The Correlation of Local Citation Data with Citation Data from *Journal Citation Reports*

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University librarians continue to face the difficult task of determining which journals remain crucial for their collections during these times of static financial resources and escalating journal costs. One evaluative tool, Journal Citation Reports (JCR), recently has become available on CD-ROM, making it simpler for librarians to use its citation data as input for ranking journals. But many librarians remain unconvinced that the global citation data from the JCR bears enough correspondence to their local situation to be useful. In this project, I explore the correlation between global citation data available from JCR with local citation data generated specifically for the University of British Columbia, for 20 subject fields in the sciences and social sciences. The significant correlations obtained in this study suggest that large research-oriented university libraries could consider substituting global citation data for local citation data when evaluating their journals, with certain cautions.

University librarians continue to search for data that helps them evaluate their collections, particularly their journal collections, as subscription costs rise approximately 10% each year and as additional funds are needed to pay for access to full-text electronic journals. Use studies are time-consuming if one wants to obtain enough data to make the study meaningful, and the compilation of the results can be cumbersome. With the recent appearance of *Journal Citation Reports (JCR)* on CD-ROM, quantitative citation data are now relatively simple to manipulate. Because the citation data on *JCR* are global, librarians have questioned the relevance of *JCR*'s data to their own institutions, preferring citation data generated from their own users' publications. These local data are more difficult to obtain, particularly if one wishes to restrict the data to one subject area, which is crucial because citation patterns vary by subject field and affect citation figures. In order to determine how global citation data relates to local citation data, I explored the correlation between global citation data from the *JCR* and local citation data for the University of British Columbia (UBC) for 20 subject fields in the sciences and social sciences.

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Literature Review

Previous studies on the relationship of global and local citation data have been few in number and limited to only a few subject fields. Wiberley (1982) studied the relationship of local and national citation data for social work by using an encyclopedia and four periodicals as the sources for the national citations and local citations from publications from lists of faculty publications. He compared the method of using earlier national citations to predict later local citations with the method of using earlier local citations to predict later ones and concluded (358) that for social work, "national databases of citations are almost as good as local data in predicting future citation of journals by local authors." This conclusion therefore suggests that national citation data are useful for journal selection. Wiberley's study took place in a university known for its high productivity in publishing in the field of social work, but because the field was one of the applied social sciences, the field exhibits different citation patterns than does a subject in the pure sciences.

Joswick and Stierman (1997) showed that there was little relationship between global citation data from *JCR* and local citation data gathered from the three citation databases from the Institute for Scientific Information (ISI) and organized using DIALOG's "rank" command. However, all subjects were considered together. The university's comparatively small departments in chemistry and physics as well as the lack of a medical program meant that there was little correspondence between the predominance of social science titles cited by the professors and *JCR*'s top cited titles, which lean heavily toward scientific titles.

Garfield (1972) originally suggested using global citation data to evaluate journals. Although this practice, along with other criteria for evaluating journals, has since become fairly common in academic libraries, there is continuing discussion and debate on the relationship between citation data and other indicators of the use of journals in libraries. Since 1972, there have been numerous studies and reviews of the literature. Broadus (1985, 33) summarized previous studies and stated that "counts based on the *JCR* can be almost as good as expensive local [use] studies for predicting use of periodicals in a given library." But Broadus cautions against automatically eliminating a journal that has low global citation counts in the library, as there can be valid local reasons for retaining the title.

Bensman (1985) summarized research on the correspondence between global citation data and use, and despite some conflicting studies, states (24) that "ISI citation frequency is measuring an extremely powerful variable in academic library use, and . . . is undoubtedly one of the most important measures that can be utilized . . . [for] managing the journal collections of research libraries." Bensman was not concerned that the citation data were not local.

