Print versus electronic journals: a preliminary investigation into the effect of journal format on research processes*

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Purpose: To begin investigating the impact of electronic journals on research processes such as information seeking, the authors conducted a pilot journal-use study to test the hypothesis that patrons use print and electronic journals differently.

Methodology: We placed fifteen high-use print titles also available in electronic format behind the circulation desk; patrons were asked to complete a survey upon requesting a journal. We also conducted a parallel survey of patrons using library computers. Both surveys asked patrons to identify themselves by user category and queried them about their journal use.

Results: During the month-long study, patrons completed sixty-nine surveys of electronic and ninety surveys of print journal use. Results analysis indicated that fellows, students, and residents preferred electronic journals, and faculty preferred print journals. Patrons used print journals for reading articles and scanning contents; they employed electronic journals for printing articles and checking references. Users considered electronic journals easier to access and search than print journals; however, they reported that print journals had higher quality text and figures.

Discussion/Conclusion: This study is an introductory step in examining how electronic journals affect research processes. Our data revealed that there were distinct preferences in format among categories. In addition to collection management implications for libraries, these data also have implications for publishers and educators; current electronic formats do not facilitate all types of uses and thus may be changing learning patterns as well.

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INTRODUCTION

In times of technological evolution, new technologies often imitate older entities that are not necessarily related; for example, early photography often imitated painting. Once individuals realized the capabilities of the new medium, photography developed as a distinct

art form. Similarly, in the library world, older practices are often applied to the new medium of electronic information. To take full advantage of this new medium, librarians should create practices that leverage on their libraries' existing expertise in organizing and understanding information but take into account the revolution in format. For example, the need for accurate electronic journal-use statistics is well known in the library community [1, 2].

While use statistics are a tested and necessary measure for evaluating the value and cost-effectiveness of electronic and, for that matter, print journals, most measures do not take into account how the new format and added capabilities of electronic journals may be affecting the process of scholarly research and communication. Traditional use counts cannot tell if users employ print or electronic versions of journals for the same purposes or if browsing of electronic journals affects the serendipitous discovery of information that occurs when users leaf through print journals. This paper reports on a pilot study conducted at the Eskind Biomedical Library (EBL) at Vanderbilt University Medical Center (VUMC) that incorporated both traditional use counts and an examination of whether different categories of patrons use print and electronic journals differently to investigate if dissimilarities forecast a shift in the processes of idea generation and scholarly research. Additionally, the paper reports on survey respondents' preferences for journal formats and the reasons formats were favored.

BACKGROUND

Just as electronic journals have matured and become integral to library collections, so have use studies progressed from those examining barriers to electronic journals' acceptance and desiderata for their design, to studies measuring use counts, to studies examining what the widespread adoption of electronic journals portends both academically and economically. Libraries early recognized that electronic journal design was key to their acceptance and engaged in numerous studies to determine effective design elements. Olsen interviewed novice academic electronic journal users and identified essential functions of print journals that electronic versions should duplicate [3]. Stewart interviewed chemists about their satisfaction with electronic journal performance of functions such as browsing and portability [4]. In the Commercial and Free Electronic Journal User Study, Woodward et al. utilized a structured questionnaire to elucidate master's degree students' perceptions of the quality, ease of access and navigation, and advantages and disadvantages of electronic journals [5]. Wright et al. surveyed physicians' attitudes toward electronic journals and determined that while nearly 80% of respondents believed electronic journals would decrease office clutter and facilitate location of useful articles, 74% were concerned about losing the convenient readability and portability of print journals [6].

Other investigators have focused on methods for obtaining electronic-journal-use statistics. Luther examined many of the issues surrounding statistics collection [7], and the Association of Research Libraries has launched the E-Metrics Project [8] to gather best practices for statistics and use measures for electronic resources. Mercer reported on a statistical program developed to record electronic-journal-use statistics to tailor marketing efforts and collection development decisions [9].

Several authors have conducted studies of electronic-journal usage and opinions. Schloman profiled the perceptions and use of both print and electronic journals among nursing faculty and found that roughly 75% of respondents used print journals frequently, but only about 25% used electronic journals to the same extent [10]. Comparing the use of an identical set of print and electronic journals, Morse and Clintworth noted that while print uses for the journals investigated over the six-month study period in an academic health sciences library were 1,800, electronic uses were approximately 28,000 [11].

