal of Academic Media Librarianship (http://wings.buffalo.edu/publications/mcjrnl/)
Public Access Computer Systems Review (http://info.lib.uh.edu/pacsrev.html)

This study's author survey sample includes all authors who had in-press papers as of July 1, 1997 in these eight journals. Requests for bibliographical information about the in-press papers were sent to the editors of the eight journals. Authors of these papers were contacted for the reference lists if the editors had not already provided such information. When the survey started in late February 1998, 203 authors whose contact information (either postal or e-mail address) was known were included in this study. During the survey, it was found that two authors were not reachable due to affiliation change, which reduced the sample size to 201.

The distribution of the author sample by journal format and presence/absence of e-citations in the papers is summarized in Table 1. Overall, 7 percent of the authors were to publish their papers in the e-journals, while 93 percent of them were to publish in the p-journals. The group of e-journal authors was much smaller than the p-journal author group because, at this stage, the publication frequency and journal size of the e-journals were much smaller than those of most p-journals. Also, in the sample, nearly one-third (32.3 percent) of the authors cited e-sources in their papers while about two-thirds (67.7 percent) did not.

Survey Instrument and Procedures

A survey questionnaire was designed to collect researchers' demographic information, frequency of use of various Internet tools and protocols, ways of accessing various Internet tools and applications, strategies of locating e-sources for research, opinions on citing such sources, evaluation of Internet-based sources for research, and suggestions for improving their use of e-sources for research.

TABLE 1.
AUTHOR SAMPLE BY JOURNAL FORMAT AND PRESENCE/ABSENCE OF E-CITATIONS FOR IN-PRESS PAPERS

	Frequency	*Percentage*
e-journal paper author	14	7.0
p-journal paper author	187	93.0
Total	201	100.0
with e-citation	65	32.3
without e-citation	136	67.7
Total	201	100.0

A Web survey application was developed for this project in order to:

- generate personalized cover letters and questionnaires with hyperlinked e-citations where possible,
- collect survey data via the Web, and
- serve as a data entry interface for survey data received via U. S. mail or fax.

On February 20 and 21, 1998, an initial personalized invitation to participate in the survey was sent via e-mail to the 197 authors whose e-mail addresses were available. At the same time, print copies of the survey were sent via U. S. mail to the six authors whose e-mail addresses were unavailable. In the following seven weeks, nineteen print copies were sent via U. S. mail or fax to authors who had been originally contacted by e-mail and who subsequently had requested a print copy.

There were three follow-ups: the first was sent to the nonrespondents via e-mail on March 7, 1998; the second was also sent via e-mail on March 30; the third was sent via both e-mail and U. S. mail on April 30 and May 1, 1998.

Response Rate

By June 15, 1998, 125 usable replies were received via the Web and 31 via U. S. mail or fax. Twelve potential respondents declined to participate.[3] Eleven responded to the survey request, but their replies were either not received or were unusable.[4] In total, 179 researchers responded to the survey request; 156 completed replies were usable. With 201 potential respondents in total, the overall response rate was 89.1 percent (179/201), and the usable reply rate was 77.6 percent (156/201).

SURVEY RESULTS

Characteristics of Respondents (Questions 9, 10 and 11 from the Survey)

Of those responding, 54 percent indicated that they were male and 46 percent female. Six percent of respondents were under age 30 and 6

percent were over 60, 24.7 percent were 30 to 39, 34.7 percent were 40 to 49, and the remaining 28.7 percent were 50 to 59 (Figure 1). The average age of respondents was 45.4 years old. Within this particular sample, the overwhelming majority (94.2 percent) of respondents were p-journal paper authors, while only 5.8 percent of them were e-journal paper authors (Table 2). Overall, 29 percent of respondents cited e-sources in their papers in the sample, while 71 percent did not (Table 2), even though they might have cited e-sources elsewhere. Respondents' research interests ranged widely and covered almost every aspect of the LIS area.

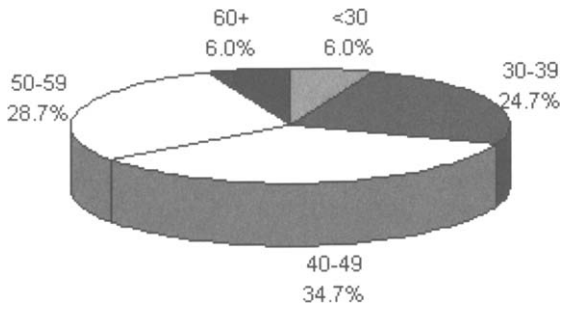

Figure 1. Percentages of Respondents in the Various Age Groups (N=150).

TABLE 2.
RESPONDENTS BY JOURNAL FORMAT AND PRESENCE/ABSENCE OF E-CITATIONS IN THE PAPERS

	Frequency	*Percentage*
e-journal paper author	9	5.8
p-journal paper author	147	94.2
Total	156	100.0
with e-citation	45	29.0
without e-citation	111	71.0
Total	156	100.0

Using and Citing E-Sources for the Papers in the Sample (Question 1 from the Survey)

Respondents were asked to recall if they had used but not cited e-sources for their research papers in the sample. Approximately half (50.3 percent) of respondents answered "No," 12.3 percent answered "Cannot recall," while 37.4 percent of respondents answered "Yes" (Table 3). Respondents who had used some e-sources but did not cite them were then asked to explain why those e-sources were not cited. Nearly 7 percent of these respondents indicated that they would have cited e-sources if these e-sources had been in print format; 34.5 percent reported that they would not have cited them anyway; and 10.3 percent could not recall the details (Table 3). A majority (72.4 percent) of respondents gave specific reasons as to why they did not cite e-sources. These reasons can be grouped into the following two categories.

