Electronic Journal Usage at Ohio State University

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E-journal, printed journal, and database usage data from campus polls conducted annually, 1998–2000, at one large research university show increased use of e-journals and decreased use of printed journals by faculty and graduate students as the number of available e-journals increased from two hundred to more than three thousand. Little or no statistical correlation between age and frequency of use was found. The majority of frequent users of all three types of resources were from departments in the sciences. Transcripts from the 1998 poll provided insights into attitudes toward replacing printed journals with e-journals. The advantages and disadvantages mentioned were consistent with previous studies.

As more publishers are making their journals available in electronic form, academic libraries are wondering when their users will accept these online resources as satisfactory—and even desirable—substitutes for the printed equivalents. This article describes a three-year study that examined the impact of making available a "critical mass" of electronic journals. The initial phase of the study assessed the level of awareness and frequency of use of electronic reference databases, e-journals, and printed journals by faculty and graduate students at Ohio State University in 1998 when only about two hundred journals (from Academic Press) were available online. Attitudes toward replacing printed journals with the electronic format and the correlation between age and use of electronic resources also were examined. The second and third years of the study were designed to assess whether the level of awareness and use increased as the number of available e-journals increased significantly. By 2000, about 3,300 e-journals from twenty-five major publishers were available to those participating in the study.

Previous Studies

Early studies on e-journal usage discussed special projects designed to test the viability of the electronic format. They reached similar conclusions about scholars' readiness to accept the e-journal as a substitute for print; namely, e-journals must offer the same advantages as printed journals in order to gain wide acceptance among scholars. The TULIP and Red Sage projects, begun in 1991 and 1992, respectively, were groundbreaking efforts to deliver e-journals to the desktop. TULIP, which concluded in 1995, made available forty-three Elsevier and Pergamon journals. The Red Sage project included sev-

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enty-one journals from nineteen publishers, which were available to users from January 1994 until December 1996.[1] Both projects benefited greatly from the advent of the Web, but both recognized the need to offer a critical mass of e-journals to motivate users to change their preferred method of accessing journal literature.[2, 3]

How frequently faculty and students were using the e-journals already available to them through the libraries' Web site was not known; similarly, nothing was known about their attitudes toward substituting e-journals for printed format.

While the TULIP and Red Sage projects were under way, Jan Olsen interviewed forty-eight scholars in three disciplines at Cornell University and the University of Pennsylvania concerning use of journal literature and asked them to speculate on the advantages and disadvantages of electronic versus printed journals. Her study, published in 1994, found that all three groups considered journals indispensable to their research, although the frequency of use varied by discipline. Having to go to the library to access printed journals was seen by all as a major inconvenience. All of the scholars surveyed said they photocopied articles they considered important. Olsen found the scholars to be receptive to the idea of e-journals, although they had concerns about browsing and annotating capabilities, ergonomics, and the quality and retrieval of graphics.[4] She found that "the attributes of print cannot be dismissed as simply something to which the reader is accustomed" but, rather, must be considered "crucial to thinking, comprehension, and retention of concepts."[5]

Following Olsen's study, Linda Stewart reported on interviews with thirty-nine users of the Chemistry Online Retrieval Experiment (CORE) conducted at Cornell University in the spring of 1995. Participants in the CORE project had access to the full text of twenty American Chemical Society journals and the scanned images of the journal pages. Their concerns, based on actual use rather than speculation about the usability of e-journals, were similar to the concerns raised in Olsen's study, with the ability to make a printed copy of the electronic text given the highest priority.[6] Although the CORE participants thought most functions of printed journals eventually could be accomplished by e-journals, one-third did not foresee them replacing printed journals entirely. Stewart concluded that improvements in accessibility, comfort of use, browsing ability, portability, and availability of back files would be needed if e-journals were to become a satisfactory substitute for the printed format.[7]

