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Abstract

Bibliographic citation analysis of student research papers is one method of evaluating the use of a journal collection. Journal selection and cancellation may be done on the basis of use and cost-effectiveness to maximize the usefulness of materials purchased with the library budget. An analysis of the bibliographic citations of research papers by undergraduate and graduate students in the psychology department of St Mary's University was used as one basis for psychology journal selection and deselection in the academic library. Findings confirmed that the most cost-effective and the most used materials were usually held by the library. Titles that met these criteria and were not held are good candidates for new subscriptions. Likewise, the least cost-effective and least-used titles are candidates for cancellation. Convergence of data from other sources should be used to confirm citation analysis findings due to the inherent limitations of the method.

Introduction

Citation analysis is an effective but somewhat neglected technique of collection development and evaluation. The method of citation analysis consists of counting and ranking the number of times documents are cited in bibliographies, footnotes, and/or indexing tools (Baker and Lancaster, 1991). The methodology is simple though time-consuming if online databases are not used. It can be difficult to select and collect the sources of citations that reflect local user needs. However, the method does give a picture of the material that local users found essential to their research.

Local citation analysis versus national citation analysis

Citation analysis has been done through nationally collected citation statistics and proposals have been made to use these analyses for library collection development and evaluation (Bensman, 1985; Broadus, 1985; Pan, 1978). In opposition to the use of nationally collected citation data, Line (1985) argued that since every library has a different clientele and these clients have different information requirements, national surveys may have little relevance for individual libraries. When budgets are large and growing, libraries can collect more widely but, with smaller budgets, libraries must target their collections to the needs of their users. Calhoun (1995) used national citation analysis data and average journal price information to estimate that an academic library should spend \$800,000 for a core list of journals and a research library should spend \$1,800,000. Clearly this is far out of the range of the budgetary resources for most libraries and journals must be more narrowly selected. Many libraries have done local citation analyses to determine the special needs of their users (Chambers and Healey, 1973; Greene, 1993; Hardesty and Ottmans, 1989; Joswick, 1994; Magrill and St Clair, 1990; Peritz and Sor, 1990; St Clair and Magrill, 1992; Walcott, 1994).

Some studies have compared national citation studies with locally collected information and found that the two do not always coincide. Stankus and Rice (1982) showed a correlation between local use data and national citation data but only when the selected journals were

similar in subject, scope, purpose, and language and when there was heavy journal use. Scales (1976) found only a very low correlation between the most cited journals in *Science Citation Index* and use data on serials from the National Lending Library.

Citation analysis and the literature of psychology

Citation analysis has been a tool of research in the psychological literature for many years. Mace and Warner (1973) began a search for a core list of psychology journals by asking 60 chairpersons of psychology departments in the USA to rate 64 psychology journals. Hohn and Fine (1973) criticized the method of selection of the 64 journals, the rating scale, and the selection of raters as being inappropriate. Gynther (1973) questioned the validity of the ratings due to the unfamiliarity of some raters with all the journals. Koulack and Keselman (1975) attempted to meet some of the criticisms using another approach. But again, there was criticism of the study including the problem of bias toward familiar journals and lack of meaningfulness of rankings (Levin and Kratochwill, 1976; Porter, 1976).

Buss and McDermott (1976) used the original Mace and Warner list of 64 journals and counted citations to their articles in three major psychology journals. They found many similarities to the original rankings found by Mace and Warner but also some discrepancies. To account for the different number of articles published in each journal, White and White (1977) used citations per published article to evaluate a journal's importance. They performed a citation analysis on 57 psychology journal titles and found a rank-order correlation of 0.56 with the Mace and Warner journal ranking and a 0.39 correlation with the Koulack and Keselman ranking.