Todorov and Glänzel (1988) reviewed studies on the relationship between journal citation measures and objective and subjective ratings of scientific journals; in some of the studies there was a positive relationship, while in others there was not. Kelland and Young (1994) presented a comprehensive review of the literature on the relationship between citation data and library use. Because the correlation data vary, the authors conclude (86) that "citations represent a form of literature use, and to some extent that can be considered library use. . . . Actually, the relationship between library use and citations is so complex that it should not be expected to produce high correlations."

Swigger and Wilkes (1991) compared techniques (including using local citation data generated by a DIALOG search of ISI) when evaluating journals at Texas Woman's University and concluded (52): "There is only a weak correspondence between use of serials as measured by reshelving data and by citation data, and no correspondence between citation data and the subjective judgments of faculty or librarians." The Texas Woman's University has graduate programs in allied health, education, and library science, so the results are limited to those fields. On the other hand, Bensman (1996) showed

a strong correlation in the field of chemistry at Louisiana State University between global citation data (in the form of total citations from *JCR* for the journals) and ratings of those journals by faculty members.

To summarize, although there is not total agreement that the relationship of citation data with other indicators of use in libraries is strong, it generally is acknowledged that such a relationship exists and that it is worthwhile to take citation data into account with other measures when evaluating journal titles.

The question remains whether the citation data must be local, or whether global data are just as useful. Despite the difficulties inherent in generating local citation data, authors of articles published in the last several years reveal that librarians are using local citation data in preference to, or in addition to, global citation data due to a widespread reluctance to rely on global citation data to evaluate journals. Haas and Kisling (1994) reported on a project at the University of Florida to evaluate the relevance of their science journal collection using local citation data produced from ISI. Schmidt, Davis, and Jahr (1994) used local citation data, faculty ranking, circulation statistics, and impact factor to prioritize biology journals at the University of Illinois. Sylvia and Lesher (1995) used local citation data generated from psychology theses and dissertations in a cost ratio to evaluate their psychology journal collection at St. Mary's University. Hughes (1995) examined local citation and publication data along with global data when ranking journals in molecular and cellular biology at Pennsylvania State University. Dole and Chang (1996) conducted four local citation analyses in the fields of marine sciences, chemistry, and sciences as a whole to produce local citation data to use along with faculty rankings and use studies in preparation for a journal cancellation project at the State University of New York at Stony Brook. Loughner (1996) produced local citation data from ISI to evaluate use of science journals at the University of Georgia. Lambert and Taylor (1996), who evaluated journals at Staffordshire University in the U.K., stated (318): "Citation rankings seemed too general; we would not have felt justified in canceling subscriptions purely on the basis of externally generated lists."

Statement of the Problem and Purpose of the Study

Citation data are commonly used along with other criteria such as reshelving statistics and ratings by faculty and librarians to determine core journal titles in a field or to find candidates for cancellation. Librarians often rely on local citation data rather than global citation data, despite the ease of gathering global citation data and the ability to manipulate them electronically, using the CD-ROM version of *JCR*. Librarians nevertheless remain unconvinced of the value of global citation data, thanks partly to the lack of studies. The purpose of this study is to explore the correlation between global citation data and local citation data to determine the potential of relying on global citation data instead of local citation data, for evaluating a journal collection. A second purpose is to design and test a consistent method for obtaining correlations across a number of subject fields at one specific institution.

Sources of Data

The local institution involved in this study was the University of British Columbia (UBC), a provincially funded university with the third largest academic library in Canada, a student body of 27,000 undergraduates and 6,000 graduates, and faculties not only in arts and sciences, but also medicine, dentistry, pharmacy, law, engineering, commerce, education, agriculture, forestry, etc. Its overall rank among Association of Research Libraries (ARL) has ranged between 25 and 30 during the past 10 years.

The local citation data were provided by the Local Journal Utilization Report (LJUR), produced by ISI from its database specifically for UBC. This report, in a database format, contains counts for the number of times authors from UBC cited

specific journals during a 12.5-year period from January 1981 to June 1993. The LJUR was generated using all author addresses, not solely the first author.

