Electronic or print: Are scholarly journals still important?

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The author's work in collaboration with Donald King has encompassed many studies over a 25-year period that have provided a wealth of data on the usage of scholarly journal articles by scientists. She uses the data to arrive at some major conclusions about scientists' behaviour: they read a lot, the material from journals is essential to them, they use different ways to get hold of the material, they use electronic sources when convenient, and journals in many fields divide into core and peripheral titles – core titles obtained on subscription and peripheral material as separates.

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Introduction

My title is 'are scholarly journals still important?' The answer is yes. I will give you some evidence from the research that I have been doing with Donald King. Certainly there have been and there will need to be continuing changes in scholarly journals, but the answer is very definitely yes, with some changes.

I am talking about scholarly journals as something that is peer reviewed. They may be electronic, or print, or both. In the 2002 issue of Ulrich's list of worldwide serials, there are approximately 16,000 scholarly peer-reviewed journals listed, and over 12,000 of those are available in electronic form. So, journals are media independent by definition, but they are published in an ongoing, usually regular, basis by a commercial publisher, scholarly society, or other entity such as a university. It is particularly important, in addition to the peer review, that a journal have a particular editorial voice, editorial processes, and an editor. What adds value for many of the authors and readers may be the name of the journal, or it may be the editor or the editorial board, but that editorial voice is something that is recognised.

Scholarly journals, of course, are available in multiple formats. I am including in the definition of scholarly journals both the journals model (that is the bundled model, where you can browse through an issue to see what is in this entire title) and the separate article model (where the articles are extracted and put into an aggregator service or some kind of online database). So there are two models and I will make a distinction between them.

Why are journals important? There are five categories of evidence, or points that have led me to the conclusion that they are important. The first is that scientists read a lot. (I am going to be using the term scientist, but many of the research studies that I

am covering here have looked at social scientists as well. So we have scientists from all fields of science and social science. What I do not have data on are the humanities.) The second point is that information in journals is essential to those readers. The third is that scientists and social scientists use many different ways to get to journal articles, and the number of ways is increasing. The fourth is that electronic versions are adopted when it is easier and I will show you some evidence for that. The last point is that there are core journals and peripheral journals in almost every academic discipline, and the way people use them and what they need from them is actually quite different in the peripheral and the core journals.

The evidence that I am presenting is from almost a lifetime of work. Donald King and I have been working together since 1995, but each of us had been doing research on journals for three decades. I was involved in the electronic side and he has been involved more in the print and usage side, and we had data between the two of us from 1977 on. In 1995 we decided to bring various studies up to date and to look at it all together in a longitudinal way. We have a recent study, so we are continuing to collect data. In all, we have samples of over 15,000 scientists from all fields of science. Some of the groups are worldwide, but there are more North American scientists than others. However, they come from a variety of settings – professional organisations (the survey we just finished was of the American Astronomical Society, which, in spite of its name, is a worldwide organisation). We have surveys of faculty at various universities as well as government laboratories, private companies, etc. We have information from over 100 organisations in addition to the 15,000 scientists.

Scientists read a lot

The first point is that scientists and social scientists read a lot. Scientists have always relied on reading the research of others to support their own work, but the amount that they read has often been grossly underestimated. We have looked at the amount of reading by the groups that we have studied over the years, and find that the average number of scholarly article readings per year has fluctuated over time, but has remained high. All work fields averaged together show that it has fluctuated somewhat over the years from 1977 until the latest studies of 2000-2001. Certainly, since the 1990s the number of articles read per year across all work fields is increasing. I know that a lot of the readings from the late 1990s and the last few years are directly attributable to electronic journals.

The average reading now across all fields is about 130 articles per year. These numbers vary considerably across work fields. Engineers are on the low end of the number of articles read per year. They read other things. The very high end that we and others have identified, over the same time period, are university medical faculty, in particular, those who do some clinical work. Other work fields are somewhere in between.

The time spent reading, however, is not necessarily the same as the amount of reading. We found that the time spent reading fluctuates a lot over the studies that we have done from 1977 until the present. It goes up and down more and it does not seem to be increasing. Certainly it is not increasing nearly as much as the number of articles read. Anything that publishers and librarians can do to help them speed up the time to locate and to read is most welcome, because they feel the need to read more, but they don't have a lot more time to do it. Again, that varies a lot by work field, and engineers stay on the low end (if you look at time spent reading per year on an average). But medical faculty drop down from reading the most, in terms of time spent. They are second, and chemists actually spend the most time reading, even though they are not at the top in the number of articles read.

