The Use of Electronic-Only Journals in Scientific Research

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Abstract

Journals that are published exclusively in electronic format present an innovation in the way that scientific information is communicated to the research community. Significant concerns remain regarding the impermanence of materials in electronic formats and the use of innovative features of electronically formatted material. It has taken some time for the e-only journals to become integrated into scientific information systems, indexed by major services, appear in library catalogs, or cited by other researchers. This article surveys the current place of the e-only journal within the information system.

Keywords: electronic journal, e-only journal, indexing, cataloging, citation analysis, scientific communications

The use of print journals has developed over several centuries and during that time these journals have evolved in specialized ways to fulfill their primary activities. Rowland (1997) describes the four major functions of a scholarly journal as:

- Dissemination of information
- Quality control,
- Canonical archives, and
- Recognition of authors.

Electronic journals were first suggested some years ago as a possible means of revolutionizing the world of research journals. Electronic journals could be distributed more economically than paper journals, because the main costs of preparing the text, the review process and other like procedures are not as capital intensive as the costs of printing and mailing print copies. Consequently, it was hoped that the financial costs of journals in the electronic environment could slow or reverse the escalating costs of scientific journals.

Accessing print journal articles has long involved a number of methods including the use of a variety of both specialized and general indexes, library catalogs, references/citing from other articles, and recommendations from readers and colleagues. When electronic journals first appeared they fell outside the formal communication patterns, especially that of journal indexes and library catalogs. This caused concern about "academic respectability" and "archival access."

Our study hypothesized that for electronic-only journals to become a part of the traditional scholarly system of research they must be included with other journal articles in the major academic indexes, included in library catalogs, and cited by researchers. We set out to determine:

1. How many scientific e-only journals existed,
2. If and where scientific e-only journals were being indexed,
3. If libraries were cataloging scientific e-only journals,
4. If e-only journals were being cited by researchers, and
5. Whether or not relationships exist among these variables.

What Are E-Only Journals?

Our first challenge was to determine a definition of the term e-only journal for our study and identify the current e-only journals available. To accomplish this we felt that we must initially agree on a definition of e-only journals as accepted in the literature. There is a great deal of ambiguity about the use of the terms electronic or online journals in the literature. There is no single agreed upon term for journals published only in...
electronic/online format versus the electronic/online version of a print publication. Existing literature on electronic journals either does not make the distinction or is primarily concerned with the electronic counterpart of print.

Although the literature contained multiple uses and definitions for the terms "electronic-only journal" "electronic journal" and "e-journal," for the purposes of this article we chose e-only journals to mean electronic journals that are originally published only in electronic format. The phrase "electronic journal" is used to denote a broader category of electronic publications that may or may not have a print counterpart. Throughout the remainder of this article we will quote from authors who use a variety of terminology to describe electronic journals. When we use another author's terminology for "electronic journals" we will put their term in quotes.

Langscheid (1992) made an early attempt to distinguish between "electronic journals," journals in electronic format only, and the electronic publications with a parallel print counterpart, "online journals." These definitions formed the basis for a new column in Serials Review, "Electronic Journal Forum," that was intended to be a forum for issues involving electronic journals. The column did not become a regular feature in the journal, and the common usage of the phrase "electronic journal" has evolved to a much broader definition including any journal available electronically. According to Jones and Cook (2000)

"an e-journal is a digital periodical that publishes on the Internet or WWW. An e-journal may not be all that different from a print journal in the fundamental editorial process. Articles are submitted by individuals in the academic and practice community, are peer reviewed by editorial board members of the journal to be accepted or rejected, and are subsequently published. It is the digital medium that is different.

In their discussion of the definition of e-journal, they go on to provide a smattering of similar definitions from the current literature. They quote a 1999 article by Sparks who states that "Some consider any communication via electronic medium to be electronic publishing -- but electronic publishing and e-journals are not synonymous." Jones and Cook (2000) go on to state "another type of journal that is not an e-journal is the 'dual' publication." These are web sites that provide information about articles in the printed journal. These sites are mainly intended to direct the reader to the printed journal or to promote document delivery of articles. Often there is not an actual electronic version of these articles. Murray and Anthony (1999) called these pages "websites." Quinn (1999) states that "the term 'electronic journal' refers to exclusively electronic publications, that is, those Internet-based journals with no print counterpart." Harrow's Librarians' Glossary and Reference Book (Prytherch 2000) defines "electronic journal" as "Strictly a journal in which all aspects of preparation, refereeing, assembly and distribution are carried out electronically."