Not Citing Because of E-Source Format. Some respondents indicated that they did not cite e-sources because (1) e-sources have some limitations such as limited availability, or (2) they preferred to cite the print equivalents:

"Not too citable but if in print higher probability of being cited."

"It was also available in print."

"The e-sources in question simply disappeared. Old addresses [that were] used to consult these e-sources no longer worked when the time came to verify bibliographic citations for publication (2 years later)."

"We did not know how to cite them."

"These were background sources—browsing sources; I found print information to cite. Too many URLs disappear too quickly. If possible I will cite print."

Not Citing for Reasons Applicable to Both E-Sources and Print Sources. Many respondents indicated that they did not cite e-sources because of content rather than format. Relevance to research was one of the key elements for the citing decisions. Some of the comments illustrate how the researchers used e-sources. For example, e-sources were used to obtain some background information or as a tool during the research process.

> "They gave me only general ideas and confirmed some conversations that I recall having with colleagues concerning the topic."
>
> "In the end, they were not as pertinent to the article."
>
> "Because they were less relevant—their format was not the issue, their content was."

Technological Background (Questions 2 and 3)

Respondents were asked how many years they had been using the Internet (including e-mail). Roughly half (46.1 percent) indicated that they had five to nine years of Internet experience, while 27.3 percent

TABLE 3.
USING AND CITING E-SOURCES IN THE PAPERS: RESPONSES TO QUESTION 1

	Frequency	*Percentage*
Q1a: "Did you use any e-sources during the research that were not cited in this paper?" (N=155)		
Yes	58	37.4
No	78	50.3
Cannot recall	19	12.3
Q1b: "For what reasons were the sources not cited?" (N=58, more than one reason may be given)		
I would have cited them if they were in print format	4	6.9
I would not have cited them even if they were in print format	20	34.5
Cannot recall	6	10.3
Other	42	72.4

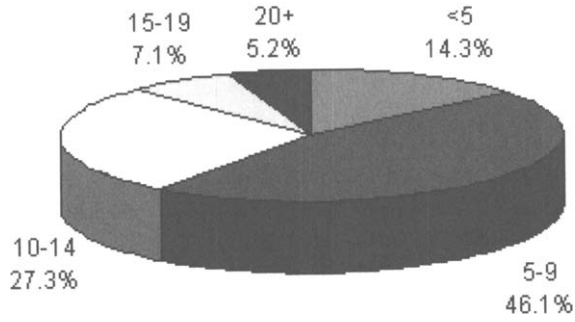

Figure 2. Percentages of Years of Experience Using the Internet (N=154).

indicated that they had ten to fourteen years of experience (Figure 2). These two groups comprised 73.4 percent of the total respondents. Of the remaining respondents, 14.3 percent indicated that they had less than five years of Internet experience, while 12.3 percent indicated that they had over fifteen years. On average, respondents' Internet experience was 8.9 years.

Respondents were also asked to rate their overall ability to use the Internet on a five-point scale from 1 (beginner) to 5 (expert). Nearly half (47.4 percent) of respondents rated themselves as "above average," one-fifth (20.5 percent) as "average," nearly 30 percent as "expert," and 4.4 percent as "below average"; no respondents rated themselves as "beginner" (Figure 3)—i.e., 95.6 percent of respondents rated themselves as having at least average ability to use the Internet while only 4.4 percent rated themselves as "below average." On the whole, respondents' self-perceived ability to use the Internet was quite high. One possible explanation is that, because of the nature of this survey, most participants were those researchers who used the Internet for research purposes.

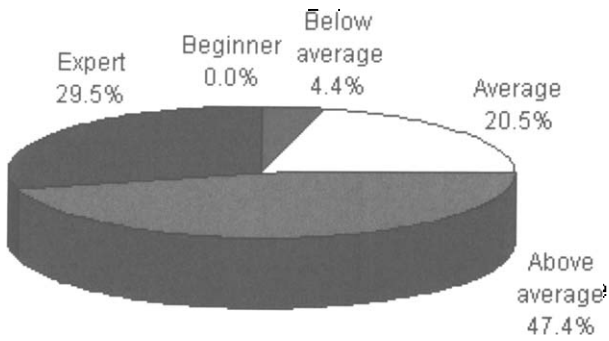

Figure 3. Percentages Indicating Overall Ability to Use the Internet (N=156).