The JSTOR project, which was established as an independent, not-for-profit organization in August 1995, is addressing the issue of back files and contributing to the creation of an archive of e-journal literature serving a number of disciplines. JSTOR began with the goals of using the e-journal format to reduce costs of back file storage and to increase convenience of access and visibility for articles not indexed in electronic databases.[8]

The various projects exploring the potential to provide journal literature online paved the way for journal publishers and aggregators to offer the electronic format on a subscription basis. After a group of e-journals such as the Academic Press titles became available, use studies could be done in production rather than test environments. In 1996, the Commercial and Free Electronic Journals User Study investigated the use of more than three hundred e-journals by academic staff and postgraduate students at Loughborough University, in England. Study participants were asked to use one or more e-journals in a subject area of interest to them and to fill out a questionnaire giving their views of the journals. Slow access time, too many navigational screens to get to an article, and difficulties using the viewer required to read the full text were problems that users identified. Nevertheless, most of the study participants also recognized that the e-journals offered advantages over printed journals (e.g., for searching and browsing).[9]

By 1997, the opportunity for libraries to offer their users a critical mass of e-journals was becoming a reality, assuming that satisfactory pricing and licensing agreements could be negotiated. That year, OhioLINK, a consortium of Ohio academic libraries and the State Library of Ohio, negotiated a groundbreaking three-year contract to license Elsevier Electronic Subscriptions (EES) in order to locally store and deliver the full text of all Elsevier Science journals.[10] This contract and establishment of the OhioLINK Electronic Journal Center (EJC) in April 1998 increased the number of e-journals available through OhioLINK from about two hundred (Academic Press titles) to more than twelve hundred titles. Subsequent agreements with other publishers increased the EJC title count to more than three thousand by May 2000.

Research Questions

As plans were being finalized to make the Elsevier Science journals available through OhioLINK, library administrators at Ohio State University (OSU) discussed the need to assess the impact and value of their investment in this body of e-journal literature (which is subsidized only in part by OhioLINK). How frequently faculty and students were using the e-journals already available to them through the libraries' Web site was not known; similarly, nothing was known about their attitudes toward substituting e-journals for printed format. This information was needed to predict how long subscriptions to printed journals that were also available in electronic format might have to be retained.

To learn more about these issues, the author submitted five questions to the annual OSU poll in 1998. Financial support for this activity was provided by the libraries' administration and by an internal research grant obtained by the author. The questions were designed to assess levels of awareness and use of electronic research and reference databases, e-journals, and printed journals provided by the library. In addition, those polled were asked about the perceived advantages and disadvantages of replacing printed journals used to support their primary teaching and research activities with archived electronic equivalents. The questions concerning frequency of use were asked again in 1999 and 2000; those concerning perceived advantages and disadvantages were not asked again. However, a question on the importance of replacing subscriptions to printed journals with subscriptions to archived e-journals was asked in 1999.

The primary hypothesis, based on earlier studies, was that awareness and use of e-journals would increase as critical mass became a reality over the three-year period and users became more familiar and comfortable with the e-journal format. Levels of awareness and use were expected to be higher for electronic databases than for e-journals because the databases had been available online for a longer period of time. A second hypothesis, based on results of previous studies, was that there would be an inverse relationship between age and frequency of use for both types of electronic resources. Graduate students were expected to use the electronic format more frequently than faculty based on the assumption that the students would be more receptive to new technologies. An additional hypothesis was that the majority of frequent e-journal users would be from the scientific and medical disciplines due to the large number of scientific journals included in OhioLINK.