Why Worry about Access to E-Only Journals?

What are the issues that will inevitably control the use of e-only journals? The literature seems to focus on four: economics, access, legitimacy, and instant interaction. "The explosion of e-journals has resulted from two converging forces: economics and advances in networked information technology" according to Jones and Cook (2000). They describe how increasing costs of journals from traditional print publishers have affected journal purchasing by academic libraries and how some of the lower costs of "e-journals" can help solve this problem. Harter (1998) states that,

"to transform scholarly communication as some have predicted or even to have a measurable impact on it, e-journals must become an integral part of the scholarly process. Authors must read and contribute to e-journals. They must be influenced or affected by the findings reported, so as to build or modify their own research and scholarship on the content of e-journal articles. Only if this occurs can e-journals be said to have an impact on scholars and researchers in the disciplines they serve."

Jones and Cook (2000) claim that "e-journals" are a new method of delivery of knowledge and building scholarship. They report that "e-journals" have "produced an advanced method of scholarly interaction in the sense that individuals can respond instantaneously to the articles and their responses can be published as soon as editors receive them." This creates a more dynamic interaction than in the print journals. The peer-review process assures that the information in the journal is reliable and indexing assures that the information is available. Because "e-journals" are new to publishing it is often more difficult for them to meet the citation criteria for scholarship.

One of the major reasons for this is the issue of academic respectability of e-only journals. Gessner (1996) asserted that "due to the factors of economics, space and access, the continued growth of electronic journals is inevitable." He goes on to state "though the technological changes support the increasing frequency of e-journals over their print counterparts, changes in attitude are much slower to appear." Gessner also addressed the "legitimacy" issue by stating that,

"the maxim of 'publish or perish' is taken seriously by academics seeking tenure, and the issue of tenure looms large in any discussion of the legitimacy of electronic journals. Although in some disciplines it seems to be accepted that being published is being published, regardless of the medium, in most fields refereed print journals are more respected and therefore get more submissions. This limits the first-rate material available to e-journals and helps to perpetuate their perceived inferiority. Researchers in the United Kingdom have a formal policy regarding the validity of the e-journal in the tenure process...referred journal articles published through electronic means will be treated on the same basis as those appearing in printed journals."

E-only journals offer several advantages that cannot be translated to a printed version such as increased speed of production through electronic interaction between authors, editors, and readers; availability through computer networks; and use of multimedia (molecular models, audio clips such as bird calls, or video clips of a chemical reaction taking place). As noted by Hitchcock, et al., (1998), "Some electronic journals are beginning to demonstrate and exploit the potential of the new medium. The next stage should be to see real examples of multimedia enhancements involving sound, video and simulations, particularly in the fields of biology and medicine."

One of the earliest reports of e-journal indexing was in a column from Serials Review by Langscheid (1992) describing how New Horizons in Adult Education, an e-only journal, was first indexed in ERIC. Originally indexing services were hesitant to cover e-only journals because of fears about the possible ephemeral nature of the medium and the lack of stable access to web sites (Boyce 1997). Rentschler (1998) described efforts by the H.W. Wilson Company to index "electronic journals" and provided a very good summary of the problems associated with this process. These problems included notification of new issues that were ready to be indexed, keeping up with URL changes, and identifying the existence of new journals. Rentschler and her colleagues had to develop methods of dealing with new issues and articles, including making decisions on what information needed to be provided in their records. Additional issues that arose included citing pagination versus file size and listing all methods of retrieving articles (gopher sites, FTP, web archives, telnet, e-mailing of articles, etc.).