Frequency of Internet Use (Question 4)

Respondents were asked to indicate the frequency with which they used various Internet tools and resources, including e-mail, mailing lists, newsgroups, ftp, gopher, telnet, Web browsers, online databases, and Internet search engines. The frequency of use was measured on a six-point scale:

0 = no use
1 = less often than or nearly once a month
2 = two or three times a month
3 = about once a week
4 = two or three times a week
5 = almost every day

The data are summarized in Table 4. E-mail was the most frequently used tool. All respondents indicated that they used e-mail at least once a week, while 93.6 percent used it almost every day. Web browsers were the second most frequently used Internet tools. Nearly 95 percent of respondents used Web browsers at least once a week; among them, 75 percent used Web browsers on an almost daily basis. Next to e-mail and Web browsers, mailing lists and Internet search engines were the third and fourth most frequently used Internet tools. Nearly 74 percent of respondents indicated that they used mailing lists at least two or three times a week, while 68.2 percent used Internet search engines at least two or three times a week. The fifth and sixth most frequently used Internet tools and resources were telnet and online databases. Over half of the respondents used telnet and online databases at least two or three times a week. As to newsgroups, about one-third of the respondents used newsgroups at least once a week. However, more than half of the respondents reported that they used newsgroups no more than once a month; in fact, nearly 30 percent did not use newsgroups at all. The second least frequently used tool was ftp. Only a quarter of the respondents indicated that they used ftp at least two or three times a week, 30 percent used it less often than or nearly once a month, while 13.5 percent did not use ftp at all. Gopher was the least used tool reported. The majority (81.4 percent) of respondents used it no more than once a month; nearly half (48.1 percent) of them did not use it at all.

Access to Internet-Based E-Sources (Question 5)

Respondents were asked how they gained access to the Internet tools and resources (including e-mail, mailing lists, newsgroups, ftp, gopher, telnet, Web browsers, and online databases) and e-sources in special formats (including audio, video, SGML, pdf, Postscript, and compressed files). The access consisted of the following categories (with possible overlap):

0 = no experience
1 = at work (access from workplace)
2 = at home (access from home)
3 = at public site in library (access from public site in library)
4 = no access
other = access from other places, specify

The access data are summarized in Table 5. Overall, the majority of respondents had access to the major Internet tools and resources. More than 80 percent of respondents had access to e-mail (94.2 percent), the Web (92.3 percent), mailing lists (90.4 percent), telnet (83.3 percent), online databases (82.7 percent), and ftp (80.1 percent) from their workplace. The access rate to newsgroups and gopher from work was 69.9 percent and 64.1 percent, respectively. Generally, the access rate to these e-sources from home was nearly 20 percent to 30 percent lower than the

TABLE 4.
USE FREQUENCY OF INTERNET TOOLS AND RESOURCES: RESPONSES TO QUESTION 4

N=156	*E-mail*	*Web Browsers*	*Mailing Lists*	*Internet Search Engines*	*Telnet*	*Online Databases*	*Newsgroups*	*Ftp*	*Gopher*
no use	0.0%	0.0%	1.9%	0.6%	9.0%	7.7%	29.5%	13.5%	48.1%
less often than or nearly once a month	0.0%	3.2%	8.3%	3.8%	16.0%	14.1%	25.0%	29.5%	33.3%
two or three times a month	0.0%	2.6%	3.8%	6.4%	7.1%	12.8%	10.3%	15.4%	7.7%
about once a week	1.3%	5.8%	9.6%	20.5%	14.1%	10.9%	9.6%	14.1%	1.9%
two or three times a week	5.1%	12.8%	19.2%	28.2%	16.0%	21.8%	9.6%	18.6%	1.3%
almost every day	93.6%	75.0%	54.5%	39.7%	34.6%	31.4%	12.8%	6.4%	0.6%
not answered	0.0%	0.6%	2.6%	0.6%	3.2%	1.3%	3.2%	2.6%	7.1%

Note: The Internet tools and resources are listed in descending order of the values in the category "almost every day."

TABLE 5.
ACCESS TO THE INTERNET TOOLS AND RESOURCES: RESPONSES TO QUESTION 5

N=156	*No Experience*	*At Work*	*At Home*	*At Public Site in Library*	*Other*	*No Access*
Internet Tools and Resources						
E-mail	0.0%	94.2%	73.7%	3.2%	2.6%	0.0%
Web browsers	0.6%	92.3%	67.3%	7.1%	0.0%	0.0%
Mailing lists	1.9%	90.4%	56.4%	2.6%	0.6%	0.0%
Telnet	6.4%	83.3%	57.1%	5.8%	1.3%	0.0%
Online databases	9.0%	82.7%	46.2%	11.5%	0.0%	0.6%
Ftp	9.0%	80.1%	46.2%	1.3%	0.0%	0.0%
Newsgroups	16.7%	69.9%	37.2%	0.6%	0.6%	1.9%
Gopher	21.2%	64.1%	29.5%	0.0%	0.0%	1.3%
File Formats						
Compressed files	14.7%	75.6%	37.8%	1.3%	0.6%	0.6%
Pdf files	14.1%	73.1%	43.6%	2.6%	0.0%	1.3%
Postscript files	24.4%	65.4%	26.3%	1.3%	0.0%	1.3%
SGML files	32.7%	53.2%	29.5%	1.9%	0.0%	2.6%
Video files	29.5%	51.3%	32.7%	1.3%	0.6%	2.6%
Audio files	32.1%	48.7%	34.0%	1.3%	0.6%	3.2%

Note: The data are listed in descending order of the access rate of the category "at work." All percentages were calculated by dividing the number of responses by the number of usable replies (N=156).

access rate from work. Libraries seldom served as places for researchers to gain access to Internet resources.