The 1994 edition of *JCR* on CD-ROM produced by ISI was the source of the global citation data for this study. The specific global citation data used were the "1994 Total Cites," which is the number of times a given journal title was noted as being cited in ISI's Science Citation Index and Social Sciences Citation Index during 1994.

The time periods of the two sets of data do not overlap; the sources were chosen because they were available in electronic format, which facilitated analysis using spreadsheets and databases. ISI produced the LJUR for UBC in 1993, but the *JCR* was not available on CD-ROM until the 1994 edition was produced in 1995.

Because this project was based on ISI data, it has all the limitations of that database:

- errors in the data themselves
- the limited number of journals covered (an example is the field of law, for which only 96 titles are listed in *JCR*, which led to the exclusion of the subject of law in this study)
- *JCR* is based only on journals; hence citations to journal articles from other types of publications are not included, and for subject areas that are less journal-centric, these might be significant
- few foreign language titles are included
- total citations are influenced by the length of time the title has been published; titles begun during or near the end of the 12.5-year period covered by the LJUR in this study will not have either global or local citation data comparable to those from well-established titles

Method

In order to identify journal titles for a specific subject field, two sources were used. The first was the *JCR*, which assigns each journal title to one or more subject fields. The second was UBC's existing local coding of all active subscriptions to one or more of the 20 subjects under consideration, corresponding to departments at the university. The subjects assigned by the *JCR* are finer categories than those assigned by UBC. In order to have them correspond as much as possible, the *JCR* was filtered to obtain similar subject groupings. For example, to correspond with the subject of "Chemistry" as defined by UBC, the following subject categories were chosen from the *JCR:* Chemistry; Chemistry, analytical; Chemistry, inorganic and nuclear; Chemistry, organic; Chemistry, physical; Electrochemistry; and Spectroscopy.

The following databases were loaded into a local database on a personal computer: the LJUR, the list of titles for each of the 20 subjects from the *JCR,* and the *JCR* lists of all science titles and social science titles. Using the UBC subject listings of subscriptions, subject codes were keyed into the LJUR. If a UBC subscription was not in the LJUR, the title was added, with zero as the number of citations. The database was used to create a list for each subject, with the following information for each journal: (1) its title as abbreviated by ISI; (2) the global citation count (i.e., the 1994 total citations from *JCR*); and (3) the local citation count (i.e., the number of times UBC authors cited the title over the 12.5 year period from the LJUR). The beginning of one of these lists is shown in table 1 for the field of zoology.

The Pearson correlation coefficient was chosen to measure the correlation between the global citation data and the local citation data. The Pearson correlation coefficient reflects the extent of a linear relationship between two sets of data; it ranges between -1 (indicating a perfect negative relationship) and +1 (indicating a perfect positive correlation). A correlation close to ±1 indicates a strong correlation. Other correlation studies have used the Spearman correlation coefficient, which measures the correlation of ranked data. However, if the raw data are available (not just the rankings), it is preferable to use the Pearson correlation because the actual data give more information, such as the varying size of gaps between the ranked data. Before applying the Pearson correla-

TABLE 1

ZOOLOGY JOURNAL TITLES WITH GLOBAL (FROM *JCR*) AND LOCAL (FROM LJUR) CITATION COUNTS

Abbreviated Title	Global	Local
ACAROLOGIA	142	0
ACTA ANAT	1,572	38
ACTA BIOL CRACOV ZOO	3	0
ACTA PHYTOPATHOL HUN	97	0
ACTA PROTOZOOL	195	0
ACTA THERIOL	360	13
ACTA ZOOL HUNG	33	0
ACTA ZOOL-STOCKHOLM	397	3
ADV INSECT PHYSIOL	425	34
ADV PARASIT	481	12
ADV STUD BEHAV	336	13
AFR J ECOL	189	5
AM BEE J	155	0
AM ENTOMOLOGIST	0	4
AM J PHYS ANTHROPOL	2,642	47
AM J PHYSIOL	78,546	2,634
AM J PRIMATOL	826	0
AM MALACOL BULL	79	4
AM ZOOL	2,652	202
AMPHIPACIFICA	0	0