We can break this down again. If you look at average time spent per article, the reason that the university medical faculty tend to read a lot more, but don't spend a lot more time doing it, is that they are spending an average of about 20 minutes per article. They are reading to keep up. They tend to read fewer titles; they read perhaps an entire journal; they tend to read a higher proportion in print rather than electronic form than others do, and they tend to spend a very short time per article. Engineers, on the other hand, do not read as many articles, but when they find the one or two that are particularly useful, they spend a lot of time reading each

individual article. The national health service of Mexico has collected the same sort of data for medical staff and they have found that 20 minutes per article is also true there. So they have designed in their information services a digest service, where they get the latest medical articles down to a condensed version, designed in a way that can be read in 20 minutes. So I think these numbers are true worldwide.

Journal information is essential

This leads to the second point and that is the information found in journals is essential. In a recent study of students and faculty members, I found that there is some point in a student's career (and it is probably the last year of undergraduate study or at the graduate level) where journal articles become understandable, essential and important. From that point on, journal articles are considered the most important information source. In our recent studies we found that about half of the readings contained information that was new to the reader. Most of the readings in every work field are of material that is current (within a year or two), but overall, about a third of the readings are of material that is more than a year old. The older materials tend to be reported as more valuable to their work. Scientists may be re-reading something they remembered when they were flipping through a current issue, electronic or print, and they go back to it. So, with old articles, there is not as much reading, but readings are considered to be of especially high value. This is important for back files. You won't see the amount of use perhaps, but there is great value there.

We also ask questions in surveys about honours and awards, and demographic questions about the individuals (this is self-reporting). We do a correlation between the number of honours and awards and how much they read, and we have consistently found over time that high achievers read more than others. They also read journals, in particular, for many different purposes: current awareness; research; teaching; etc. Lots of different needs are fulfilled by journal articles. Scientists consistently rate journals as more important than other resources.

Scientists use a variety of ways to get journals articles

Finally we have been working on asking about, and trying to measure, the value of the information found in articles. Scientists report that reading has saved them time. We asked about a particular reading and what the result of it was. They report that it improves their productivity, and the quality and timeliness of their work. There is other evidence that they are willing to pay for information in terms of their time. They are continuing to spend time reading, so that is a measure of value. However, they are not willing to pay out-of-pocket expenses. All the end users that we have studied are very cost sensitive. If it comes to an outlay of actual money, then the willingness changes. This leads to the third point: scientists use a variety of ways to get journal articles. They want the least expensive way to get them. A subsidy by their organisation is the most convenient. So they will change behaviour based on cost and based on convenience. I am not going to discuss pricing here. The average number of personal subscriptions has gone down at a fairly drastic rate, directly attributable to prices. In 1977 the average scientist had about six personal subscriptions and that is down to about two currently. Again it varies by work field. Dirk Haank of Elsevier, in his keynote address to the 2002 UKSG conference, said that because of pricing they have lost the small academic library market and they have lost the individual market. That is certainly true of journals from any kind of publisher. Individuals haven't stopped reading, but they have turned to other sources to get articles. As the number of personal subscriptions decreased, scientists turned to the library and to other sources, mostly separate copies.

We have looked at scientists at the Oak Ridge National Laboratory. This is a government laboratory mostly concerned with energy, and also engineering and physics. We had studied that group in 1984, so we went back and studied the same group at the end of 2000 and beginning of 2001. As the use of subscriptions has decreased, the use of separate copies has gone up. So they have fewer subscriptions, but they are relying more on separates through online databases and interlibrary loans, etc.

Electronic journals are used when it is easier

Besides being price sensitive, scientists are very convenience sensitive, or ease sensitive. They will use a variety of electronic versions when it is more convenient. Behaviour can change quite quickly when the option is easy to use and more convenient. It does not change so quickly when it is not. We have known for years that the further away someone was from the library, the less they used the library. With an electronic journal on the desktop, we have found that if you have to do three or four clicks to get to the article instead of one or two clicks, the use goes down. So our measure of convenience has become quite spectacularly short: 'How many times do I have to click to get to an article?'. Scientists are using a variety of ways to get articles, but again, the ones they adopt are the ones that are the easiest.

One of the most touted types of electronic journals is the e-print server, and we asked two groups recently (the Oak Ridge scientists and astronomers) specifically about their use of the arXiv.org e-print service. We found that although about a third of the Oak Ridge scientists were aware of the e-print service, it actually accounts for a fairly small percentage of their total number of readings. They are aware of it, but they are not using it really heavily yet. This varies quite a bit by work field. If they were finding a high percentage of what they needed there, then they would be using it more. So, the bigger an e-print service set gets, the more convenient it gets. We also asked them about another pre-print network from the U.S. Department of Energy (the Preprint Network.)