Methodology

The OSU poll, which is an annual survey of the OSU-Columbus campus community, was conducted by the College of Social and Behavioral Sciences's Center for Survey Research (formerly called the Survey Research Unit) using Computer-Assisted Telephone Interviewing operating CASES software. In addition, e-mail solicitation to complete the survey via a Web site was used for the first time in 2000 to reduce the number of telephone interviews required. The author's questions concerning the use of electronic resources, along with questions on a number of other topics, were

addressed to participants randomly selected from two populations: current graduate and professional students, and nonemeritus faculty. The sampling pools were drawn from databases provided by the university registrar and the human resources department. The telephone interviews were conducted between February and April of 1998, 1999, and 2000. Approximately three hundred completed surveys were obtained for each group, each year. At a 95 percent confidence level, the error associated with the samples is between 5.2 and 5.6 percentage points.[11–13]

Findings

Advantages and Disadvantages of E-journals

Two open-ended questions were posed in 1998 to assess how respondents would feel about giving up the printed journals used to support their primary teaching and research activities in favor of using archived e-journals. They were asked to describe, first, the main disadvantage this would present and, second, the main advantage it would offer. The interviewers did not suggest any answers, but they coded the responses into categories. The author received a copy of the response transcripts created during the telephone interviews as well. The transcripts provided insights into the attitudes underlying the coded responses and a more complete understanding of the environment at the beginning of the three-year study. Faculty gave more lengthy and varied responses than graduate students did when answering the question about perceived disadvantages of e-journals; however, the responses of the two groups were matched more evenly when they discussed the perceived advantages.

The primary advantage for 41 percent of the faculty respondents was 24-hour availability and easy access. This also was the top advantage for graduate students, being mentioned by 25 percent of the respondents in that group. Another perceived advantage, noted by 13 percent of faculty and 19 percent of graduate students, was that it would be easier and less time-consuming to find needed information. Interestingly, 15 percent of faculty and 21 percent of graduate students could not think of an advantage and responded "don't know," possibly due to limited experience with the electronic format.

Both faculty and graduate students noted that switching to e-journals would save space in the library and provide a solution to the problem of journals being at the bindery, in use by someone else, or damaged. However, some of the perceived advantages went beyond what the library might be able to deliver, such as "information is readily available, no missing pages"; "any particular issue or article would be immediately available"; and "equal access to everyone." Some of the e-journals available to OSU students and faculty in 1998 did have missing pages or issues that were being filled in over time, and the coverage period for each title was three years or less. Also, equal access to "everyone" certainly is not the rule where licensed electronic resources are concerned!

Advantages other than those related to convenience and availability also were mentioned. One faculty respondent observed that "students would have more access to research and who the researchers are." Another said it would be easier to incorporate e-journals into electronic presentations. Some saw the potential for less interlibrary loan and closed reserve activity. A graduate student noted that e-journal use was a skill she would need after she finished school. Another commented that the electronic format is the "wave of the future, everybody else is doing it."

The top category for disadvantages was "don't know," mentioned by 24 percent of faculty and 33 percent of graduate students. This response could be considered encouraging in that no disadvantages immediately came to mind, but it is more likely indicative of limited experience with e-journals. An additional 8 percent of faculty and 6 percent of graduate students actually said they saw no disadvantages.

The second most frequently cited disadvantage for both groups, mentioned by 16 percent of faculty and 17 percent of

graduate students, was the lack of a computer or online access. An additional 5 percent of faculty and 3 percent of graduate students said that it was too difficult or time-consuming to learn to use e-journals. At the time of the 1998 poll, members of the university community had to dial into the campus network to authenticate in order to access licensed electronic resources from home. A number of comments concerned the problem of getting a free modem line in the evenings. Subsequently, alternatives for authentication became available, making access to licensed resources possible even when using a commercial Internet service provider.

The third most frequently cited disadvantage for both groups (12% of faculty, 13% of graduate students) was the lack of hard copy, due to a preference for using the printed format. An additional 7 percent of faculty and 9 percent of graduate students cited having to print articles themselves as the primary disadvantage of switching to e-journals. On the other hand, some of those accustomed to making photocopies considered making printouts of e-journal articles to be a faster, and therefore preferable, alternative. Those willing to read articles online recognized that they would save time and money by not having to make photocopies.