tion, the citation figures were transformed using the logarithmic transformation. The decision to transform the data was based on an examination of the histograms of the data for the field of microbiology. For that field, both the global and the local citation data sets were dominated by a small number of highly cited journals; in statistical terminology, the variance increases with the mean, resulting in a negative binomial distribution. The other subject fields appeared to have similar distributions. Figure 1 illustrates the dominance in the field of zoology by one title, in this case the *American Journal of Physiology,* for both local and global citations. These observations agree with those of Bensman (1996), who has worked with similar citation counts and who noted that the logarithmic transformation is an appropriate way of dealing with such data.

Unfortunately this procedure was not quite as uncomplicated as it would appear. As noted by Haas and Kisling (1994), Loughner (1996), and Harter (1998), raw ISI data can be disconcertingly inconsistent. The LJUR required extensive editing in order to combine titles with different abbreviations, to combine titles that had changed, and to correct errors. When the editing was completed, a great many titles listed with only one citation remained, and many of these were difficult to identify by full title, either because they were esoteric, ambiguous, incorrectly abbreviated, or referred to monographs. Examples of such titles include PHYSIS, PLENARY LECTURE, and TXB PSYCHIATRY. In order to eliminate having to spend undue time identifying these titles of little importance and in order to make the database smaller and easier to manipulate, all

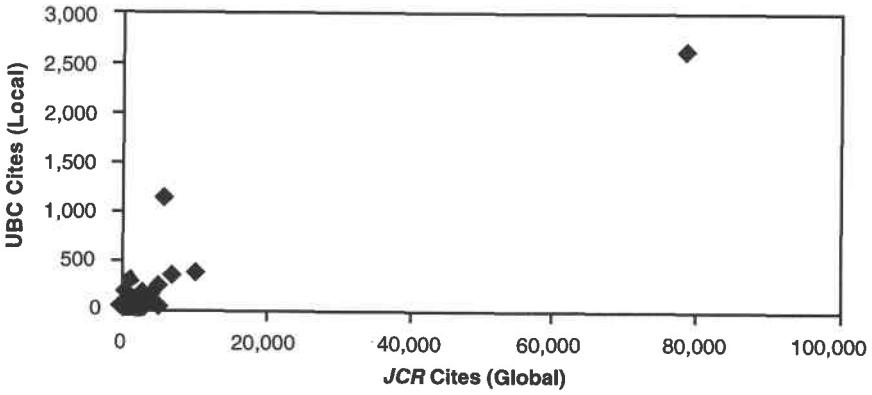

Figure 1. Scatter Plot of Raw Data for Zoology Titles.

of the titles having only one citation were eliminated except: (1) those in which UBC authors had published (using the publishing data from the LJUR); and (2) titles that began with CAN, CANADA, CANADIAN, BC, BRITISH COLUMBIA, VANCOUVER, etc., because we wished to retain as much Canadian data as was feasible. Although not necessary for this correlation study, obvious monographs; titles indicated as INPRESS, UNPUB, and THESIS; and titles beginning with numbers or abbreviations of months were eliminated.

Another modification to the LJUR was its expansion to include 755 titles in the 20 subject fields to which UBC actively subscribes. These titles had a local citation count of zero, but 175 had global citation data from *JCR*. The primary reason for adding these titles was to analyze all UBC subscriptions in the 20 subject areas for correlation between global and local citations. The effect for this study was an expansion of the data beyond that of ISI as the source. The periodicals added included esoteric titles, popular titles such as *Sky* and *Telescope*, new titles that had not existed long enough to have received citations at UBC, foreign titles, and titles perhaps a bit outside a strict definition of journal such as the *Yearbook of Astronomy*. Modifications to the *JCR* were also needed, because it was already several years old and numerous titles had changed or split into parts, so data for the various versions of a title had to be gathered under the latest version of the name.

