

Digital Collections: Acceptance and Use in a Research Community

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Abstract

This paper describes a project designed to capture evidence of changing approaches to identifying, locating, organizing, and producing scientific information in a university-based research community. Faculty in the basic and health sciences were interviewed regarding their uses of electronic journals, databases, and other digital resources to support their teaching and research activities. The findings are intended to provide a better understanding of scientists' use of digital collections for librarians who acquire and manage research collections and who develop services to faculty and students, especially those in pure and applied sciences. This knowledge should lead to better informed acquisition decisions and improved library services. The changing behavior patterns documented suggest emerging models of scientific communication as scientists begin to incorporate use of digital collections and information technology in innovative ways.

Statement of the Problem

Research libraries are spending increasing amounts to build digital collections that may include thousands of electronic

journals as well as bibliographic, full-text, image, and numerical databases. Faculty and students in research universities have access to an ever-growing array of electronic resources that deliver content and functionality not found in traditional print materials. Librarians recognize the potential of information technologies to enhance the research process and to offer enriched educational opportunities, and many are involved in developing Web interfaces to organize networked resources and promote their use to various constituencies both on campus and in more remote sites. Other librarians are designing innovative instruction programs to ensure that users understand and utilize the full potential of new electronic products. Digital collections require not only major funding to create but also bring ongoing commitments for maintenance and staffing that are more extensive and qualitatively different from those associated with print resources. Assessment of use of these powerful but costly new resources is very much in preliminary stages, but is needed to provide direction for the ongoing development of digital collections.

Related Research

Carol Tenopir and Donald King have published a monograph that is, at this time, likely the most detailed and comprehensive analysis of emerging developments in scien-

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tific journal publishing.¹ They synthesized findings from over 100 studies of participants in the system of scientific communication, including scientists (as authors and readers), publishers, and organizations (universities, research institutes, and libraries.) They also drew on data from surveys of more than 13,500 scientists and thirty-two organizations and tracked characteristics of a sample of 715 scientific scholarly journals from 1960 to 1995. Tenopir and King's research was directed toward furthering a better understanding of key issues and questions among journal system participants. Their book contains numerous tables summarizing their findings and documenting the trends they identify. They also develop cost models for publishing, provision of library services, and "costs" to readers that were derived from in-depth explorations with participants concerning their roles in communicating scientific information.

Other related research includes a number of smaller scale projects focused on evaluation of electronic journals, an emerging area of interest among librarians. Some of these studies seek to develop measures of usability and to identify value-added features from the users' perspective. Others describe efforts to measure use of electronic journals by analysis of vendor- and institution-generated statistics, and these have potential to support efforts to standardize usage data so that cross-title and cross-provider comparisons can be meaningful.

Studies that employ the perspective of the journal reader have identified various aspects of content and functionality as features that seem likely to influence whether users will adopt electronic journals. Carol Franck and Holly Chambers focus on timeliness and content in their comparative study of twenty-six journals, primarily in social sciences and humanities, that were received both in print and electronic versions by the SUNY Potsdam library. Issue-by-issue comparisons provided quantitative data on availability of content by type as well as quantity and quality of graphics and other non-textual features of articles. The authors found substantial differences across publishers with respect to equivalency of print versus electronic issues, availability of issues, and quality of graphics.² Shelley Shaffer, with colleagues at the Scripps Institution of Oceanography Library, describes a study that compared the timeliness of print versus electronic issues of journals to which the library subscribed in both formats. The authors collected and analyzed data on receipts over a six-week period to support collection development decisions. The investigators reported that "84% of our print issues had electronic versions at the

time of receipt, either the same issue number or future issue numbers."³ Anthony Watkinson, speaking at the 1998 Charleston Conference, focused on issues of functionality of electronic journals. He acknowledged that scientists are both readers and authors; his remarks emphasized the reader role. Watkinson affirmed the importance of browsing and discovery to scientists as well as convenient, desk-top access to journal content. He offered examples: PDF as a preferred format that provided both text and graphics, and linking that supported easy and seamless navigation across related information. He urged a continuing conversation among scientists, librarians, and publishers to ensure that new products reflect what users want.⁴ Sarah Pederson and Rosemary Stockdale surveyed scientists at seven UK universities, and followed up with in-depth interviews of some, in order to assess their attitudes toward and use of electronic journals. Their respondents identified a critical mass of content as well as functionalities that supported ease of searching and navigating as critical determinants in their adoption of an electronic resource.⁵ Christie Degener reported on her experiences with faculty using electronic journals in a medical library setting. Health sciences researchers with whom she spoke valued the convenience and time-saving features of electronic journals including 24/7 access from office, laboratory, and home and ease of searching and navigating among articles. They cited the ability to print articles of interest, complete with color illustrations and figures, on printers located in their own departments. Degener found some evidence of changing approaches to reading journals. For example, one scientist who formerly scanned tables of contents now employs targeted keyword searches to identify newly-published articles of interest. She speculated on whether changes in reading habits would ultimately affect citation patterns.⁶