Several members of both groups commented on ease of use (or lack thereof) and the discomfort associated with trying to read long documents on a computer screen: "It's no easier to use an online journal than to use a scroll." The inability to browse within issues of e-journals or among titles in a particular subject area in the same manner as printed journals was a concern mentioned by both groups. Many said they simply preferred using the printed format or needed the portability it offered.

Other disadvantages included uncertainty about the quality of graphics when making printouts, varying pagination of e-journal articles when printed, and what to do if the computer is down or access is slow. Additional concerns related to the ability of computers to represent multiple-character sets and to be usable by those with disabilities. Both faculty and graduate students also mentioned the cost of printing. OSU charges for printing done at library public workstations, and printing from home also was not viewed as being free.

Some faculty thought that e-journals would be less current, less complete, and less authoritative than their printed counterparts: "I'd probably have to subscribe to journals that I use most often so I could get up-to-date information as soon as it's out." They expected students to have difficulty assessing the value of information in e-journals: "print conveys primary quality source; will confuse online journal with junk on the Internet." One graduate student expressed a similar feeling, noting that "Whatever comes in the written form is still the law. It's always good to go back to the original book and verify." Some faculty commented that journals "can be erased," "might get lost on the computer," and "after so many years, they are taken out of the computer," reflecting a lack of confidence in the stability and durability of the electronic format.

In 1999, poll respondents were asked, "How important do you believe it is that the OSU Libraries replace their subscriptions to printed journals with subscriptions to electronic journals when permanent electronic storage is available?" A response of "very important" or "important" was given by 61.3 percent of faculty and 63.4 percent of graduate students. An additional 15.9 percent of faculty and 19.6 percent of graduate students thought that it was "somewhat important."

Although the barriers to acceptance and use of electronic journals noted above were consistent with earlier studies, the responses to the question posed in 1999 suggested at least philosophical agreement with shifting library dollars from printed to e-journal subscriptions as long as the electronic format is archived permanently. The next question was whether usage patterns over the three-year study period would provide evidence of growing acceptance.

Frequency of Use

Poll questions related to frequency of use of electronic reference databases (figure 1) and printed journals (figure 2) were included to confirm that the respondents were users of electronic resources and journal literature in general and to compare usage of e-journals (figure 3) to printed journals. As expected, the recently introduced e-journals received less use overall than printed journals and the more familiar electronic databases, which had been made available in increasing numbers over the five years prior to the study. However, between 1998 and 2000, the frequency of e-journal use did increase as the number of titles available increased. The frequency of printed journal use decreased during this period, but at a slower rate. Electronic database usage remained fairly consistent.

The number of faculty respondents reporting daily, weekly, or monthly use of e-journals increased from 36.2 percent in 1998 to 53.9 percent in 2000 (a 17.7% increase). The number reporting similar use of printed journals decreased from 74.3 percent to 65.6 percent over the same period (an 8.7% decrease). The number of graduate students reporting daily, weekly, or monthly use of e-journals increased from 42.6 percent in 1998 to 54.3 percent in 2000 (an 11.7% increase), whereas the number reporting similar use of printed journals decreased from 62.3 percent to 55.2 percent over the same period (a 7.1% decrease).

Faculty consistently used electronic databases and printed journals more frequently than graduate students did (by 6% to 8% for databases and 8% to 10% for printed journals) over the three-year period. Graduate students used e-journals more frequently than faculty did by about 6 percent in 1998 and 1999; but by 2000, usage by the two groups was almost the same.

Figure 4 shows a breakdown of the daily, weekly, or monthly users of electronic databases, e-journals, and printed journals by academic discipline. The percentages of users in these frequency categories and departmental groupings in 1998, 1999, and 2000 were averaged for each resource type. The result is a composite snapshot for the three-year period. Unfortunately, graduate students were not asked to indicate their department or college of study in the 1998 OSU poll, so the percentages shown for them represent