The LJUR ended up with 10,601 titles, with local citations ranging from a high of 5,350 for the *Proceedings of the National Academy of Sciences* to the 755 titles with a citation of zero. The *JCR* for the science fields contained 4,438 titles, with global citations ranging from a high of 265,329 for the *Journal of Biological Chemistry* to a low of one citation for 13 titles. The *JCR* for the social science fields contained 1,402 titles, with global citations ranging from a high of 20,038 for *Archives of General Psychiatry* to a low of one citation for four titles. The two *JCR* sets had an overlap of 148 titles. The LJUR and the *JCR* for the sciences overlapped by 3,212 titles (72% of *JCR*), and the LJUR and the *JCR* for social sciences overlapped by 946 titles (67% of the *JCR* titles).

Discussion of Results

Table 2 lists the 20 subjects that were analyzed for this study, arranged in descending order by correlation of the data after they had undergone a logarithmic transformation, where N is the number

TABLE 2
CORRELATION OF GLOBAL AND LOCAL CITATION DATA

Subject Field	N	Pearson Correlation of Raw Data	Pearson Correlation of Logarithmically Transformed Data
Microbiology	89	0.953	0.814
Forestry	140	0.817	0.810
Astronomy	42	0.963	0.755
Economics	260	0.916	0.731
Business and Management	279	0.849	0.695
Biochemistry	272	0.959	0.687
Pharmacy	176	0.832	0.682
Computer Science	254	0.696	0.681
Mining	39	0.617	0.677
Biology	346	0.968	0.675
Botany	154	0.783	0.661
Mathematics	307	0.800	0.634
Zoology	220	0.927	0.634
Physics	343	0.903	0.625
Mechanical Engineering	177	0.816	0.623
Librarianship	135	0.613	0.622
Geology	208	0.818	0.607
Chemistry	401	0.871	0.567
Metals and Materials	212	0.579	0.547
Chemical Engineering	148	0.477	0.530

N = number of journal titles in each subject

of journal titles in each subject cohort. The correlations between the global and local citation counts using the raw data were extremely high in most fields, a finding that was not corroborated by visual inspection of the scatter plots. Only five subjects had a correlation below .7, but as mentioned previously, the skewed distribution of the data (large clusters of both global and local citation data dominating the low end) indicates that more realistic correlations can be obtained from the transformed data. This led to the rationale for arranging the table in descending order by correlation of the data after a logarithmic transformation was performed. The actual ranking of the subjects is less important than the fact that the correlation figures are moderate to moderately high for all the subjects. The scatter plots of the transformed data show a linear relationship of varying strength for each subject, a relationship that gets decidedly weaker for the smaller citation values. Figure 2 shows the relationship for zoology. Note the cone shape of the data points that gets wider for the smaller values, indicating the increasing weakness of the relationship as the citation values decrease. The fact that the linear relationship between the global and local citation transformed data gets weaker for the smaller values has implications for libraries. It means that a low global citation count does not always imply a correspondingly low local citation count, despite the moderate to relatively high correlation figures for all the subjects.

The placement of the various subjects in the ranked list in table 2 does not permit any general conclusions about the strength of a subject's correlation based on whether the subject is a pure or an applied science, a science or a social sci-

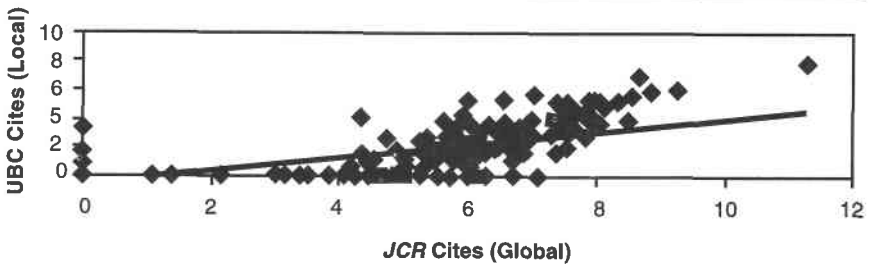

Figure 2. Scatter Plot of Transformed Data for Zoology Titles.

ence, or the degree of a subject's dependence on journal publishing. Neither does there seem to be a relationship between the number of titles included in a subject field and its correlation.