E-sources in special formats, such as compressed, pdf, Postscript, video, and audio files may require additional hardware/software to actually retrieve the contents. Respondents were therefore asked to indicate where they could get access to files in these special formats. Overall, the access rate from work to files in these special formats was generally lower than was that to Internet tools and resources, ranging from 48.7 percent (audio files) to 75.6 percent (compressed files) but, on the other hand, it was about 20 to 30 percent higher than was the access rate from home. The percentages of respondents indicating that they had "no experience" with these file formats were 14.1 percent for pdf files, 14.7 percent for compressed files, 24.4 percent for Postscript files, 29.5 percent for video files, 32.1 percent for audio files, and 32.7 percent for SGML files. It is unclear whether or not this portion of respondents could actually retrieve the contents of e-sources in the special formats listed but simply had not used this capability.

It seemed that the workplace was the primary access site to various Internet tools, resources, and e- sources in special formats; the home was the second major access point. Libraries did not serve as major access places. Some indicated that they gained access to e-sources in special formats, such as audio/video files, "by special arrangement." Others indicated that they tried to get access to e-sources when traveling.

Strategies to Locate E-Sources for Research (Question 6)

Respondents were asked to indicate their strategies to locate e-sources for research and to rank the strategies in order of frequency of use (1 = most frequently used). The strategies are listed in Table 6 in descending order of the number of responses. Overall, respondents used all of the strategies listed in this question. At least 84 percent chose "follow up references in printed sources," "use Internet search engines," "by personal communications," and "follow up references in e-sources," while 76.9 percent to 59 percent selected "subscribe to mailing lists or newsgroups," "attend seminars or conferences," and "browse some sites regularly."

However, respondents used these strategies quite differently. Variations were reflected not only in their selection but also in their ranking of the strategies (Table 7). In fact, all the strategies were given a rank from most frequently used (rank = 1) to least frequently used (rank = 7). To compare the uses of these strategies, a rank of each strategy was calculated by weighting the ranks with the number of responses received under each rank. Table 8 summarizes the weighted rank of each strategy, which indicates an overall place of each in terms of how frequently it was used.

Overall, "use Internet search engines" was ranked as most frequently used by respondents. It is not a surprise that when respondents were

TABLE 6.
STRATEGIES TO LOCATE E-SOURCES FOR RESEARCH: RESPONSES TO QUESTION 6 (N=156)

Strategy	*Number of Responses*	*Percentages*
Follow up references in printed sources	142	91.0
Use Internet search engines (e.g., Yahoo, Alta Vista, etc.)	138	88.5
By personal communications	138	88.5
Follow up references in e-sources	132	84.6
Subscribe to mailing lists or newsgroups	120	76.9
Attend seminars or conferences	114	73.1
Browse some sites regularly	92	59.0

Note: The strategies are listed in descending order of number of responses.

TABLE 7.
RANKING FOR USE FREQUENCY OF STRATEGIES: RESPONSES TO QUESTION 6 (1 = most frequently used)

Rank →	1	2	3	4	5	6	7
Follow up references in printed sources	24	30	20	15	18	19	9
Use Internet search engines	44	24	14	22	16	8	4
By personal communications	32	23	22	23	21	4	6
Follow up references in e-sources	22	28	30	24	13	6	2
Subscribe to mailing lists or newsgroups	24	14	20	13	12	18	12
Attend seminars or conferences	11	8	17	18	7	23	21
Browse some sites regularly	5	14	16	12	19	12	9

Note: The same rank was allowed for multiple strategies. Only a few respondents reported more than 7 strategies, and responses under rank 7 were mostly blank. Thus only those ranks up to 7 were selected.

TABLE 8.
OVERALL RANK FOR USE FREQUENCY OF STRATEGIES: RESPONSES TO QUESTION 6

Strategy	*Weighted Rank*	*Overall Rank*
Use Internet search engines	2.86	1
Follow up references in e-sources	3.03	2
By personal communications	3.11	3
Follow up references in printed sources	3.49	4
Subscribe to mailing lists or newsgroups	3.68	5
Browse some sites regularly	4.13	6
Attend seminars or conferences	4.48	7

asked for suggestions for improving their use of e-sources for research, many of them called for better search engines and ways of efficiently locating e-sources (see the section for Question 12 and Comments). It is noted that "follow up references in e-sources" was not as widely used as "follow up references in printed sources" by respondents (Table 6), but it was ranked more frequently used than "follow up references in printed sources" by respondents who did use it (Table 8). On the other hand, "follow up references in printed sources" was reported as the most widely used (Table 6); however, it was only ranked as the fourth most frequently used by respondents (Table 8). These results suggest that references cited in print sources were considered as an important source to locate relevant e-sources, but respondents relied more heavily on some readily available e-sources (e.g., search engines) to find information for their research.

Many respondents indicated that they used other strategies, such as background knowledge, to locate e-sources for research. Some indicated that they just knew where to find the e-sources. For example, a number of sites available from the university library were mentioned as very useful. Similarly, given an incomplete citation of an e-source like "such and such an organization has published *x* document on the Web," it was really up to the researcher to track the source down. Some mentioned that they asked for help from reference librarians or students in their classes. Some indicated that they searched online databases to locate e-sources or used journals or other readings to track specific sources.

Citing E-Sources (Question 7)

Did scholars use the same rules in their citing decisions for e-sources as they did for print sources? Which additional factors might they consider when citing e-sources? Question 1 of this survey asked respondents to recall their citing decisions related to their papers in the sample (results are reported in the section for Question 1). Question 7 asked, in general: (1) if some factors that are related to e-sources particularly would be a consideration in citing decisions, and (2) if a factor was a consideration, how it would affect the citing decisions. Table 9 lists the results.