Rusch-Feja and Siebeky surveyed researchers at the Max Planck Institute and revealed a high acceptance of electronic journals and a reluctance to return to print journals only [12]. In addition to querying users' opinions of electronic journals' efficacy as print replacements and their advantages and disadvantages, Rogers tracked student and faculty use via annual surveys from 1998 to 2000. Daily, weekly, or monthly faculty use of electronic journals increased 17.7% over the time period, while print use decreased by 8.7% [13]. Bauer reported on the use of indexes in an academic health sciences library to amalgamate electronic-journal-use statistics to make meaningful comparisons with print statistics and noted that the use of sampled electronic journals increased more than 100% from 1997 to 1999 [14].

Other authors have also begun examining the potential effects of electronic journals on scholarly research and communication. The SuperJournal project in the United Kingdom was initiated to determine factors necessary for an effective electronic journal by tracking academic readers' use of a freely available journal collection [15]. Noting that their statistics demonstrated multidimensional use, project organizers categorized users by their interactions with journals (e.g., demand-specific users, exploratory users), thus classifying users by how they used a journal as well as how often. Harter used citation analysis of a set of scholarly, refereed electronic journals to examine authors' citation of articles published in electronic journals as a measure of their influence on scholarship. While few journals included in the study had an impact on schol-

arly communication according to his findings, certain electronic journals did enjoy a high citation rate. For instance, he observed that in 1995, the average article in the online-only journal *Online Journal of Controlled Clinical Trials* was cited more often than 88% of the other related journals indexed in *Journal Citation Reports*™ [16].

Using repeated surveys, Milne examined changes in scholarly communication patterns, specifically patterns of library use and information seeking and dissemination among academics at the Australian National University. Library visits decreased, electronic journal use increased, and the importance of email as a communication mechanism grew over the period of the study, while print publication remained the most important means of information dissemination [17]. Stewart touched on the idea of electronic journals' effect on serendipitous discovery of information. In her survey, the idea of experiencing serendipity while using electronic journals provoked varied responses. A number of users considered search features an aid to serendipity, while others considered the electronic medium itself a barrier to unfettered thought [18]. Like Stewart, the study reported here began examining the idea of how the electronic medium might affect practices like browsing articles and serendipitous discovery of information that are integral to idea generation and the research process. As a first step toward in-depth investigation of this issue, the authors report on a pilot study to further understanding of how and why readers employ electronic journals or print journals in their research processes.

METHODOLOGY

This study grew out of the authors' attempts to measure print journal use as accurately as possible to develop a correction formula for the print use-over- or under-counting that inevitably occurs because of patrons' reshelving journals or using multiple issues within bound journals. For this print-use study, we sequestered certain journals from the stacks and gave patrons a use survey upon requesting an issue. Our preliminary data analysis indicated that in addition to information about *how often* patrons use journals, we were inadvertently collecting a rich body of information about *how* they used journals. This brief pilot also demonstrated that changing the way patrons accessed journals by removing them from their usual locations resulted in drastic changes in the numbers of uses.

These facts made us curious about how electronic journals, which were a newer method of accessing journals, might be affecting how journals were used. We discovered we had unconsciously proposed another hypothesis—that different kinds of patrons (e.g., residents, nurses) used print and electronic journals for different purposes—with our initial print-use survey. Given the EBL's focus on building a targeted electronic collection, we decided to develop this hypothesis through a parallel survey method. We also wished to test the waters to determine how patrons would react to a study; thus we initiated this brief pilot project as a preliminary information-gathering phase for a more rigorously designed, more complete second phase study currently being planned.

Data collection

We employed a two-pronged survey method to elicit differences in use of print journals versus unmatched electronic journals by different patron categories. To measure print use, we sequestered high-use titles behind the circulation desk and gave surveys to patrons requesting titles. We placed signs on the shelves indicating the journals' new location, explaining that a journal-use study was being conducted, and noting that journals were also available electronically in most cases. We also placed signs on the covers of journals included in the study requesting that users return the journals to the circulation desk after using them and complete a use survey at that time.

Recognizing that less dramatic measures generally result in a low survey count, we opted for this invasive measure of removing journals from the stacks and forcing patrons to request issues. Because this method was so highly intrusive, we further decided to employ a brief study period and to end the study should we receive any complaints from patrons that could not be resolved once we explained the purpose for isolating the journals. As it happened, patrons accepted the procedure and the study, and we received only one complaint, which was easily resolved with an explanation.