Thorne (1977) criticized these studies and the underlying method of citation analysis by listing a number of problems including repetitious self-citation, multiple publications of similar data, and citation of eminent authorities to gain respect. The point was to refute the concept that citation analysis has any usefulness in judging the enduring worth of a publication. Rushton and Roediger (1978) also criticized the White and White study on the basis of the

criteria for journal inclusion and the reliability of the data obtained. Colotla (1978) analyzed data which supported the reliability of the White and White study and the debate continued on the worthiness of citation analysis to help determine a core list of psychology journals (Boor, 1982; Buffardi and Nichols, 1981; Over, 1978; Robinson, 1979).

Hogan and Hedgepeth (1983) reviewed the research on determining a core list of psychology journals and compared journal citations from five textbooks in developmental psychology. Even within that single field, there was little agreement on a core list of journals except on the two leading journals, *Developmental Psychology* and *Child Development*. The authors concluded that there may be no definitive group of core journals for psychology due to the diversity of the field. Others disagreed and continued the search for a core list.

Haynes (1983) computed a Discipline Impact Factor for journals, taking into account variables such as subscription cost, total journal circulation, publication lag, and manuscript acceptance rate, to establish a core list of psychology journals with high impact on the discipline. Some deficiencies of this study were noted by White (1984) including problems with the unreliability of *Journal Citation Reports* as a source of data. Feingold (1989) examined journal rankings by citations for core journals in eight areas using *Social Science Citation Index* ratios and its citations in the corresponding American Psychological Association (APA) journal covering that topic. The top ten journals from the Koulack and Keselman study also received the highest within-area ranks in the Feingold study. Everett and Pecotich (1993) used citation analysis to rank journals by importance and to show the interrelationships of psychology journals published by the APA.

Validity and reliability of the citation analysis method

One problem with citation analysis is that the author of a paper may not cite all the works actually used in its preparation. Alternatively, but equally troubling, the author may cite materials that contributed marginally, if at all, to the research. Citations may be made to curry favor with important people, increase length and "scholarliness," or to increase the number of

self-citations or citations to friends. In the case of student papers, if a certain number of citations are required by the professor, the necessary number will generally appear whether all were used in the preparation of the paper or not. Broadus (1977) observed that handbooks and texts do not receive citations commensurate with their use because they are taken for granted by many researchers. He also noted that some papers are cited only to have certain errors corrected or to be refuted in their entirety.

Ease of access to journal articles can affect journal use and thus affect what journals are cited. Users are most likely to read and cite materials that they have easy access to locally. Thus, there should be a higher incidence of citations to materials held in the nearest libraries and researchers may want to take this into consideration when analyzing citations from a local user group. Sampling techniques and the problem of sampling error should also be considered. When sampling student bibliographies there are a number of difficulties to overcome. If all courses that make use of library research are not taught in a single semester, sampling must be done over a period of time. Ideally, all citations from all students doing library research through a complete rotation of courses should be collected to get the best data.

A final problem with the validity of citation analysis is the inaccuracy of the information found in the citations themselves. Boyce and Banning (1979) reported that 13.6 percent of citations in the *Journal of the American Society for Information Science* contained inaccuracies as did 10.7 percent of citations in the *Personnel and Guidance Journal*. Since there is no reason to believe these two journals are either more or less accurate than others, large scale citation analysis studies will be affected by these inaccuracies. On the other hand, one advantage of citation analysis is that it is an unobtrusive method, so counting the citations generally does not cause any changes in them. This fact contributes to the overall validity of the method's use. Using convergence of data from other sources of collection evaluation, such as reshelving and inter-library loan data, can also contribute to the validity of the method.

Examining the results of various citation studies reveals good reliability of the method. Fussler (1949) used references in key journals in

chemistry and physics to begin a citation analysis study. After determining which journals were cited most by the key journals, he used those as his source journals. There was little difference in whether he used the key group or the source group in the citation analysis since the rank-order correlation between them was 0.905 for chemistry and 0.976 for physics. Gross and Woodford (1931) showed little difference in results of their citation analysis of geological literature whether they used an equal number of pages, an equal number of citations, or a given time period for each journal.