Most of these concerns about indexing arise because e-only journals do not always follow the rules of traditional serial publications. Some titles
publish articles as soon as they are ready for publication rather than waiting for regularly defined issues. Some allow readers to submit "comments" or critique the article post-publication. And some allow the article text to be modified by authors after publication. Gessner (1996) wrote that,

the majority of e-journals are not included in the standard scholarly indexes, and therefore are virtually unavailable to the scholarly researcher...lack of permanence also contributes to the second-class status of the electronic journal within the academic world, which in turn reinforces the ambivalence with which most index publishers view the electronic journal.

There are definitely a number of factors influencing the ability of individual e-only journals to survive and/or flourish. While most articles mention credibility and journal reputation as the most common factors, Kiernan (1999) also suggests that "if the journal is not indexed, scholars may never find papers it has published that are relevant to their research, and other researchers will not be interested in submitting work to it." This concept is reinforced by a recent study of "electronic journal" usage among British university faculty, which demonstrated that the most common reason for non-use of electronic journals (given by 68.52% of respondents to a survey) was the lack of awareness of relevant publications (Tomney & Burton 1998).

Quinn (1999) examined the current state of "electronic journal" indexing in the social sciences; rather than looking at specific journals, he investigated and documented vendor-indexing policies for electronic journals. He stated, "Indexing will play a crucial role in helping electronic journals gain acceptance into the mainstream of academic research. Indexing service providers seem to be waiting for cues from scholars, publishers and librarians before taking significant steps in this direction." He found there were a number of issues related to use--or the lack of use--of electronic journals by librarians, faculty and students. These included:

- Availability
- Full-text searching
- Accessibility and stability
- Price
- Text mutability and authority
- Speed of publication
- Article length
- Media and hyperlinks
- Lack of standardization
- Citation
- Quality
- Permanence
- Critical mass and index/abstract coverage

Libraries are the major archive of journals for most scientific researchers and must be involved in providing access to e-only journals. Fosmire and Young (2000) described library access to free "electronic journals," in all subject fields. This included links on library web pages, coverage by major indexing services and whether or not they were cataloged in OCLC. Fosmire and Young found that "mere existence of free scholarly e-journals does not automatically mean that libraries should provide access to them. On some level, the journals need to be of good quality and useful. In general libraries state...that e-journals undergo the same selection process as print journals." Some of these factors included:

- Importance of the periodical, as indicated by its inclusion in standard lists,
- Importance of periodicals subject matter in relation to the university's educational goals,
- Inclusion in the periodical in indexes and abstracts,
- Authoritativeness as reflected by recommendation or criticism,
- Reputation and standing of the publisher, and
- Price.

Harter (1996) mentions that in 1968 R.K. Merton said, "Citations are a fundamental part of the scholarly communication process. They reflect the reward system of science and technology and have been called the currency of scholarship." Therefore, Harter's approach was to determine citation counts with the assumption that citations reflect influence or impact. We are also using citations to measure the use of e-only journals by scientists. Our article examines the extent to which scientific e-only journals are becoming part of the mainstream scholarly research process as demonstrated by their inclusion in standard indexing tools, library catalogs, and citation in research journals.

Methods

Defining e-journals for this study:

At first glance, the concept of "e-only journal" seemed adequately well defined, but there were a number of instances where this proved inadequate or murky. Several electronic publications provide alternative article access afterward such as an annual or quarterly print volume. In these instances, the distinguishing characteristic appeared to be the lack of a simultaneously issued print counterpart; hence, the phrase "original publication in electronic format" in our criteria. For the purposes of this article we chose to use e-only journal to mean electronic journals that are originally published only in electronic format, although in a few instances titles have an annual archival print version.

Identifying the titles and creating the list:

Locating a list of electronic journals was not difficult; there is a plethora of seemingly endless choices available via many library web pages. No one list is restricted exclusively to e-only journals. The difficulty was to sift through the lists to locate those journals that are only available in electronic format. Searching the term "electronic-only" in search engines and databases often produced lists of false hits for titles that offered an electronic-only subscription rate. Most of these had a print counterpart with a separate subscription rate.