An interesting phenomenon is that local citation data are zero for numerous journals in all 20 subject fields. There seem to be three reasons for this. First of all, 755 titles were imported into the subject groupings because they were identified with the subject by UBC's local coding of all active subscriptions but were not included in the original LJUR due to the title's obscurity (e.g., *Amphipacifica*) or because the title was a popular rather than a research title (e.g., *Audubon*). A second reason is that most of the titles from the LJUR that had only a single citation were culled. Finally, some of these titles are simply of little relevance to research at UBC (e.g., *American Bee Journal*).

It might be assumed that researchers at UBC would cite Canadian journals more heavily than would be the case globally, which would produce relatively lower correlations in this study than would be obtained for an institution in the U.S. However, each subject field includes only a few Canadian titles, and often only one is truly important, so the effect is minimal. The subject list for business and management includes 25 Canadian titles, more than the other disciplines. Excluding the 25 Canadian titles and then recalculating resulted in a correlation of .702, compared with the correlation of .695 when the Canadian titles were included. However, the opposite effect occurred in forestry, which included 14 Canadian titles; recalculating the correlation without the Canadian titles gave a correlation of .794 instead of the .810 when the Canadian titles were included.

The *JCR* data (1994) and the LJUR data (1981–93) obviously do not come from the same time periods. At the time of this study, there was only one year of *JCR* data available on CD-ROM, and it might have seemed more worthwhile to have used only one year of local data (and from the same year) to correspond precisely with the one year of global data. However, for a given year, local citation data are considerably sparser than global citation data. Just as use studies based on reshelving counts require a long time frame to be representative, a citation study using merely one year of local citations would not be as indicative of local citation practices as more years would be, both in terms of the variety of titles covered and citation counts themselves, making a reliable correlation figure difficult to obtain. Whether a full 12.5 years of local citation data was necessary is open to debate. Certainly with only one year of local data, the correlations would have been much lower. Although *JCR* data change from year to year (probably more so for titles with few citations), they are still relatively stable—likely more stable due to sheer size—than are local citation data. Line (1985) found a 92% overlap for the top 500 journals cited the most frequently in ISI's *Science Citation Index (SCI)* in 1979 and in 1982. For the *Social Science Citation Index (SSCI)*, there was an 87% overlap for the same time period. Hence, using *JCR* data (which are drawn

from *SCI* and *SSCI*) from a different year than that covered by LJUR should have a relatively minor impact on the results. The local citation data on LJUR would vary more from year to year than do global data. ISI has since enhanced the product to indicate the years of the citations, making it possible to study the growth or decline in citations for a particular title.

The nature of this project required that it be specific to our institution, and factors unique to UBC might have affected the data in unknown ways. Therefore, the results should not be overgeneralized for use by other institutions but rather should be viewed as providing an exploratory study of correlations for various subject fields using a specific method. The relative correlation for each subject is of less importance than the fact that a moderate to moderately strong correlation was shown consistently for all 20 subjects. This allows others to consider the similarity of their situation to UBC and to decide whether the size of the resulting correlations merits their substituting global citation data for local citation data when determining the importance of a journal to their library collection.