Law of Scattering

Citation analysis is useful in identifying core journals because of the bibliometric phenomenon known as the Law of Scattering, which describes the manner in which articles on a subject are dispersed through the periodical literature. A small percentage of journals normally accounts for a large percentage of cited articles in any given field (Kanasy, 1975; Subramanyam, 1975). Is there a core list of journals that will satisfy most students at a university? The Law of Scattering predicts that about 80 percent of the citations will come from about 20 percent of the journals cited (Tobias, 1975). If this is true, the top 20 percent of journals cited in student papers should represent at least part of a core list for the university. A study by Hardesty and Oltmanns (1989) found a core list of 20 journals accounting for 80 percent of citations by undergraduate psychology majors at two institutions. The top 20 titles at both institutions overlapped almost completely though with a slightly different rank order. However, a local study at another institution found only seven journals in its top 20 that overlapped those of Hardesty and Oltmanns (Thomas, 1993).

Use versus cost

Use by clients, however, is not the only factor that contributes to the library's choice of journal subscriptions. Another important factor is price (Line and Sandison, 1975). Line (1978) notes that there are both fixed and variable costs associated with library materials. The cost of a journal includes the initial subscription price and also the annual recurring costs of receiving and processing issues, claiming parts not

received, replacing missing issues, preparing issues for binding, and so forth. Most of the recurring costs are unpredictable and they are neglected in this analysis in favor of a more definite cost which is defined as the current subscription price. Use is defined in this analysis as a citation in the bibliography of a student research paper.

The aim of this research is to determine what journals, if any, are being cited in psychology student research papers but are not provided by the library, as well as to determine what journals, if any, the library is providing that are not being cited. Using price data, it is also possible to determine the cost-effectiveness of the various journal titles. The hope is that analysis of past trends in use will be helpful in predicting the future use of journals by psychology students at the Academic Library. In the end, since no information we collect from the past will perfectly predict future use, we must take the approach Simon (1981) called "satisficing," which is finding good enough answers to questions whose true answers cannot be known.

Method

Introduction

Bibliographic citations for journals from research papers written by graduate and undergraduate students taking classes in the Department of Psychology at St Mary's University were collected. During three consecutive long semesters, Fall 1994, Spring 1995, and Fall 1995, requests were sent to all full-time and adjunct professors in the department to collect the bibliographies from research papers in their classes for the study.

Procedure

As bibliographies were received, the journal title and citation year were recorded for each journal citation from the student research papers. This information was used to check for library holdings of the journal. The current subscription price was used to determine the cost-effectiveness of each journal by dividing the cost of the journal by the average number of times cited per year. Rank-order of the cost-effectiveness is unchanged by using the average number of times cited or the total number of times cited and the rank-order is the factor of importance

here rather than the actual "cost-per-use." To calculate the real cost-per-use for the library, citations from all students and other university users must be sampled. Subscription prices were taken from the *Librarians' Handbook* (Ebsco Industries, 1995).

Journals were placed in rank order by use and by cost-effectiveness. A calculation of Spearman's rho was used to determine the correlation between rank orders. Journal titles from both lists were studied for possible subscription and cancellation. Journals purchased by the library with funds allocated for the psychology department were compared to the lists. Finally, citations were summarized by decade to determine whether there was a preference for current or retrospective materials.

Results

The total number of bibliographies examined was 157, of which 94 were from undergraduates and 63 from graduate students. The mean number of citations per bibliography was 8.2. The number of citations for each journal ranged from 1 to 88. The total number of journal citations was 1,315 and the total number of journals cited was 400. Journal titles were verified through checking in the PsycLIT database, St Mary's library catalog, the *Librarians' Handbook* (Ebsco Industries, 1995), *Ulrich's International Periodicals Directory* (1996), and OCLC. If the journal title did not appear in any of these sources, the citation itself was researched using the PsycLIT database. A total of 26 citations and 17 journal titles were excluded from the analysis when they could not be verified.

For this analysis, then, the total number of journal citations was 1,289 from a total of 383 journal titles. Journals that changed title over time and were cited under old and new titles were collapsed into the newest title for usage purposes. The mean number of citations for each journal was 3.4, the median was 1, and the mode was 1.