To measure electronic use, we gave patrons using electronic journals at the library's public workstations a similar survey. We did not use an identical set of journals for each survey, because we did not know which electronic journals patrons were using when they were asked to complete a survey and did not want to invade patrons' privacy to a greater extent than we already were.

For the print-use arm of the study, we selected fifteen titles§ representing clinical, research, and nursing areas from a list of 400 frequently used titles. Most titles selected were weekly publications to increase the likelihood that patrons would request titles often during the month-long study period; we sequestered the current issue and successive issues for the study period. As noted above, signs in the usual journal loca-

§ Titles included: *American Journal of Epidemiology, Annals of Internal Medicine, Blood, British Medical Journal, Canadian Medical Association Journal, Cancer, Cell, Circulation, JAMA, Journal of Biological Chemistry, Journal of the National Cancer Institute, Nature, New England Journal of Medicine, Proceedings of the National Academy of Sciences,* and *RN.*

tions noted that a journal-use study was in progress and indicated that the titles could be accessed by requesting them at the circulation desk or electronically.

To ensure a varied user base, staff at one of the EBL's service points randomly distributed electronic-use surveys to two to three patrons per hour at public workstations from 9:00 A.M. to 5:00 P.M., the library's peak use hours. Distribution of the surveys was not scientifically random. Staff simply walked through the public workstation area, scanned the workstation screens without actively intruding on users' space, and asked patrons who appeared to be using electronic journals to complete a survey. Although users were employing public, highly visible terminals, we did not want to invade patrons' privacy to an unreasonable extent; thus we could not be sure that all survey respondents were actually using electronic journals.

Survey design

Both print-use and electronic-use surveys asked patrons to identify themselves in one of several categories. Categories included: clinical / research faculty, resident, VUMC staff, VUMC medical student, Vanderbilt University (VU) nursing student, fellow, nurse, VU student, and other. Both surveys also queried patrons about how they used a journal. Possible uses included browsing the journal, checking article references, printing articles, reading articles, and reading instructions to authors, tables of contents, or job advertisements.

Questions on the electronic-use version of the survey (e-use survey) mirrored those on the print-use survey (p-use survey); however, we added questions related to the novel format. The e-use survey asked patrons to select from a list of *why* they used an electronic journal, which we differentiated from *how* users employed a journal. The list of responses to this ''why did you use an electronic journal'' question included noticed articles while browsing through journals, retrieved articles during database searches, preferred to access electronic versions of journals when available, retrieved articles through search of journal home page, and knew article or electronic journal existed and went directly to it.

The e-use survey also asked patrons to indicate which format, if either, they preferred and why. Because we had a captive audience and knew data from the study could be utilized for planning purposes, the e-use survey also requested patrons to indicate how they discovered the EBL's electronic journals. We presented patrons with a list including such choices as a link in the online catalog, full-text link from a database search, the EBL's electronic journals Website, EBL training classes, EBL staff members, and colleagues among others.

Table 1
Print and electronic journal survey respondents by patron category

Patron categories	Electronic use respondents % of total (N = 69)	Print use respondents % of total (N = 90)
Clinical/Research faculty*	10% (7)	35% (32)
Fellows	15% (10)	14% (13)
Medical students	12% (8)	8% (7)
Nurses	3% (2)	— (0)
Nursing students	23% (16)	1% (1)
Patients/Families	— (0)	— (0)
Residents	10% (7)	4% (4)
Vanderbilt University (VU) staff	3% (2)	2% (2)
VU students	15% (10)	1% (1)
Vanderbilt University Medical Center (VUMC) staff	20% (14)	17% (15)
Others†	10% (7)	29% (26)
Total‡	121%§ (84)	102%§ (92)

* Research faculty and clinical attending faculty were combined during analysis into one category.
† Others includes alumni, nonmedical graduate students, other university students, medical sales representatives, and visiting physicians.
‡ Total exceeds number of surveys, because patrons identified themselves in more than one category.
§ Total exceeds 100%, because patrons identified themselves in more than one category.

RESULTS

We collected ninety print and sixty-nine electronic use surveys during the month-long study period and compiled them in an Access database. All data was analyzed using the Pearson chi-square test to reveal statistically significant relationships. Significance was attributed at a probability ≤ 0.05.