TABLE 9.
FACTORS IN CITING E-SOURCES: RESPONSES TO QUESTION 7

Factors	*A Consideration*	*Effect*		*Number of responses* (N)
		Tend to Cite	*Tend Not to Cite*	
(f) They have current information.	82.6%	81.9%	0.7%	149
(g) They have hyperlinks to related information.	59.7%	57.0%	2.7%	149
(j) It is convenient for readers to locate the sources.	56.5%	50.3%	6.1%	147
(d) They may not be available later.	53.0%	9.4%	43.6%	149
(l) This is an article for an electronic journal.	43.2%	39.9%	3.4%	148
(i) It may be difficult for readers to locate the sources.	40.0%	8.7%	31.3%	150
(k) This is an article for a paper journal.	35.8%	25.2%	10.6%	151
(c) They are less prestigious than traditional print sources.	35.4%	6.1%	29.3%	147
(b) They are not a "real" publication.	28.6%	7.5%	21.1%	147
(a) There must be print versions also available.	28.1%	21.2%	6.8%	146
(h) It is not clear how to cite e-sources.	22.3%	7.4%	14.9%	148
(e) They are visually attractive.	10.1%	9.5%	0.7%	148

Note: Factors are listed in descending order of the percentage of responses to "a consideration," that is, 1- % of responses to "not a consideration" in the survey.

Respondents considered these factors in a variety of ways. Over half indicated that they considered the following factors when citing e-sources: (1) "They have current information" (82.6 percent); (2) "They have hyperlinks to related information" (59.7 percent); (3) "It is convenient for readers to locate the sources" (56.5 percent); and (4) "They may not be available later" (53 percent). Over 40 percent indicated that the following two factors about e-sources also seemed to affect decisions on citing e-sources: "This is an article for an electronic journal" (43.2 percent) and "It may be difficult for readers to locate the sources" (40 percent). Respondents indicated that they seldom considered the factor "They [e-sources] are visually attractive" (10.1 percent).

Respondents also indicated how certain factors affected their citing decisions. Their responses show that they tended to cite e-sources because:

"They have current information," "They have hyperlinks to related information," "It is convenient for readers to locate the sources," and "This is an article for an electronic journal." However, they revealed that they tended not to cite e-sources due to poor availability: "They [e-sources] may not be available later," and "It may be difficult for readers to locate."

In addition to the factors listed in the questionnaire, some respondents added other factors. Some of these factors are particularly related to e-source format such as:

if the e-sources "contain material harder to do in print (color, multimedia)"
if the e-sources "provide improved navigation"
if the e-sources may "not be available in any other format or elsewhere"
if there is a "time lag in getting printed source"
if the e-sources are about "rules, regulations, specifications, governmental current information"
if both "journal and topic are e-source related (audience likely to expect very current, electronically savvy, info)."

On the other hand, some factors that were not related to e-source format were also mentioned. Relevance of content was a major concern, for example: "Does it contain information I want to cite?" "Is it about the topic?" and "The source influenced my thinking." Other non-e-source format factors include:

if the e-sources are "by an authority in the field"
if the "reputation of webmaster of site" is good
if the e-sources are "edited," "peer reviewed," or "refereed papers"

Evaluation of E-Sources for Research (Question 8)

Respondents were asked to rate e-sources according to the following features: accessibility, accuracy, authority, availability, consistency, ease of use, flexibility, permanence, timeliness, uniqueness, and usefulness. The evaluation was on a five point scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent. The results are summarized in Tables 10 and 11.

On the whole, respondents gave a relatively high evaluation to the e-sources. However, the rating of each feature of e-sources varied (see Table 10). Overall, "timeliness" was rated as the best feature of e-sources with a rating close to "very good." "Ease of use," "accessibility," "availability," "usefulness," "flexibility," and "uniqueness" were rated better than "good," while "accuracy," "authority," and "consistency" were rated between "fair" and "good." "Permanence" was rated relatively low with a weighted rank near "fair."

TABLE 10.
RATING OF E-SOURCES AS SOURCES FOR RESEARCH: RESPONSES TO QUESTION 8

	Poor	*Fair*	*Good*	*Very Good*	*Excellent*	*Total (N)*
Accessibility	5	25	45	41	35	151
Accuracy	10	55	49	21	9	144
Authority	15	52	49	20	9	145
Availability	7	27	39	42	34	149
Consistency	22	58	47	11	7	145
Ease of use	5	21	48	34	39	147
Flexibility	8	24	49	40	20	141
Permanence	50	61	24	8	3	146
Timeliness	3	12	31	57	44	147
Uniqueness	6	34	48	41	17	146
Usefulness	9	24	45	47	21	146

Table 11.
Overall Rank of E-Sources for Research: Responses to Question 8

	Weighted Rank	*Overall Rank*
Timeliness	3.86	1
Ease of use	3.55	2
Accessibility	3.50	3
Availability	3.46	4
Usefulness	3.32	5
Flexibility	3.28	6
Uniqueness	3.20	7
Accuracy	2.75	8
Authority	2.70	9
Consistency	2.47	10
Permanence	1.99	11

Note:
- The features are listed in descending order according to their weighted ranks.
- The scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

Satisfaction with the Current State of E-Sources for Research (Question 12 and Comments)

Researchers in this study were asked about satisfaction with the current state of Internet-based e-sources for their research (Question 12a), which is a very important variable to investigate user behavior. Less than one-third of the respondents (31.8 percent) indicated that they were satisfied while over two-thirds (68.2 percent) were not satisfied. The latter group of respondents was then asked to give suggestions for improving their use of e-sources for research (Question 12b). Responses to question 12b and comments about scholarly use of e-sources in general are summarized below.