Of the 383 different journal titles cited, 197 or 51 percent were cited only once each. The 186 journals that were cited two or more times account for 1,092 of the total citations or 85 percent of the total number of journal citations. This is 49 percent of the total number of journal titles, far more than the 20 percent predicted by

the Law of Scattering which should account for 80 percent of use.

Of the 1,289 citations, 906 (70 percent) are held by St Mary's University Academic Library. An even higher percentage of these citations, 87 percent, can be found using the PsycLIT database. The top 23 percent of the journals, which includes 88 titles with four or more citations each, accounts for 66 percent of use or 857 citations, not 80 percent. (Due to ranking ties of journal titles with four citations each, I included the top 23 percent of journals in this calculation, rather than the top 20 percent.)

The top 15 journal titles ranked by number of citations is shown in Table I. The top 15 journal titles ranked by cost-effectiveness is shown in Table II. An examination of these tables reveals that there are six journals common among the top ten in each list: *American Journal of Psychiatry*, *American Psychologist*, *Journal of Clinical Psychology*, *Journal of Personality & Social Psychology*, *Journal of Social Psychology*, and *Psychological Reports*. A comparison using Spearman's rho was made of both lists to determine ranking differences between them. A value of $r_s = 0.23$ was calculated. Spearman's rho takes the value of +1 when paired ranks are in the exact same order, -1 for inverse order, and 0 when there is no relationship between the rankings. Practically speaking, however, the correlation would have to be much greater for the

Table I Journals as ranked by use (number of citations)

Journal title	Citations
<i>Journal of Personality & Social Psychology</i>	88
<i>Psychological Reports</i>	45
<i>American Psychologist</i>	34
<i>Journal of Experimental Psychology</i>	27
<i>Perceptual & Motor Skills</i>	24
<i>Journal of Social Psychology</i>	19
<i>Journal of Consulting & Clinical Psychology</i>	17
<i>Journal of Applied Psychology</i>	15
<i>Journal of Clinical Psychology</i>	15
<i>Personality & Social Psychology Bulletin</i>	15
<i>British Journal of Psychiatry</i>	14
<i>Behaviour Research & Therapy</i>	13
<i>Journal of Applied Social Psychology</i>	13
<i>Journal of Personality & Individual Differences^a</i>	13

Note:

^aJournal not held by St Mary's University Academic Library

Table II Journals ranked by cost per use (\$)

Journal title	Cost per use
<i>American Journal of Psychiatry</i>	6.66
<i>Psychological Reports</i>	11.33
<i>Journal of Social Psychology</i>	11.58
<i>Journal of Personality & Social Psychology</i>	11.94
<i>Representative Research in Social Psychology^a</i>	14.00
<i>Psychotherapy</i>	15.00
<i>American Psychologist</i>	16.82
<i>Journal of Genetic Psychology</i>	17.26
<i>Journal of Criminal Law & Criminology</i>	17.50
<i>Journal of Clinical Psychology</i>	18.66
<i>American Journal of Criminal Law</i>	20.00
<i>Journal of Psychology</i>	20.00
<i>Adolescence</i>	20.44
<i>Perceptual & Motor Skills</i>	21.24
<i>American Imago</i>	21.66
<i>Behavior Therapy</i>	21.66

Note:

^aJournal not held by St Mary's University Academic Library

library to use only citations counts for purchases and ignore cost data.

What journals were frequently cited in the study but not held by the library? The top 23 percent of journal titles accounted for 665 of the citations. These titles were examined for library holdings to determine the answer to this question. Table III lists the 21 titles that were ranked in the top 23 percent by citations but that St Mary's did not own. In examining the top 23 percent of journal titles ranked by cost-effectiveness, 16 titles were found that were not held by the library. These titles are listed in Table IV.

Next, the titles purchased by the library with funds allocated for psychology journals was compared to the list of all cited titles. Six of these journals were not cited in the study and are listed in Table V. Examining the list of least cost-effective journals reveals that there are a few of these journals with holdings in the library. These titles appear in Table VI. Finally, regarding the currency of citations, Table VII summarizes the number of citations organized by decade.