Use by patron category

Surveys asked patrons to identify themselves in one of several categories. Table 1 illustrates electronic-versus print-journal use by patron category. The proportion of ''faculty'' and ''other'' (alumni, nonmedical graduate students, other university students, medical sales representatives, visiting physicians) respondents for the p-use survey was significant ($P < 0.05$). The number of ''nursing'' and ''Vanderbilt University (VU) student'' e-use respondents was also significant ($P < 0.05$). A natural speculation here is that faculty, who are likely older than most nursing or VU students, may be later adopters of newer technologies such as electronic journals. In her survey of electronic journal use, Rogers tested for a correlation between age of respondents (a demographic we did not record in our surveys) and use of electronic journals and other resources. Her data for her study's final year indicated ''a tendency for older faculty members to use [electronic] resources less frequently than younger faculty'' [19]. Though Rogers' correlation between age and use of new technology was weak, and our data represent only a small number of respondents, exploring this

Table 2
How patrons use journals

Use	Electronic-use survey respondents (N)	Print-use survey respondents
Browsed	39% (27)	72% (65)
Checked references	41% (28)	22% (20)
Printed or photocopied articles	58% (40)	36% (32)
Read articles	16% (11)	20% (28)
Read entire journal	1% (1)	3% (3)
Read instructions to authors	1% (1)	— (0)
Read job advertisements	3% (2)	8% (7)
Read tables of contents	6% (4)	32% (29)
Other use	4% (3)	2% (2)

link in light of library service planning may be a fertile area for study.

Comparison of types of uses (how patrons used a journal) by e-use and p-use survey respondents was noteworthy in several instances. We defined types of use as browsing, checking article references, printing (e-use survey) or photocopying (p-use survey), reading *X* number of articles, reading the entire journal, reading instructions to authors, reading job advertisements, reading the table of contents, and other.

Patrons use journals somewhat differently depending on the format, as seen in Table 2. The most commonly reported print journal uses over all patron categories were browsing (72%), photocopying (36%), reading tables of contents (32%), and checking references (22%). The most commonly reported electronic journal uses over all patron categories were printing (58%), checking references (41%), and browsing (39%). The most frequently reported uses for both formats were browsing (58%), printing or photocopying (45%), checking references (30%), and reading tables of contents (21%).

Respondents' use of print journals for browsing and reading tables of contents over electronic journals was significant. Print use respondents accounted for 71% ($P < 0.001$) of both print and electronic browsers. Moreover, 72% of all p-use respondents indicated that they browsed print journals compared to 39% of e-use respondents. P-use respondents account for 88% ($P < 0.001$) of total readers of tables of contents; 32% of all p-use respondents read tables of contents compared to 6% of e-use respondents.

Respondents relied more heavily on electronic journals for checking article references and printing. E-use respondents accounted for 58% ($P < 0.05$) of all article reference checkers, and 41% of all e-use respondents checked references compared to 22% of p-use respondents. For the purposes of data analysis, we considered printing and photocopying to be equivalent uses of each format. Not surprisingly, because the EBL did not charge for printing but did charge for photocopying, e-use respondents accounted for 56% ($P < 0.005$) of all printing or photocopying; 58% of all e-use respondents printed compared to 36% of p-use respondents who photocopied.

Few respondents indicated that they used either print or electronic journals to read an entire journal issue; readers printed or photocopied articles at a higher frequency than they read articles on screen. E-use respondents indicated that they read articles 16% of the time but read printed articles 58% of the time. The numbers were less dramatic for p-use respondents, who read articles 20% of the time and photocopied 36% of the time. Overall, respondents preferred print journals for browsing, checking article references, photocopying, reading tables of contents, and reading articles. Electronic journals were also used for browsing, checking article references, reading articles, and printing articles.

There was a noticeable difference in the percentages of p-use respondents and e-use respondents who read the tables of contents (32% vs. 6%, respectively). Few respondents for either format reported high use of journals for reading the complete issue, reading instructions to authors, or reading job advertisements.

Electronic journal use results

As mentioned previously, our e-use surveys asked additional questions pertinent to the electronic format that were not included on the p-use survey. The following section details results from responses to the e-use survey. The total number of e-use respondents was sixty-nine; in several cases, patrons listed themselves in more than one category (e.g., ''Vanderbilt University student'' and ''nursing student''). To streamline results for this analysis, we relegated respondents to the category most germane to medical center patrons (''nursing student''). Patrons who listed themselves as both attendings and faculty were merged into one category, clinical and research faculty, so the population could be represented in the analysis. Fellows who listed themselves as fellows and VUMC staff were designated as fellows. We used cross tabulation to figure percentages.