We recently asked astronomers if they were aware of arXiv.org, and there is actually a subset for them – astrophysics@astroph – so there is a high level of awareness by members of the American Astronomical Society of the preprint services, and the amount of reading is higher. About 22 percent of all of their readings came from e-print services. What can have a big impact on ease of use, and what really seems to have an impact on use of journal articles, is a good, reliable, familiar bibliographic database that serves as a gateway into electronic journal use. It has to be something that is familiar. It has to be in a work field where that database fulfils a lot of their needs. So Medline (PubMed) is a good example. The other example in astronomy is the ADS or Astrophysics Data Service, which is very well known to astronomers. They almost all know about ADS, and it is used a lot because it is linked to journal articles. A familiar gateway into electronic journals will result in scientists changing habits very quickly and relying on separates in electronic journals.

There are three reasons for the number of separates increasing: (1) cost of subscriptions; (2) reliance on online searches with links to separate articles (that has had a demonstrated impact on reading more separates); and (3) more reliance on someone recommending an article. That has always been a familiar behaviour pattern, but now it is so much easier for someone to recommend via e-mail messages or listservs that they are getting lots of recommendations. A URL in a listserv, and sometimes the whole article passed on, results in a huge jump in reading separates that are recommended by a colleague. E-mail has had a profound effect on the groups that we studied during these two periods of time.

Journal issues or separates? Core and periphery

My final point is the difference between the two models: the journal model, where you have a bundled issue where you can browse through all of the articles in a particular issue, or the separates model, where you are going to a search engine and searching for separates. Both are used by scientists.

Scientists now read at least one article per year from each of approximately 23 journals, and that is up from 13 in the late 1970s and about 18 in the mid 1980s. However, there are very few titles from which they are reading more than a few articles. There is very definitely a separation between the core titles, where they are reading a lot, and the periphery. Half of those 23 titles are read less than five times. Only one of those titles, on an average, results in 25 or more readings per year. So there is a very definite core for high reading and then all of the peripherals for separates. In almost every discipline there is a core group of journals, where it is important to have the journal model. Whether it is electronic

or print, people need it as a bundled journal because they want current awareness reading. They want to keep up with it and read many articles. That number of titles varies, but only about 2-6 for most disciplines are core, titles that it is important for the library to have electronic or print subscriptions to.

For the others, separates through databases are really what is needed. Scientists do not care about the whole thing. They read one or two articles per year from that title. They are still using the title, but it is not nearly as important.

Medical faculties are very different from the average. They tend to rely more on print and more on subscriptions, and they tend to have a larger number of subscriptions and a larger number of core titles – about six titles. They tend to read very quickly. They pick up and they will tend to read on the run, if they are clinical practitioners especially. They will pick a journal and flip through it when they have a break. That is why print is still more convenient. If you could read more on a personal digital organiser, or have journals on it, that would mirror that behaviour. They read quickly, they read on the run, but that particular group relies more on print. They have a group of journals they want to read everything in, but they don't want to read it in great detail. So that is one kind of work field that perhaps is a little different, but by studying them you can help design products that may be more useful to them.

Conclusion

In conclusion, what we need and, I think, will continue to need for the future is multiple co-existing alternatives. People want what is most convenient. As alternatives become available they are using a wider variety of them and there are different kinds of journals that are needed for different purposes. So, print journals in the journals model are useful for reading on the run, for the one or two, maybe up to six, core titles, may come with a membership to a professional society, and are something people want to keep on their shelves.
E-journals in the journal model, where the editorial processes are evident, are also probably the most useful in a library environment and, of course, because of the links to additional articles, become very important. Both print and e-journals in the journals model are for core reading where users want to see everything in an issue. For non-core, for the peripheral reading articles, databases are particularly important. Also serving a role, not in competition, but as more of an addition, are e-print services, and those are used in some fields more than others. Lastly, the model of an author putting their own articles up on a web site with someone finding them, either by knowing the author's name or going there, is used a lot less by the scientists that we have studied They tend to use them when they know an author's name, when it is somebody who has written a lot, who is a big name in the field, and somebody that they respect and admire.

All of these models are complementary. They are not competitive, in the sense that they are all being used and scientists are finding the way for them, for the way they do their work. Scientists use a combination that seems to work best for them.