More Research Sources on the Internet. Some researchers suggested putting more research sources on the Internet: "full text print-only journals in online form," "make all journals available on the Web," "start new, lower-priced (free would be best) e-journals," "more refereed e-journals," "more digitized materials, especially books and older resources," "more historically oriented information resources," and "more and easier to use statistical data." Some noted differences in availability of e-sources in research areas in this field:

> "I am actually quite surprised that I have not located more relevant information on my primary research area (impact of Internet-related technologies on the profession) through e-sources."
>
> "Electronic resources related to human resources are primarily commercial and of little use in research; this is also somewhat true of print resources when compared to other disciplines...."
>
> "When I am involved in the history of information science and libraries, it's difficult for me to find electronic resources. On the contrary, when I am looking for [information about] new technologies and [the] Internet—for example, electronic journals and so on—electronic sources are good and easy to find."

Better Stability of E-Sources. The dynamic nature of e-sources makes them hard to locate or relocate. Web pages go up and down frequently. This may make it difficult for researchers to use, cite, and publish e-sources:

> "The most frustrating aspect of using the Internet seems to me the need to verify sources and the inability often to find the same materials since they were changed or taken off the Web."
>
> "I expect my work to be read 5 years from now so people must be able to get to the sources I cite. I cannot be sure that will occur at this stage. The main issue I see is permanence. It's too often the case that a site is located, maybe even bookmarked, and then it's gone in a fairly short time."
>
> "Must continue to be available for future consultation, otherwise my research is compromised."

Some respondents gave specific suggestions for better availability of e-sources—i.e., "more robust addressing (e.g., URNs instead of URLs)," "Some assurances of archiving of information," and "permanence of access to the electronic version of the material." Some suggested that e-sources should be archived in "non obsolescent formats" so that they can be reused for a relatively long time period; another researcher suggested: "We should devise a better method of recording changes and paper publication of some e-sources."

Better Reliability of E-Sources. Reliability was a concern of many respondents, which surfaced in the following ways: (1) who writes the text? (2) is it up-to-date? (3) is it relevant? Sometimes there is not enough information to judge the reliability, authority, accuracy, and validity of e-sources. Many

respondents mentioned that e-sources promote a "lack of trust"—i.e., anyone can put anything on the Web, and there is no reliable quality control involved. Researchers have to judge the reliability of e-sources themselves:

> "I tend to only use e-sources if they are the electronic version of a paper journal. I will also use an e-source if one of the authors has a reputation for solid work. Interestingly enough, that reputation is typically built via traditional journals."
>
> "I use the search engines as a first basis for identifying literary quotes and historical facts, but I then go to print sources to verify the accuracy...."

Better Quality of E-Sources. Quality was another major concern of many researchers. Many suggested that some sort of refereeing process, evaluation, or verification would be helpful to improve the current situation, and many indicated that researchers have the responsibility to contribute more high quality e-sources:

> "When I do locate an e-paper I am always disappointed with the level of scholarship. The titles sound so promising but the articles have little substance."
>
> "In terms of most important—quality of the e-sources—perhaps we need to start including a referee process, although I do like the idea of more "openness" in electronic publishing. More data and more accurate data. There's a lot of trash on the Web!"
>
> "The major factor is the quality of the content. It is generally poor...."
>
> "Improve the quality of the researchers doing the research . . . .We need higher standards."
>
> "The issues of review, editing etc. that are consistent with current forms of publishing should be applied to e-sources."
>
> "Scholars must continue to provide high-quality, authoritative material for the Web."
>
> "There is too little content on the Web compared to the hype it receives. It could be improved if more academics were recognized and encouraged to publish e-journals or other refereed publications, perhaps as the CIC has suggested."

Better Organization of E-Sources for Efficient Retrieval. Many researchers called for improved ease of use through a better organization of e-sources. Given the current state of e-sources, it is hard for researchers to find the way to locate them:

> "While there are probably more e-sources than I am aware of for cataloging research, I find that Internet-based sources tend to be difficult to locate unless you have a specific address. The state of indexing and search engines on the Internet tends to make it hard to find things, since you often get a lot of false and duplicate hits. If this were improved, I would probably be more likely to use e-sources."

> "E-sources are often the most current up-to-date research and case study information available, especially on cutting edge topics. However, the proliferation of e-resources as well as conference proceedings makes it difficult to know what's out there. I'm sure I am missing a lot of relevant information for my research."
>
> "Access—I have the feeling that I perhaps am not finding appropriate e-sources because I do not know the best places to look. . . ."
>
> "Searching is still a pain if you don't know the right words to use. Of course, this is a problem that has root in indexing."

Respondents suggested the following possible ways to improve the situation:

- To differentiate scholarly sources from commercial ones. Currently, search engines cannot do this, so it is hard for users to narrow a search to identify scholarly research work. Some respondents suggested how to make this work:

  > "An accreditation program for sites that would help winnow the chaff (particularly to mark sites that are academic, associated with university and research organizations and that have been peer-evaluated and are continually updated and reviewed)...."