Format preferences

Although all of the respondents completed the e-use survey distributed to patrons using the library's public computers, 17% of the total e-use respondents indicated they preferred to use print journals. Thirty-three percent of the total e-use respondents had no preference or said it depended on why they were using the journal. Patron categories with four or more respondents—fellows (70%); medical students (63%); VU students (63%); other (60%), which included visitors and alumni; and residents (57%)—showed the highest preference for electronic journals (Table 3). Faculty were evenly represented across format preferences.

Table 3
Electronic use (e-use) respondents' format preferences

Patron category*	Electronic (N)	Print	No preference
Clinical/Research faculty	25% (1)	50% (2)	25% (1)
Fellows	70% (7)	— (0)	30% (3)
Medical students	63% (5)	— (0)	38% (3)
Nursing students	39% (5)	15% (2)	46% (6)
Residents	57% (4)	14% (1)	29% (2)
VUMC staff	33% (3)	33% (3)	33% (3)
VU students	63% (5)	13% (1)	25% (4)
Others†	60% (3)	— (0)	40% (2)

* Only those categories with at least four respondents are included.
† Others include alumni, nonmedical graduate students, other university students, medical sales representatives, or visiting physicians.

Table 4
Why patrons access electronic journals

Reasons	Percent (N = 69)
Searched Ovid	58% (40)
Searched PubMed	26% (18)
Searched another database	10% (7)
Searched journal homepage	13% (9)
Knew article existed	17% (12)
Noticed article while browsing	10% (7)
Preferred to access electronic journals	43% (30)
Printed version not on shelf	10% (7)
Read journal regularly	10% (7)
Other reason	9% (6)

High percentages of the other category (40%) and nursing students (46%) reported no preference.

Respondents also answered an open-ended question about the reasons they preferred a format. In many cases, different respondents preferred different formats for the same reasons. The most-cited reasons for preferring electronic journals included ease of access, ease of printing, and ease of searching. Respondents provided many testimonials to the convenience and breadth of access of electronic journals. Respondents also valued access from home and fast, free printing. Though it would be reasonable that patrons would prefer to print an article at no cost rather than locate and photocopy an article at a fee, respondents preferred electronic journals for a variety of other reasons, including some of those discussed by Stewart and Olsen as features necessary for electronic journals—namely, the ability to browse text and graphics to estimate the utility of an article [20].

Respondents favored print journals for aesthetic reasons—the higher quality of photos, graphics, and tables. Similar to the preferences cited for electronic journals, the most-cited reasons for preferring print included that the format was easier to read with better graphic quality, easier to browse, and easier to access. One user stated that with print, one was ''not distracted by the process; with electronic [there are] too many loose ends, false trails, lack of ability to focus,'' and another felt ''unfamiliar and uncertain when retrieving electronic articles.'' Similarly, some of Stewart's respondents noted that electronic journals constrained their free generation of ideas [21].

It was curious that users declared their allegiance to each format for similar reasons. Both groups had members who found a format easier to read, more easily accessible, and preferable when printed. Unexpectedly, given anecdotal evidence as well as the printing and photocopying data from our surveys, most users did not read electronic journals on the computer screen but tended to print articles. A high number of e-use respondents nevertheless indicated they preferred electronic journals for browsing.

Why patrons use electronic journals

The e-use survey also attempted to discern why patrons used an electronic journal. Among the answer choices included on the survey were: retrieved article or articles through search of databases (via Ovid™, PubMed, Internet Grateful Med, or other), retrieved articles through search of journal home page, knew articles existed and went directly to them, noticed articles while browsing through journal, preferred to access electronic versions of journals when available, found the print journal was not on the shelf and found a sign with instructions to use electronic version, regularly read articles from or browsed this journal, and other (Table 4). We asked respondents to specify their reasons for using an electronic journal if they selected the ''other'' option. The few respondents who defined ''other'' use indicated ''no print available,'' working on a ''paper,'' ''convenience,'' ''needed for a class,'' and ''easier and I thought it might be faster.''

Of the 88% of respondents who cited database searching as their method for discovering an electronic journal, 58% took advantage of full-text access while searching databases available via the Ovid system and 26% while searching PubMed or Internet Grateful Med. Forty-three percent of e-use respondents indicated that they would rather use an electronic journal when given the choice of format, which confirmed the additional finding that 46% of all e-use respondents preferred electronic journals.