Other related research relied on statistical analyses, whether of large questionnaire-based surveys or on system-generated data from providers or vendors of electronic resources. Deborah Lenares described findings from a 1999 survey of 500 faculty members at 20 universities whose libraries were members of the Association of Research Libraries. She documented the growing acceptance of electronic journals by scholars in research institutions and interpreted her results using Rogers' Diffusion of Information Theory.⁷ Linda Mercer addressed the complexity and challenges in measuring use of digital resources. Her focus was on journal usage statistics whether vendor-provided or generated institutionally from transaction logs. She described how use statistics for Highwire Press and Ovid jour-

nals provide not only a sense of the volume of use but also the breadth across disciplines and user groups. She recommends that librarians explore measurement issues both locally and at higher levels to establish a set of minimal standards for basic use statistics.⁸ Alan Dawson has analyzed electronic journal access data and attempted to relate that data to the activities of browsing, reading, and searching by users of a collection of 249 electronic journals provided to UK users by the BUBL Journals service. Dawson offers an approach that infers details of use patterns from statistics; he proposes a measure of use, a "Search-Browse Ratio", that he argues is more meaningful than a simple count of accesses to a resource.⁹

The above references provide evidence of the increasing interest in documenting use of electronic journals. Whether the investigators collect and analyze data from users or from system-generated statistics, a picture emerges of growing acceptance of electronic resources. The details provided by these studies, and others to come, will certainly benefit decision makers in all sectors of the communication structure and inform the developers of new products and services. The study reported in this paper builds on the research recognized above.

Methodology

The author of this paper has a long term interest in studying information-seeking by faculty in scientific and medical specialties and has, with colleagues, published results of analyses of surveys, citation studies, and use statistics to document the adoption of electronic resources.¹⁰⁻¹⁸ Our surveys of faculty have provided evidence that faculty in the pure and applied sciences are adopting information technology; our analyses of vendor-provided use statistics document levels of use that continue to increase. The study described here builds on our previous work and explores how networked resources available to the desk top and laboratory bench are changing the work patterns and behavior of researchers. This research employs structured interviews with selected faculty in the basic and health sciences to learn the details of their use of the library's digital collections and other Web-based resources. Much of the focus is on electronic journals although use of other networked resources appropriate to each faculty member's discipline has also been investigated.

Some of the aspects of use of digital collections that were investigated include:

- uses of e-journals (current awareness, known item searches, subject/author searches, etc.);

- perceptions of quality of e-journals (those with print counterparts versus e-only titles);
- expectations of functionalities for electronic products;
- involvement in e-publishing initiatives (Web site development, e-journal boards, e-print databases, etc.);
- reliance on print for personal files;
- use of large data repositories (e.g. gene sequencing data);
- use of technology applications such as chemical libraries, geographic information systems, etc.;
- involvement in technology-enabled collaborations

Because this research employed human subjects, the investigators were required to submit documentation to the university's Institutional Review Board that monitors all human subject research on campus. Our protocol was approved by that body.

Selection of Faculty for Interviews

Electronic journals and databases are changing the way scientists and scholars access information. Sociologist Everett Rogers is well-known for his diffusion of innovation theory that describes the early stages of adoption of an innovation.¹⁹ He describes the "early adopters" as leaders in the acceptance of an innovation. We utilized our years of personal contacts with UIC faculty in the basic and health sciences to identify a group of faculty who appear to be early adopters in their use of digital collections. These individuals were contacted by e-mail using the letter in Attachment A; interview questions (Attachment B) were supplied as well to provide a better understanding of the information we were seeking. Faculty who agreed to participate were visited in their offices by two investigators. One investigator conducted the interview; the other took notes on a response sheet that listed the questions asked. The interview questions are general, but intended to provoke thought that would be explored through discussion. No personal identification on the study participant was recorded on the response sheet.