- To provide better indexing of e-sources. Comments included "more self description of name of site," "more uniformity among the sites," "E-sources might also want to include some definite keywords on content and subject matter to help search engines retrieve pertinent material."
- To provide a better structure of e-sources for efficient use. Many researchers mentioned that a "central repository" or at least a central access place would be very helpful for better use of e-sources.

  > "Would be nice to have one on-line library to access a variety of e-sources...."
  >
  > "Specialized, research 'databases' on WWW c.f. DIALOG"

More Standards. We need more and better standards that make e-sources more usable. In this survey, respondents mentioned the following standards:

- standardization of content and format, perhaps tending toward some standardization of layout and format on Web sites;
- standardization of bibliographic access and descriptive information; and
- standardization of citing e-sources and more consistent forms of citation.

Social Norms. Many respondents also mentioned the lack of agreed social norms on using, accepting, citing, publishing, and archiving e-sources as well as on recognition of the significance of e-sources in educational administration:

> "I had no reservations in citing high quality e-sources in my research. I had many more reservations about PUBLISHING in an e-source, and in fact we very consciously choose NOT to publish in an e-source. We believed that our article would be taken less seriously, and would have far less visibility if published in a source that had no paper equivalent, particularly since the e-sources are often not indexed as well as the p-sources [print sources]...."
>
> "1. Acceptance as criteria for promotion and tenure. 2. I would like to see e-sources be the equivalent to established paper resources in terms of prestige. This of course means that they should be subjected to the same rigor (i.e., review processes) as current print journals."
>
> "Although I will look at the source and judge it, I cannot be sure that reviewers for the journals to which I submit my articles will accept online sources as valid...."
>
> "Some sort of official permanent archive/registry/depository arrangement is needed for student-authored e-sources; some are very valuable, indeed, but when students graduate, their academic institutions often terminate the hosting of those documents. Universities need to develop more permanent electronic repositories for student work (same thing is needed for employee/faculty work, too). This stupidity is the equivalent of a university burning its students' masters' and doctoral theses simply because they have graduated and are no longer affiliated with the campus, so why should their work take up valuable space in the library? If that is unimaginable for print work, why is it routine for electronic work?"

Other. Other possible ways to improve using e-sources included better interfaces; awareness services to make new e-sources known to researchers; better solutions for security, copyright, and plagiarism issues; and inexpensive training sources for using new technologies.

CONCLUSION

This article reports results from a survey of a group of library and information science researchers on their use of Internet-based e-sources. E-sources have been extensively used as part of the research process. However, at this stage, there are a number of obstacles to using e-sources for research. The major problems and concerns identified include organization, quality, reliability, and stability of e-sources; access to e-sources in special formats; standards on regulating e-sources for research purposes; and social norms regarding using, accepting, citing, publishing, archiving, and evaluating e-sources. Results also suggest that some factors that are related to e-sources particularly are involved in citing decisions.

Results from this study may not be generalizable to other areas. Nevertheless, the suggestions for improving scholarly use of e-sources from the respondents, who are information professionals with backgrounds in information collection, organization, dissemination, and preservation, are

very valuable in general for developing electronic scholarship and for providing input for decision makers in planning systematic approaches to promote scholarly use of e-sources.

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NOTES

[1] These e-journals are purely electronic and not electronic spin-offs of print publications.

[2] The details of the preliminary study are reported in Zhang, Y. (1998). The impact of Internet-based electronic resources on formal scholarly communication in the area of library and information science: A citation analysis. *Journal of Information Science, 24*(4), 241-254.

[3] The reasons included "too busy," "not an e-source user," "not the senior author" for the co-authored papers, and so on.

[4] One completed reply from a non-Internet user was unusable since most survey questions did not apply to the respondent and were left blank. Other respondents had indicated that they would like to participate, but they did not submit their replies.

APPENDIX
QUESTIONNAIRE USED IN THE SURVEY

Case ID	1234567890v
Type	with e-citation

Study of Scholarly Use of Internet-Based Electronic Resources (e-sources)

Definition of e-sources in this study:

In this stucy, Internet-based electronic resources (e-sources) refer to sources which can be available via web browser, ftp, gopher, telnet, listserv, email and any other network tools or protocols.

Questions related to your paper:

A How did you become aware of the **e-source** cited in your paper? *(Please circle ALL the numbers that apply.)*

- e-source 1: [list the first e-citation here]

  By personal communications 1
  At a seminar or conference 2
  Followed up references in a printed source 3
  Followed up references in an e-source 4
  A hyperlink from another e-source 5
  A self authored work 6
  Used Internet search engines (e.g. Yahoo, Alta Vista, etc.) 7
  Browsed some online sites regularly 8
  Subscribed to mailing lists or newsgroups 9
  Found by co-author 10
  Can not recall 11
  Other (*specify*) _____

- e-source 2: [list the second e-citation here]

...