FIGURE 1
Frequency of Electronic Database Usage

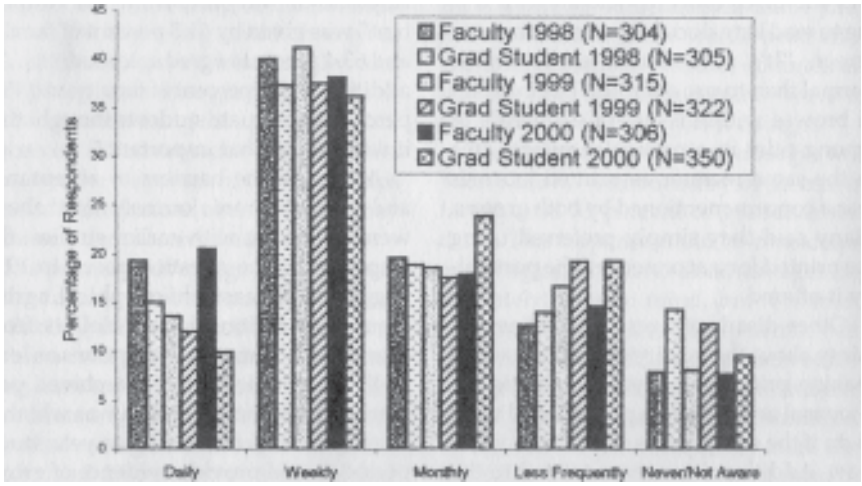
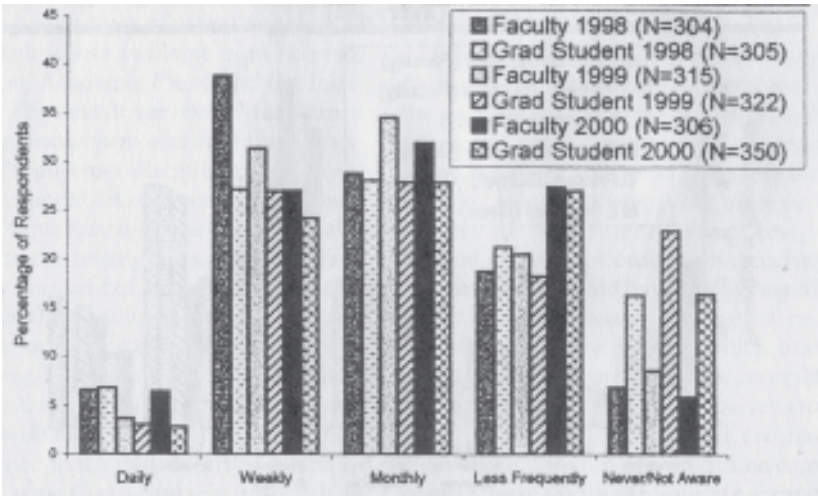


FIGURE 2
Frequency of Printed Journal Usage



an average of the 1999 and 2000 data. Figure 4 shows that more of the daily, weekly, or monthly users of the electronic databases, e-journals, and printed journals were from departments in the biological and medical sciences than from any other area. This was true for both faculty and graduate students, although in general the departmental distributions differed considerably for those two groups. Department breakdowns for electronic database and printed journal usage were fairly similar; the distribution for e-journals showed some variation from this pattern, particularly in the arts and humanities grouping.