Initially we identified 20 to 30 faculty to interview representing a broad cross-section of basic, applied, and health sciences disciplines. In our discussions with participants we asked them to identify other colleagues who are users of electronic resources, enabling us to employ a "snowball" sampling frame to expand our population.

Analysis of Interview Data

After interviewing all participants, responses were analyzed to identify patterns of information-seeking behavior and emerging trends in the use of digital collections. Individual

respondents were treated as discrete case studies, but no personal information was retained that would allow a respondent's anonymity to be compromised. A respondent's specialty was recorded as that information will be useful in identifying discipline-specific trends. Any record of names of respondents will be destroyed upon completion of the study.

Hypotheses

Both previous research and the investigators' own experiences suggest that adoption of electronic resources by research scientists is a complex process influenced by their participation in the system of scientific communication as both producers and users of information. For many scientists electronic journals are increasingly important to their research and teaching activities. The following characteristics of electronic journals were hypothesized to be key determinants in the adoption process.

Content characteristics

- critical mass of a title, enough issues and volumes;
- critical mass of titles in a subject-delineated collection provided by an aggregator;
- full equivalence to print issues, including all articles and other content, whether research or other information; and
- timeliness of appearance, before or simultaneous with appearance in print.

Functionality characteristics

- searching capabilities that support browsing, locating known articles, and subject/author retrieval;
- ease of navigation with minimal need to view screens not directly related to user's goal in using the resource;
- links to other articles, abstracts, e-mail for authors, etc.
- high quality printing capability; and
- seamless movement among related resources

Our discussion questions were designed to elicit responses from participants that provide insights on those features of electronic journals that we hypothesized would influence acceptance of the resource. At the same time, we also hoped to learn about other features that we had not considered to be key determinants. We asked open-ended questions because we wanted participants to provide details of their use of resources that would go beyond the structured responses of a survey instrument.

Preliminary Findings

Faculty in research universities are active participants in the transforming system of scientific communication. They

receive news of new electronic resources through numerous channels that range from the popular media to the scientific journals they read. Most of them have fully assimilated use of bibliographic databases into their information seeking behavior. They also use e-mail and the Web to locate information and communicate with colleagues. Increasingly, they are finding the value-added features of electronic journals make these preferred over print counterparts. The following case studies describe some of the changes that, when spread across disciplines, will result in new approaches to seeking, using, and generating information.

Professor in Paleontology

Professor A is the Web master for a scientific association in his specialty. He has designed a site that provides member support and information on current conferences and research, but that also promotes the field to others, especially to students. He is enthusiastic about the new opportunities to communicate what is happening in his field to a much wider audience.

Professor in Medicinal Chemistry

Professor B reported that he is using SciFinder Scholar on a daily basis—"spending about an hour a day searching." He is supervising several doctoral students and uses the databases and the linked electronic journals to identify related research.

Professor in Physics

Professor C has urged the library to use scarce in-library shelf space to house older issues of physics journals that are currently either in an on-site storage area or an off-site warehouse. He argues that "all physicists" now read their current journal issues online and don't use the library print issues. He would prefer to have the older material that has not been digitized readily available; presently those stored items must be requested and retrieved by staff.

Professor in Biological Sciences

Professor D is an avid user of electronic journals; she regularly recommends purchases of new titles that come to her attention. She reported that she no longer prints copies of articles that interest her, but rather bookmarks them for later reference.

Professor in Medical Education

Professor E uses an online medical textbook (Harrison's) and MDConsult in his courses for medical students. He is

enthusiastic about the 24/7 access and added-value features that these resources provide to his students.

Conclusions

Faculty who use electronic journals are enthusiastic about their benefits, but critical when a particular resource fails to offer features that they consider basic to the genre. They expect to find more than an issue or two digitized and are not likely to be repeat users of those titles that do not appear in timely fashion. If an electronic journal offers more content than its print equivalent that's a plus, but offering fewer articles or cutting other content categories is unacceptable to them. The most-valued electronic journals appear to be those that have long been high-impact, peer-reviewed print titles. These are the titles that faculty most frequently request for acquisition in digital versions.