Signs we had placed in journals' usual locations on the shelves to indicate that the journals were available either online or at the circulation desk led 10% of e-use respondents to seek the electronic versions. Of these 10% who sought print versions of a journal, it appeared that only two were regular readers of the print versions. In fact, there were just seven respondents who indicated that they always read a particular journal; the remainder of respondents availed themselves of electronic journals for other reasons. Some

Table 5
How respondents discovered electronic journals

Method	Percent (N = 69)
Link in online catalog	28% (19)
AskELIS	— (0)
Colleague	26% (18)
E-journals Web page	7% (5)
Eskind Biomedical Library (EBL) homepage	9% (6)
EBL training	4% (3)
Journal home page	7% (5)
Library staff	41% (28)
List of e-journals	12% (8)
Link noticed during search	42% (29)
Library newsletter	3% (2)
Other	2% (2)

patrons knew a particular article existed in electronic format (17%), others (13%) found articles while searching an electronic journal's home page, and the last group (9%) had other reasons, largely related to their convenience, for accessing electronic journals.

How respondents discovered electronic journals

The e-use survey also asked how patrons discovered electronic journals. As Table 5 indicates, more than 40% of users indicated they followed full-text links from database searches. Twenty-eight percent of respondents discovered electronic journals via searches of the online catalog. Library staff members also proved a significant point of contact, introducing 40% of patrons to electronic journals. Word-of-mouth was a successful means for alerting EBL patrons of the presence of e-journals as well; colleagues accounted for 26% of e-use respondents' discovery of electronic journals.

E-use respondents did not frequently cite formal advertising methods, such as articles in the library's online newsletter and links on the EBL's home page, as means to discovering electronic journals. No e-use respondents indicated that they learned about electronic journals via AskELIS, the Eskind Library Information Specialist (ELIS) asynchronous assistance service for questions about library technology and access issues. ELIS was initiated in 1999, at the time this study was conducted. In our second iteration of this study, we intend to gauge ELIS's penetration as an assistance tool for the VUMC community; we hope that the number of respondents citing ELIS as a discovery vehicle will increase substantially.

STUDY LIMITATIONS

This study provided both valuable data on which to base further investigation as well as useful lessons for an improved study design in our next iteration. The present study was limited by the small sample size of 159 total participants, who comprised a convenience, not a true random, sample. The study was further limited, because many of the respondents were dedicated library users who completed surveys multiple times, either because they were requested to complete the e-use survey while using a workstation or because they requested print journal issues each week. While users might employ journals differently on different occasions, multiple sets of data from the same users lessened the likelihood that our results applied to a truly representative cross-section of medical center users. Moreover, the study's applicability was also limited by the fact that we selected our sample journals from among a group of high-use titles available in print and electronic formats and published weekly, not from among the EBL's entire journal collection. Thus, our results were not generalizable to the entire spectrum of journals but only those that were frequently used.

Additionally, though the survey was pretested by library staff, some questions might have been ambiguous. For instance, we did not clearly define the idea of ''reference checking.'' Some respondents might have interpreted it to mean examining a reference while reading an article, in which case the use might be equivalent to reading or browsing. Other respondents might have interpreted ''reference checking'' to mean directly examining an article's references before reading the text or verifying their own references to articles by looking at the electronic version. Additionally, by sequestering only recent issues of journals, we might have privileged the instances of browsing, because recent issues are generally used more often for browsing and their content is often not yet indexed in databases, thus making browsing the only method of access.

While we were careful to explain the rationale for our study, our intrusive study method of sequestering certain journals also might have altered normal user behavior. Though we received just one complaint during the study, we might have lost regular print or electronic browsers or alienated patrons who did not elect to request journals at the circulation desk, thus modifying the use patterns we wished to study. Because we wished to avert a potential negative impact for our patrons, we kept the study period brief, only a month long. A longer study period would likely have provided additional data. Similarly, we did not collect responses from remote users through an electronic survey, because we did not wish to overtax users with surveys both in the library and at their desktops. The next iteration of this study, however, will employ an electronic survey of remote users.