FIGURE 3
Frequency of Electronic Journal Usage

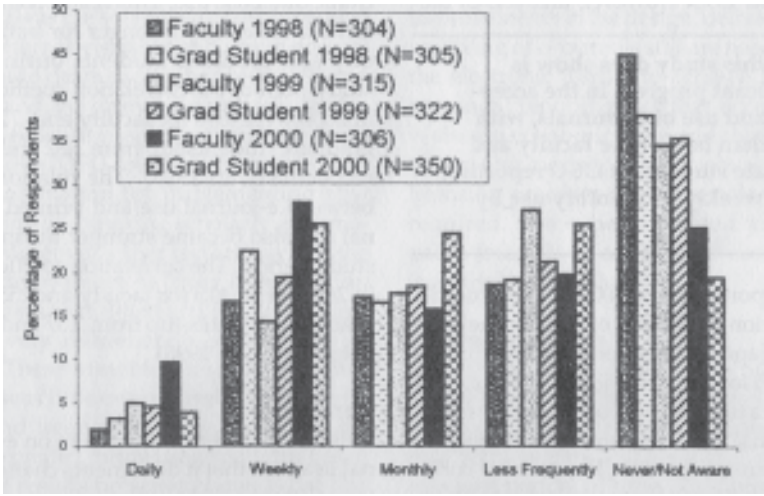
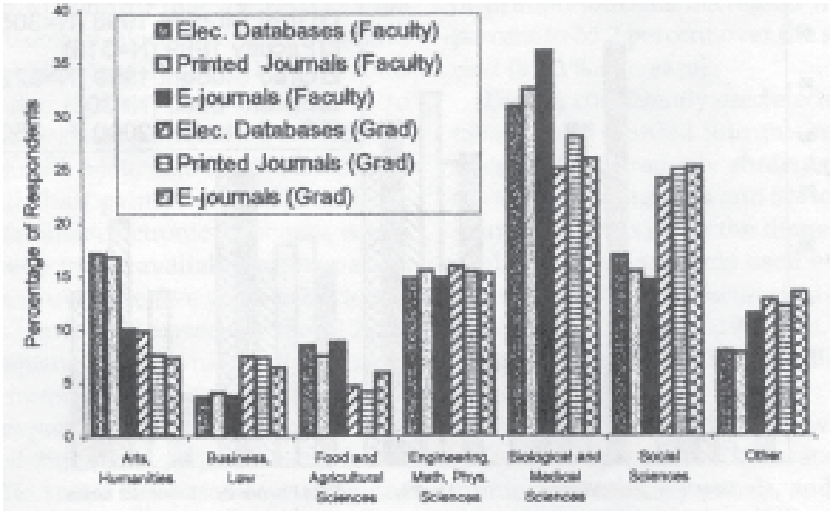


FIGURE 4
Daily, Weekly, or Monthly Users by Department, 1998–2000 (averaged)



To test for a correlation between frequency of use of electronic databases, e-journals, or printed journals and the age of respondents, SPSS for Windows 10.0 was used to isolate the cases associated with the following frequencies: daily, weekly, monthly, less frequently, and never. These cases were analyzed using Spearman's rank order correlation coefficient. There was no correlation between age and frequency of use of electronic databases, e-journals, or printed journals in 1998 and 1999. However, analysis of faculty responses to the 2000 poll produced a correlation coefficient of .293 for the variables of age and electronic database usage and .275 for age and e-journal usage, suggesting a tendency for older faculty members to use these resources less frequently than younger faculty. (The positive correlation coefficients actually indicate an inverse relationship between age and frequency of use because higher frequencies were coded with lower values; e.g., 1 for daily, 2 for weekly). Although the correlation in each case is weak, it does represent a change from 1998 and 1999 and something to check if further studies are done. There still was no correlation between age and frequency of use of printed journals for faculty in 2000.

What this study does show is significant progress in the acceptance and use of e-journals, with more than half of the faculty and graduate students at OSU reporting daily, weekly, or monthly use by 2000.

SPSS also was used to test for a correlation between e-journal use and electronic database use. This relationship became increasingly stronger for both faculty and graduate students during the study period; the correlation coefficients in 2000 were .656 for faculty and .726 for graduate students (up from .382 and .510, respectively, in 1998). The relationship between e-journal use and printed journal use also became stronger during the study period. The correlation coefficients in 2000 were .415 for faculty and .557 for graduate students (up from .137 and .354, respectively, in 1998).