William Loughner's Full-Text Science Journals on the Net is a noteworthy listing in that it contains only scientific journals and provides hot links to easily access the journal web pages. The label "web-only journal" within his list was a misnomer as some are links to databases such as AGRICOLA. Loughner's labeling of the items on the list as "web-only" is also inaccurate because the list contains journals with print counterparts.
Determined eligibility of each title:

A sampling of journal web pages were accessed and examined to determine what criteria we might want to use for accepting or rejecting a title for inclusion in this study. Some web pages contained little or no information on the sponsoring organization, how articles were chosen for publication, or how often new material was added. In some cases, it was difficult to determine publication date(s). Following the lead of Quinn and others, a decision was made to restrict the study to scientific e-only journals that met the following criteria:

- Currently being published
- Peer reviewed
- Original publication in electronic format
- Research oriented
- 2-3 years of archives (20 articles minimum) available
- Contain English language articles and
- No subscription required

Since many e-only journals do not follow the rules or patterns of traditional publications, the selection criteria were refined to fit some of the unique aspects of electronic publishing. In a number of cases, it was not possible to tell how recently the journal had been updated. For the purposes of this study, there needed to be some indication that the title was currently being published or still active -- either by current copyright date or other information indicating there had been a recent addition to the site. Stability of the publication is a key criterion for many major indexing services and therefore necessitated limiting the study to publications with a proven publication record. When the study was first being discussed, it was assumed that only free titles should be considered because there would be access problems with subscription titles; however, most subscription titles make the information needed to evaluate them readily available (and only restrict access to the full text). The criteria were modified to include subscription titles where sufficient information was accessible. Evaluating articles as research-oriented necessitated being able to view enough information either in the "about" section, table of contents, or abstract to form an opinion. Publications were eliminated from the study if they did not meet all of these criteria.

Once the criteria were clearly established, each potential title was individually evaluated by visiting its web page(s). We reviewed approximately 1,000 publications for possible inclusion in this study. Information gleaned was used to further validate a title's inclusion or exclusion in this project. Titles were then checked in OCLC WorldCat and Ulrich's International Periodical Directory to obtain any information unavailable from the journal's web pages including: ISSN, date first published, indexing (if given), number of libraries holding/cataloging record, frequency, peer-reviewed status, and publisher. The final list contains 144 titles, considerably more than the 39 identified by Harter in 1996; just five years earlier. This list of titles is shown in Table 1, Column A.

Surveying the Indexing Services:

To locate information about electronic journal indexing policies and a list of which electronic journals they indexed, we used information that was available from publisher web sites or other sources such as "list of journals indexed," Ulrich's, and OCLC WorldCat. Publishers, for whom this information could not be located, were contacted directly by phone or e-mail in an attempt to further identify electronic titles that might have been missed; their criteria for journal selection; and, whether or not they had a different policy for e-only journals than print journals. The questions asked of the indexing vendors included:

1. Do you index any e-journals at this time? If not, why?
2. What criteria do you use to select e-journals for indexing?
3. How are prospective titles identified?
4. Are there any special problems that you’ve run into in indexing e-journals?
5. What are your plans for indexing e-journals in the future?
6. Do you have a list of e-journals you currently index?

Determining library holdings of e-only journals:

Another concern was whether libraries are treating e-only journals on an equivalent basis with other scientific journals. One measure of this is to determine if libraries were cataloging them. OCLC WorldCat database was used as the measure because it is used by over 23,000 libraries, to identify their holdings as part of their cataloging process. Statistics were recorded for the number of libraries holding each of the titles (Table 1, Column D). Determining citation rates for e-only journals: To determine the usage of e-only journals we followed the example of Harter and others and checked each of the journal titles on our list in ISI's Web of Science using the "Cited Reference Search." This feature is unique to Web of Science and provides the ability to search for journal names within cited references. A decision was made to check for citations occurring from 1999-2001 in either Science Citation Index (SCI) or Social Science Citation Index (SSCI) since many of the journals had only began publishing in the last couple of years. SSCI was included (even though our study was limited to scientific journals) since many computer science and environmental journals are covered in SSCI but not in SCI. It was also necessary to search for multiple variations in the abbreviation for a particular journal title due to inconsistencies in citations. For example, Electronic Journal of Biotechnology - EJB was cited several different ways: "EJB Elect. J. Biotech.," "Elect. J. Biotechnol.," and "Elect. J. Bio." One title that was particularly difficult was Issues in Science and Technology Librarianship. Many of its citations were listed as "Iss Sci Tech" that meant they were interspersed with citations to Issues in Science and Technology, a publication of the National Academy of Science. Questionable cases were compared with the contents of the journal to distinguish between the two publications. In a few cases, when a journal had a very large number of citations, it was necessary to search each individual year from 1999-2001 instead of searching the years simultaneously because Web of Science has a limitation on viewing more than 500 entries. Statistics were recorded for the number of articles cited as well as the total number of times a given journal had been cited. These numbers are in Table 1, Columns M & L, respectively.
Statistical analyses