In the interest of the brevity of the survey instrument, we also collapsed categories of users. For example, we used only the category ''clinical/research faculty'' instead of further breaking down the category into nursing faculty, medical school faculty, basic sciences faculty, and so on. Lastly, though we did ask e-use respondents why they preferred electronic jour-

nals, we did not ask p-use respondents which format they preferred and why. Further delineation of user categories as well as soliciting print users' format preferences would likely have provided illuminating data.

DISCUSSION

Even given these limitations, this study serves as a useful snapshot in time and foundation on which to build our knowledge of how patrons use print and electronic journals differently. Our results indicate that certain categories of patrons, most notably faculty, prefer print journals over electronic, whereas most residents and fellows prefer electronic journals. While we did not collect user demographics other than affiliation (resident, medical student, etc.) in the present study, preferences and use patterns by user type revealed an interesting area for further exploration. In our repeat of this study, we intend to explore links between age of users and adoption and utilization of technology.

As might be expected, respondents valued each format for its commonly known advantages. Some respondents cited the ability to search electronic journals as a key advantage, while others favored the readability of print journals. Beyond these more format-specific uses, the present study revealed that respondents use print and electronic journals in essentially the same ways. Respondents used both formats to browse through journals, to check article references, and to print or photocopy. Though electronic journals have often been heralded as a paradigm shift in scholarly publishing and research, some authors have questioned the validity of this claim. While affirming the value and necessity of electronic journals, Jones and Cook noted that with

> e-journals currently we are only changing formats; there is no change in ideas of what scholarship is and what it is not. It is change in method, not a thought or worldview, just an evolution of the existing paradigm of scholarship and dissemination of knowledge from traditional methods of publishing to more non-traditional methods. [22]

The findings from this study supported Jones and Cook's conclusion that electronic journals were not fundamentally altering research processes as yet.

Nevertheless, our findings also showed that each format facilitated certain types of uses. For instance, respondents frequently used print journals to read journal tables of contents, while electronic users infrequently indicated this use. We could surmise that the format of most electronic journals, in which all the articles in a particular issue were displayed on one page, allowed users to scan titles and select articles directly. While this use might be equivalent to reading the table of contents of a print journal, users might perceive it differently. Similarly, hyperlinked references in articles in electronic journals facilitated reference checking—a frequent type of use among e-use respondents in this study. Thus, while electronic journals might not be altering fundamental research behaviors, they might be shifting users' perceptions of the journal itself.

As many authors note, links from database searches and the granularity of the electronic journal allow users to be less concerned about the journal as a unit. Instead, the focus is on the article. Butler remarks that

> the ability to click from an abstract or citation to the full text of an article is prompting a shift in the way that journals are used. Scientists often care less about the journal title than the ability to track down quickly the full text of articles relevant to their interests. Increasingly, users view titles as merely part of hyperlinked ''content databases'' made up of constellations of journal titles. [23]

Indeed, our data indicate that few respondents read entire issues of either print or electronic journals.

Additionally, our data regarding patrons' preference for and use of electronic journals for printing articles confirms the idea that patrons may limit their research to easily available electronic journals simply because of their convenience and regardless of whether other sources would better suit their information needs. Tenopir notes that

> When [patrons] begin to rely on electronic full texts, they often don't bother to check print journal stacks. So it is especially important for libraries to provide a wide variety of online journals, since most patrons will select the digital versions, even if a particular title or article is not best for their needs. [24]

CONCLUSIONS AND FUTURE DIRECTIONS

We conducted this study in early 1999, at which time the EBL had access to approximately 500 electronic journals. Since that time, the electronic collection has grown substantially on all fronts, and user interfaces have improved significantly. The EBL currently owns nearly 1,715 electronic journals. We plan a second iteration of this study to examine changes in electronic- and print-journal use since 1999. Given the improvements in electronic journals' usability, greater user acceptance, and the EBL's aggressive electronic collection and marketing strategies, we expect significantly different results in user preferences. Moreover, our second survey will query users about new technologies, such as personal digital assistants (PDAs), that are increasingly becoming part of the research process. Studies such as this one, which attempts to go beyond application of traditional library methods to begin to understand the impact of digital information, provide a useful base for library innovations. As Luther notes

information in digital form has functional properties that can save users time and provide value. We know that data can be indexed, searched, forwarded, filed, and processed. However, it is increasingly important for both librarians and publishers to understand the information ''context'' of users so that additional capabilities can be developed that will deliver new levels of efficiency. [25]

This study is a step toward elucidating some of the additional capabilities users want and will utilize in electronic journals as the format evolves.

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