Conclusions

This study differs from others on e-journal usage in that it documents changes in use patterns over a three-year period

rather than reporting data gathered at a single point in time. Another study, conducted in the spring of 1999, investigated acceptance and use of a similar group of e-journals (those available from Elsevier, Springer, Academic Press, and the Institute of Physics). It surveyed Max Planck Society researchers and had the advantage of being cross-disciplinary and cross-organizational. In summarizing the findings, Diann Rusch-Feja and Uta Siebeky noted that retesting a year later to trace the development of usage patterns would enhance the validity of the results. Both studies found that e-journals were being used regularly (daily, weekly, monthly) despite the various disadvantages associated with the electronic format, and they confirmed that a major shift is occurring in the way that scholarly research is done.[14] One faculty respondent to the 1998 OSU poll commented with respect to the move from printed journals to e-journals that "It takes time for us to get used to this—both students and myself. This is a large cultural change for us."

The expectation that e-journal usage at OSU would increase during the three-year study was found to be true for both faculty and graduate students. However, it is impossible to conclude that the move toward critical mass (from two hundred e-journals available in 1998 to more than three thousand by the third year of the study) was the sole cause of the increased use. Internet visibility and use in general increased dramatically between 1998 and 2000, and the growing emphasis on distance education and instructional technologies at OSU could have provided further motivation for implementing new methods of acquiring scholarly information. Moreover, other factors, such as the growing number of links from citation databases to full-text articles, could have positively influenced e-journal use as well. These variables, and the fact that there was little or no correlation between age and frequency of use, make it difficult to predict future usage patterns based on the results presented here. What this study does show is significant progress in the acceptance and use of e-journals, with more than half of the faculty and graduate students at OSU reporting daily, weekly, or monthly use by 2000.

While e-journal usage was increasing, there was an accompanying decrease in the use of printed journals, which brought usage levels for the two formats much closer together. This finding suggests that the OSU community might be more supportive of canceling subscriptions to printed journals in order to redirect resources than it would have been when the study began. However, the results presented here do not indicate which titles might be the best candidates for cancellation. If the departmental distributions for e-journal and printed journal use had been dissimilar with one discipline comprising the majority of frequent e-journal users, but the minority of printed journal users, the printed journals in that discipline might have been good candidates for cancellation. But this was not the case. The department breakdowns for e-journal and printed journal use were very similar and so were not helpful in determining which titles might be cancelled. (Carol Tenopir provides some assistance in this area by dividing e-journals into five categories and suggesting how to make cancellation decisions based on form, purpose, and source of access.[15])

This study and others have shown that improvements in the design, delivery, and archiving of e-journals still are needed for the electronic format to achieve full acceptance. Tenopir notes that acceptance is also an economic issue and that different pricing models, revenue sources, and licensing practices for e-journals will be required. She expects printed journals and e-journals to continue to coexist, at least for the short term.[16]

Further Research

One of the expectations at the outset of the OSU study was that electronic databases would receive more use than e-journals because they had been available for a longer period of time. This proved to be true, and there also was a positive cor-

relation between electronic database and e-journal use that became increasingly stronger over the three-year period. This finding is not surprising because the addition of links from citations in electronic databases to full-text articles simplified access to many of the e-journals available from OhioLINK.

Linkages are making the lines of demarcation between types and sources of electronic resources less apparent, and the result is improved service to users. For example, in June 2000, publishers participating in CrossRef began providing links from reference citations in their e-journals to the full text of cited articles available from other CrossRef participants.[17] Although CrossRef currently connects only publisher sites, efforts are under way to allow links to local e-journal archives such as the OhioLINK EJC as well. The Max Planck study provided evidence of the importance of linkages to users: "Comments found in the survey repeatedly expressed the desire for an integrated access system or interface to all journals, as well as to other information services."[18] Currently, this further integration is being introduced by products or services (e.g., SFX, WebFeat[19]) that offer the ability to do a simultaneous search of multiple types of electronic resources (e.g., databases, e-journals, Web sites) and to retrieve an integrated response set. Use of the Z39.50 protocol is not required. The impact that such developments designed to unite access to electronic resources will have on scholarly research and communication should be extremely interesting and the topic of further study.

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