Faculty users of electronic journals appear to be satisfying their current awareness needs by browsing the digital equivalent of favorite titles, rather than visiting the library to scan the latest issue. Anecdotal evidence from library staff collecting materials for the bindery corroborate that finding; they report discovering unbound issues on the shelves in receipt order for those popular titles held in electronic form. In the UIC Science Library this was particularly dramatic when Elsevier ScienceDirect titles in chemistry were made available. When faculty search databases, they appreciate links to fulltext; increasingly they *expect* such features. During the present time of transition when some, but not all, possible links are present, library staff are called to upon to explain the complexities of access that prevail. For example, the recent introduction of SciFinder Scholar with direct links to fulltext articles through its ChemPort connection stimulated inquiries about whether the library held electronic subscriptions to titles that are not linked in SciFinder Scholar.

Many users continue to build the article collections that were typical in the print-based journal world, and they use systems of organization they devised to manage those files. With electronic journals they appreciate the convenience of printing from their desktops at odd moments in their busy schedules. When users print articles of interest; PDF files appear to be preferred. Other users, fewer in number, are not necessarily printing, but are building personal files of references or bookmarking articles of interest.

The transition from print to electronic journals is well underway in the basic and health sciences. Scientists are adopting the new genre and, gradually, are changing some of the ways they work.

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Notes

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Appendix A

Sample Letter

To: SELECTED FACULTY IN SCIENCES AND HEALTH SCIENCES
From: Julie Hurd, Ann C. Weller, Deborah Blecic, and Martin Brennan
Re: Digital Collections

The UIC Library is engaged in building digital collections of electronic journals, databases, and other electronic resources to support faculty research and teaching activities. The providers of these resources supply us with some measures of use, but these measures tend to be numerical counts of sessions or logons that tell us little about the details of use that would better allow us to evaluate these expensive purchases. We are seeking input from faculty on how these resources meet your needs so that we can more effectively allocate our funds for future acquisitions.

You are known to us as a faculty member who has expressed interest in electronic resources. We would like to meet with you in your office at your convenience to talk about your use of electronic resources. We believe that digital collections have the potential to change the way scientists work and communicate, and we hope you will be willing to share your thinking on these issues with us. Attached are questions that we would use to guide that discussion; we estimate that the interview would take no more than 45 minutes of your time.

Your participation in this project is entirely voluntary; your anonymity will be maintained throughout the research. Only aggregated responses will be used in any reports.

If you are willing to talk with us, please respond to Julie Hurd at jhurd@uic.edu. We will be in touch to schedule a mutually convenient time to meet. If you have questions, please ask. We look forward to talking with you.

Appendix B

Faculty Use of Digital Collections Discussion Guide

As you are aware the UIC Library is building a collection of electronic journals or “e-journals”. The following questions relate to your use of these. For the purposes of this discussion we are defining an “e-journal” as “a scholarly journal that is available on the Internet and may or may not have a print version.”

- How did you first learn of e-journals?
- How often do you use e-journals?
 - Daily
 - Weekly
 - Monthly
- Which ones?
- Do you have any bookmarked in your Web browser?
- How do you get to them?
 - Personal subscription
 - Library Web page list of e-journals
 - Hotlinks in other articles or databases
 - UICCAT
 - Through a publisher’s or aggregator’s collection on the Library Web pages
 - Other
- What do you use e-journals for?
 - Scan latest issue articles
 - Scan tables of contents
 - Read preprints on the journal Web site
 - Search for cited article
 - Search for subject or author
 - Set up SDI / personal alert service
 - Other
- Do you search publishers’ (aggregators’) collections by subject or author?
- Do you read full articles on your computer screen?
- Do you print articles of interest?
- What features do you expect to find in an e-journal? (more data than in print, graphics, video, audio links, etc.?)
- What extra features do you particularly appreciate when they are present?
- What would be the most innovative feature you can imagine?
- What do you dislike/find frustrating about current e-journals?
- The next questions pertain to other electronic resources available on the Internet and to your use of the Internet to communicate with colleagues.
- What other Web-based resources do you use?
 - Databases
 - Data banks (Human Genome Project, chemical libraries, etc.)
 - Pre-print archives
 - Association/organization Web pages
 - Other
- How can the library help you with this type of material?
 - Instruction in use
 - Notification of new resources
 - Easier access
 - Other
- Has electronic access to information changed the way you do research, publish, or teach?
- Are you actively involved in electronic publishing in any way? (serve on board of an e-journal, contribute or edit one, etc.)
- Are you involved in any collaborative research project where data is shared on the Internet? Please describe.
- Is there anything else on a related topic you would like to discuss?