1a. Did you use any other e-sources during the research that were not cited in this paper? (*Please circle ONE number.*)

Yes 1
No ..... 2 → (SKIP TO Q.2)
Can not recall ..... 3 → (SKIP TO Q.2)

b. For what reasons were the sources not cited? (*Please circle ALL that apply.*)

I would have cited them if they were print 1
I would not have cited them even if they were print 2
Can not recall ..... 3 → (SKIP TO Q.2)
Other (*specify*) _____
_____

Your use of e-sources:

2. How many years have you been using the Internet (including email)? (*Please fill in the number of years.*)
   _____ year(s)

3. How would you rate your overall ability to use Internet? (*Please circle ONE number closest to your level.*)
   - No use at all ..... 0 → (SKIP TO Q.5)
   - Beginner 1
   - Below average 2
   - Average 3
   - Above average 4
   - Expert 5

4. How frequently do you use the following Internet tools and resources?
   (Please circle ONE number closest to the frequency of use of EACH tool or resource.)

	no use	less often than or nearly once a month	two or three times a month	about once a week	two or three times a week	almost every day
Email	0	1	2	3	4	5
Mailing list (Listserv)	0	1	2	3	4	5
Newsgroup	0	1	2	3	4	5
Ftp	0	1	2	3	4	5
Gopher	0	1	2	3	4	5
Telnet	0	1	2	3	4	5
Web browser	0	1	2	3	4	5
Online database (e.g. OPACs, Dialog, etc.)	0	1	2	3	4	5
Internet search engines (e.g. Yahoo, Alta Vista, etc.)	0	1	2	3	4	5

5. Where do you get access to the following Internet tools and resources? (*Please circle ALL that apply in EACH ROW.*)

	No experience	At work	At home	At public site in library	Other (*specify*)	No access
Email	0	1	2	3	_____	4
Mailing list (Listserv)	0	1	2	3	_____	4
Newsgroup	0	1	2	3	_____	4
Ftp	0	1	2	3	_____	4
Gopher	0	1	2	3	_____	4
Telnet	0	1	2	3	_____	4
Web browser	0	1	2	3	_____	4
Online database (e.g. OPACs, Dialog, etc.)	0	1	2	3	_____	4
Audio files (e.g. RealAudio, MIDI, etc.)	0	1	2	3	_____	4
Video files (e.g. RealVideo, QuickTime, etc.)	0	1	2	3	_____	4
SGML files	0	1	2	3	_____	4
Files in PDF (.pdf) format	0	1	2	3	_____	4
Files in postscript (.ps) format	0	1	2	3	_____	4
Files in compressed format	0	1	2	3	_____	4

6. How do you identify e-sources for your **research**?

- *Please circle ALL that apply,*
- *rank those circled in order of how frequently you use them (1 ◘ most frequently used)*

	Circle all that apply	Rank order
By personal communications	1	
Attend seminars or conferences	2	
Follow up references in printed sources	3	
Follow up references in e-sources	4	
Use Internet search engines (e.g. Yahoo, Alta Vista, etc.)	5	
Browse some sites regularly	6	
Subscribe to mailing lists or newsgroups	7	
Other (*specify*)_____		

Your citing e-sources:

7. There are many factors involved in citing decisions. **Besides** the criteria you use in citing print sources (such as actual quality and relevance, etc.), what **additional** factors do you consider in **citing e-sources** and their effects for your citing decision? (*Please add more factors if not listed; circle ONE number for EACH ROW.*)

	Not a consideration	Effect	
		tend to cite	tend not to cite
a) There must be print versions also available.	0	1	2
b) They are not a "real" publication.	0	1	2
c) They are less prestigious than traditional print sources.	0	1	2
d) They may not be available later.	0	1	2
e) They are visually attractive.	0	1	2
f) They have current information.	0	1	2
g) They have hyperlinks to related information.	0	1	2
h) It is not clear how to cite e-sources.	0	1	2
i) It may be difficult for readers to locate the sources.	0	1	2
j) It is convenient for readers to locate the sources.	0	1	2
k) This is an article for a paper journal.	0	1	2
l) This is an article for an electronic journal	0	1	2
o1) Other 1 (*specify*) _____		1	2
o2) Other 2 (*specify*) _____		1	2

Your evaluation of e-sources:

8. How would you rate e-sources on each of the following features as sources for your **research**?
(Please circle ONE number corresponding to the scale for EACH feature.)

	Poor	Fair	Good	Very good	Excellent
Accessibility	1	2	3	4	5
Accuracy	1	2	3	4	5
Authority	1	2	3	4	5
Availability	1	2	3	4	5
Consistency	1	2	3	4	5
Ease of use	1	2	3	4	5
Flexibility	1	2	3	4	5
Permanence	1	2	3	4	5
Timeliness	1	2	3	4	5
Uniqueness	1	2	3	4	5
Usefulness	1	2	3	4	5

Other:

Since we know that age and gender may be related to use of technologies, would you please answer the following two questions?

9. Your age on your last birthday (*Please fill in a two-digit number.*) _____

10 Your gender (*Please circle a number.*).

Male 1
Female 2

11. Would you please list your primary research interests?

_____

_____

12a. Are you satisfied with the current state of e-sources as sources for your research?

Yes ..... 1 → (SKIP TO Q.13)
No 2

b. What are the most important things you would suggest may improve your use of e-sources for research?

_____

_____

_____

_____

13. We would appreciate any further comments you may have regarding Internet-based e-sources for research. (*Please attach an additional sheet if necessary.*)

THANK YOU FOR YOUR COOPERATION!

Please return the completed questionnaire in the enclosed postage-paid envelope to:

Yin Zhang
Graduate School of Library and Information Science
University of Illinois at Urbana-Champaign
501 E. Daniel Street
Champaign, IL 61820

If you are interested in the results of the survey, please visit http://gaia.lis.uiuc.edu:2009/survey/ at the end of April, 1998. Please use your Case ID for the access.