The information gathered enabled us to determine the significance of some of the variables in this study using the Spearman rank order correlation coefficient. To determine the relevance or degree of relationship between the variables in the study, we determined (with the assistance of a university statistician) that the use of the Spearman rank order coefficient was the best way to describe the relevance of our data. The Spearman coefficient, often referred to as Spearman's rho, is best used to assess the strength of the relationship between two variables when the range of values is extremely wide making the Pearson's product moment less valid. Spearman's rho was used to determine the correlation of variables where significant correlations were accepted at the .01 to .05 levels.

Results and Discussion:

Subjects represented

The topics represented in the peer-reviewed, e-only journals used in the study were as follows:

- 45 Biology/Medicine (27 are clearly medicine, 14 others border it closely, 4 are purely biology)
- 32 Mathematics
- 22 Computer Science
- 12 Engineering
- 8 Physics
- 8 Chemistry
- 8 Psychology
- 5 Agriculture
- 4 Geology
- 5 Other (1 each for archaeology, architecture, geography, science education, science librarianship)

Titles were occasionally counted in more than one category if the journals subject coverage was broad enough to merit it (e.g., the journal Discrete Mathematics and Theoretical Computer Science was tallied in both mathematics and computer science categories). A large number of titles are in the biological and medical areas, closely followed by mathematical and computer sciences. The range for the number of times a subject was represented in this study was from 1 to 45 with the mean being 10.6 with a standard deviation of 13.4. These findings support those of Hitchcock, et al. (1996) who found that medicine and biology were the most popular subject areas for "e-journals."

Pricing of e-only journals

Data gathered on the occurrence of subscription pricing showed that when comparing free versus paid subscriptions 85% (122 of 144) of the titles provide free access:

- 114 free to all
- 6 free but require registration
- 2 free to individuals, but request institutions to subscribe
- 122 Total with free access
- 22 require paid subscriptions

An additional trend discovered during the duration of our study is that several titles have been acquired by major commercial print publishers, such as Springer, who now charge for access. A growing number of e-only journals are requiring subscriptions or user registration. Many publishers offer free access for a year or so and then institute subscription pricing. For the purposes of this study, if a title was free for a trial period and then began to require a subscription, the title was counted as a subscription title.

One symbol of the growing trend to "legitimize" e-only journals is demonstrated by the acceptance of the use of ISSN by publishers. Only 20 titles (14%) in our study do not have ISSNs (Table 1, Column C). In most cases, these ISSN are prominently displayed on the home page of the e-only journals, just as it is printed on the back/front cover of print journals. This seems to confirm the publishers' intent to treat these journals as serious scholarly publications by conforming to established standards.

Indexing of e-only journals

Access to journal articles has been traditionally facilitated by their appearance in the subject indexes for their fields. Our survey of the indexing service vendors found that many of the criteria listed by Quinn (1999) are still being mentioned by indexing service personnel as reasons for or against indexing "e-journals." Some challenges cited by index publishers included:

- Lack of notification that a new issue had been published,
- Irregularity of publication in general,
- Lack of page numbers, and
- Instability of URLs.