Because both the *JCR* data and the LJUR data come from ISI, it could be argued that the result has a high inherent correlation because ISI's database is based only on journals and the set of journals is limited. A better method might be that of obtaining the local citation data directly from local publications of various types, as has been done by some librarians when evaluating journals, such as Sylvia and Lesher (1995), whose source of local citations was graduate theses in psychology, and Dole and Chang (1996), who obtained local citations not only from a search of ISI but also from a list of publications by their faculty in marine sciences and from doctoral theses in chemistry. The local citations produced by the list of publications of the marine science faculty were dispersed over more titles than the ISI study, but the years of coverage did not coincide by date or length. Obtaining local citation data from sources other than ISI could produce more data, particularly in fields where the nature of publishing includes a substantial proportion of nonjournal formats, such as monographs, conference proceedings, preprints, and technical reports. Obtaining local citation data from sources other than ISI, however, has the disadvantage of being extremely time-consuming to compile and organize; consequently past studies have been limited to few subject fields. It is difficult to evaluate studies of one subject area in isolation, and it is next to impossible to compare studies in which wildly different methods were used. The obvious advantage of the method presented here is that it can be done on a personal computer, and allows numerous subjects to be examined and results compared.

Implications for Libraries

It should be noted that the usefulness of both global and local citation data is limited to evaluating titles for research purposes; it has little validity for evaluating titles intended primarily for student use, particularly undergraduates. Joswick and Stierman (1997) showed that titles used by students do not bear any relationship to the number of citations in faculty publications. Moorbath (1993) studied the nursing literature and concluded (44) that there is "a significant difference between rank by student use and rank in the Citation Index." On the other hand, Zipp (1996) found a positive association between faculty citations and citations in theses and dissertations. It should also be remembered that results of this study are not applicable to smaller institutions that cannot offer as broad a base of ongoing research and publishing, because the local research might be less likely to correspond with global research and thus probably result in far lower correlations between local and global citation data. Swigger and Wilkes (1991, 44) stated that using local citation data is "likely more valid, particularly for small to medium institutions where research is more limited in scope and number of projects than at large universities with large faculties." Sylvia and Lesher (1995) used local citation data but also advocated considering shelving counts.

The results of this study do not give us information on whether the titles cited in a specific subject field were cited by researchers in that particular subject department. Because the data from the LJUR span the entire university, citations to a journal could easily be made by someone from a department in a different subject area. This has implications for academic department libraries, which are interested in limiting the evaluation of journals to their specific subject area or perhaps primarily are interested in the research scope of their specific department. The growing interdisciplinary use of journals and their escalating costs mean that most institutions have to take an institution-wide view to their library collections, so for them the department of the researcher is increasingly irrelevant.

Conclusion

University librarians are always searching for ways to evaluate journals, due to the increasing costs of journals, the creation of new journals, and the limitation of funds. Data often considered include circulation and reshelving studies, ratings and rankings by faculty members, local and global citation counts, impact factors, availability of indexing, reputation of the publisher, cost, language, interlibrary loan requests, availability from document suppliers, etc. All this information has value when considered along with subjective evaluations by faculty and librarians. Recently, librarians such as Schmidt, Davis, and Jahr (1994), Hughes (1995), Sittig and Kaalaas-Sittig (1995), and Loughner (1996) have proposed various tools or instruments for evaluating journals that combine two or more of the following factors: a ranking or rating by faculty members, circulation statistics, local or global citation counts, local publication counts, costs, and impact factors.

In this present study, it was shown that a relatively high correlation exists between global citation data of one year and longitudinal local citation data for a preceding 12.5-year period for a large research-oriented university for 20 subject fields, suggesting that large research-oriented university libraries could consider substituting the more easily-obtainable global citation data (from *JCR*) for local citation data (whether from ISI's LJUR or a search of their citation indexes or from an analysis of local publications) when evaluating their journals. High global citation counts have been shown to correlate with local citation counts. However, because the relationship between the global and local citation data gets weaker for the lower values of the data, librarians should exercise caution when evaluating titles with a low number of global citations and seriously take other factors into account. Faculty members are likely to be more interested in local data, so if local citation data are readily available such as ISI's LJUR, they can serve a double purpose as a tool of interest to the faculty along with being of use to the librarian, who, because of the correlation of global and local data, has little need to consider global citation data in addition.

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