One of the vendor representatives, who asked not to be identified, stated "we have slightly stricter guidelines for selecting electronic journals in that we require more evidence of stability and regularity." Zoological Record staff noted that it is often difficult to decide if an "e-journal" is actually only electronic; they stated that their normal preference would be to cover print versions. They stated that their citation style and logging-in systems are geared toward volume/issue numbering used by print publications. E-only journals do not necessarily follow this model; articles may have no numbering at all and some journals have open-ended volumes where they continue to add new articles over a period of time, which can be problematic. GeoRef staff indicated that their main problems with e-journals included: monitoring them for changes in URL (the U.S. government has been particularly bad as agencies move their web pages, but they have become more aware of this issue and are improving) and finding out that e-journals exist in the first place. INSPEC includes URLs in citations from e-journals and says that the problem of identifying new journals is being handled by recommendations from publishers or scientists and being "discovered" by in-house staff. STNews stated that for
INSPEC, "the type of electronic journals selected for indexing will contain peer-reviewed articles that are permanently stored in an archive maintained by the publisher." There was considerable variation in whether or not indexing services included e-journals. The growing trend seems to be to treat e-journals as identical to printed journals in determining whether or not they should be included in a major indexing source. Most indexing services indicated the need for journals to be peer-reviewed and regularly published with an archive. Data about databases/indexing services and their qualifications for including e-journals are shown in Table 2. Like Fosmire and Young, we counted the number of titles indexed by each indexing service:

- 30 Chemical Abstracts
- 21 Zentralblatt für Mathematik
- 17 Science Citation Index
- 14 INSPEC
- 14 MathSciNet
- 13 Current Contents
- 11 Zoological Record
- 9 EEVL
- 7 Biological Abstracts
- 7 MEDLINE
- 5 GeoRef
- 4 CINAHL
- 3 AGRICOLA
- 3 ERIC
- 3 Sociological Abstracts
- 2 Psychological Abstracts
- 2 Social Science Citation Index
- 1 ACM Digital Library
- 1 Current Index to Statistics
- 1 ECImpendex
- 1 Library Literature
- 1 Philosopher's Index

Fosmire and Young (2000) in their study found that MathSciNet indexed the most "e-journals" (83%). Our results differed considerably in that we found that Chemical Abstracts indexed the most e-only journals (21%). In our findings MathSciNet was the fifth largest indexer, although Zentralblatt für Mathematik was second highest. This discrepancy can be best explained by examining the scope of journals included in each study. Fosmire and Young included any journal with an electronic version not just e-only; a substantial number of mathematical journals appeared to be available in both printed and electronic formats when we reviewed them. Chemical Abstracts indexes 30 titles but we only classified eight of our titles as being primarily chemistry. We identified 14 medical e-only journals but MEDLINE only covers seven of them. It is possible that the problems that vendors have cited in learning about e-only journals have prevented some of them from being recognized as appropriate for their coverage.

The rate of indexing for the titles included our study was as follows:

- 95 (67%) are indexed by at least one indexing service
- 53 (37%) are indexed by only one indexing service
- 43 (30%) are indexed by two or more indexing services
- 49 (33%) do not appear to be indexed anywhere

One-third of the peer-reviewed, science e-only journals included in this study are not indexed in any identifiable resource. Fosmire and Young (2000) found that only 42 percent of the "e-journals" in their study were indexed by a major indexing service; the difference in results between the two studies can be explained by looking at the scope of the journals compared. Fosmire and Young did not limit their study to peer-reviewed titles and non-peer-reviewed titles are much less likely to be covered by major indexing services.

While looking for information on where journals were indexed, Edinburgh Engineering Virtual Library (EEVL, http://www.eevl.ac.uk/) was unexpectedly discovered as an indexing source. Though our original focus was on traditional major print indexes EEVL is a conglomeration of various engineering resources on the web. Discovery of this resource as the sole index of a few e-only journals indicates that the electronic medium may become the home of new indexing services as well as e-only journals.

**Cataloging e-only journals**

The second major concern of this study was how libraries are handling access to e-only journals. Fosmire and Young (2000) found that of the 213 journals in their study, 56 (26%) had no holdings in OCLC. Our study found only 5 (3.46%) of the titles had no OCLC holdings and this figure dropped during the course of our study; at the outset of the study, 15 titles (10%) did not have OCLC records. This seems to be an encouraging trend. Titles cataloged in OCLC are more likely to be included in online library catalogs, expanding access to these journals beyond the access provided by traditional indexing services. There was a wide range in the number of libraries that had cataloged any given title in OCLC from 0-571. The record with 571 library holdings was for Osler Medical Journal -- a former print publication. This particular record was originally created for the print publication and had an added URL to indicate the electronic version. OCLC holdings for other titles may also reflect that libraries have added the URL to the print record rather than creating a separate cataloging record for the electronic version. Our summary of how e-only journals are cataloged by libraries, as indicated by the number of OCLC institutions listing holdings for each journal, are shown in the following table:

- 5 titles = 0 holdings
- 74 titles = 1-10 holdings
- 17 titles = 11-20 holdings
- 19 titles = 21-30 holdings
Using the Spearman $\rho$ test, it was determined that there is a significant correlation between the age of the e-only journal and the number of times it has been cataloged by an OCLC library (0.0111) and between the number of indexes it is cited in and the number of times an OCLC library cataloged it (0.0006).

Citing of e-only journals

We were concerned with whether or not researchers are using e-only journals. At the beginning of this study, our assumption was that the titles we had heard more about and that were more broadly indexed would also be the most widely cited. The only good measure that exists at the current time to do a count of the number of times an article has been cited is to use ISI’s citation indexes. Although this is not the definitive proof that an article has been cited and a lack of inclusion in ISI indexes does not mean an article has not been cited, it only shows that it has not been cited by a journal covered by ISI indexes. The e-only journal citation analysis in Web of Science is significant. The total numbers of citations per title are as follows:

- 36 titles = 0 citations
- 35 titles = 1-5 citations
- 14 titles = 6-10 citations
- 20 titles = 11-25 citations
- 12 titles = 26-50 citations
- 9 titles = 51-100 citations
- 9 titles = 101-200 citations
- 3 titles = 201-500 citations
- 3 titles = 501-1000 citations
- 3 titles = 1001+ citations

Eighty-five titles were cited 10 or fewer times, forty-one titles were cited 11 to 100 times, and only eighteen of the titles were cited more than one hundred times. Using the Spearman $\rho$ test results, we were able to determine that there was a highly significant correlation at the .0001 level between the:

- Number of indexes including a journal title and number of times the journal was cited,
- Number of indexes including a journal title and the number of articles cited, and
- Number of articles cited and the number of times a journal was cited.

There was a correlation at the .0305 level between the number of libraries cataloging a journal in OCLC and the number of times it was cited and a .0335 level of significance correlation between the number of libraries cataloging a title in OCLC and the number of articles cited.

Conclusion

There are a growing number of e-only journals being published and our research indicates a growing acceptance of this format. Two thirds of the e-only journals identified by our study are being indexed by major indexing services and indexing services appear to be working out the problems associated with indexing e-only journals. Scientists are finding these new publications and citing them. Libraries are serving their role in the research process by providing access through their online catalogs. There are still several seemingly viable titles that have not been selected for indexing for one reason or another; it does not appear to have completely limited the visibility of articles among researchers. Two titles were not indexed anywhere but were heavily cited -- *Psyche* and *J. USC: the Journal of Universal Computer Science*. One consideration for further study would be to determine how those titles that are not indexed but are being heavily cited are being discovered by researchers; the issue of the "invisible college" (the interaction or scholarly communication between colleagues) may be a partial factor.

Considerations for further study

This study has addressed several concerns about the indexing of e-only journal articles, but it has also raised a considerable number of other questions that suggest areas for further research:

- How do libraries compensate for the lack of access points to electronic articles?
- Have libraries assigned call numbers to e-only journals?
- Do libraries provide a list of known e-journals on their web pages?
- What are the usage/behavior patterns of scientists using e-only journals? Do they rely on indexes or do they go straight to the web page for a journal?
- Are articles indexed in web search engines? Can researchers do a subject search in a web engine and still come up with articles inside a given e-only journal?
- How do search engines deal with articles from journals that require a subscription? Can the search engine even index it?
- To what extent is the growing body of e-only journal publishing self-referential -- i.e., do e-only articles tend to cite other e-only articles?

Appendices

Table 1: E-Only Peer-Reviewed Scientific Journals
Table 2: E-Only Recommended Scientific Journals
Table 3: Database Vendors Information Table

References