Discussion

In St Mary's Academic Library, the current concentration lies more in deciding what journal titles to retain and what to cancel than what

Table III Most frequently held titles not held by St Mary's Academic Library

Journal title
<i>Acta Psychiatrica Scandinavica</i>
<i>Annals of Neurology</i>
<i>Archives of Neurology</i>
<i>Biological Psychiatry</i>
<i>Brain Research</i>
<i>British Journal of Psychology</i>
<i>Bulletin of the Psychonomic Society</i>
<i>Epilepsia</i>
<i>International Journal of Psychoanalysis</i>
<i>International Journal of the Addictions</i>
<i>Journal of Child Neurology</i>
<i>Journal of Clinical Psychopharmacology</i>
<i>Journal of Experimental Social Psychology</i>
<i>Journal of Neurology, Neurosurgery & Psychiatry</i>
<i>Journal of Research in Personality</i>
<i>Journal of Youth & Adolescence</i>
<i>Neurology</i>
<i>Neuropsychologia</i>
<i>Personality & Individual Differences</i>
<i>Psychiatry Research</i>
<i>Psychosomatic Medicine</i>

Table IV Most cost-effective journals not held by St Mary's Academic Library

Journal title
<i>Archives of Neurology</i>
<i>Bulletin of the Psychonomic Society</i>
<i>College Student Journal</i>
<i>Essence</i>
<i>Journal of Clinical Psychopharmacology</i>
<i>Journal of Evolutionary Psychology</i>
<i>Journal of Mental Imagery</i>
<i>Literature & Psychology</i>
<i>Mademoiselle</i>
<i>Neurology</i>
<i>Psychoanalytic Quarterly</i>
<i>Psychological Record</i>
<i>Public Interest</i>
<i>Readers' Digest</i>
<i>Representative Research in Social Psychology</i>
<i>Young Children</i>

new titles to add to the collection. This is due to the escalation of journal prices in excess of budgetary increases. Citation analysis as a collection evaluation method is perhaps a bit more useful for deselection than selection decisions. We expect that materials the library owns will be more often used than those it does not

Table V Uncited journals purchased with funds allocated for psychology journals

Journal title
<i>American Behavioral Scientist</i>
<i>Contemporary Psychology</i>
<i>Journal of Employment Counseling</i>
<i>Journal of the Experimental Analysis of Behavior</i>
<i>Personnel Psychology</i>
<i>Psychometrika</i>

Table VI Least cost-effective journals held by St Mary's Academic Library

Journal title
<i>Accounting, Organizations, & Society</i>
<i>Alcoholism: Clinical & Experimental Research</i>
<i>Behavioral Neuroscience</i>
<i>Cognition & Emotion</i>
<i>Clinical Social Work Journal</i>
<i>Contemporary Family Therapy</i>
<i>Drug & Alcohol Dependence</i>
<i>Journal of Affective Disorders</i>
<i>Journal of Divorce</i>
<i>Journal of Organizational Behavior</i>

Table VII Citations by decade

Years	Number of citations	Percentage of all citations
1940s	1	0.1
1950s	5	0.3
1960s	20	1.6
1970s	96	7.0
1980s	399	31.0
1990s	768	60.0

own, simply due to convenience. Thus, it becomes a form of self-fulfilling prophecy that library holdings should be more heavily cited than materials not held by the library. This lends even more strength to the idea that library holdings that are not cited are good candidates for cancellation, provided that citation counts converge with reshelving counts and other data.

Selection decisions

The Law of Scattering indicates that the top 20 percent of titles should generate about 80 percent of use. In this study, the top 23 percent (calculated due to a tie at 20 percent), of the journal titles generated only 66 percent of the citations. Though there is some overlap of titles in the top ten of the lists of most used and most

cost-effective titles, the rank order correlation of 0.23 between the two rankings confirms that cost does indeed make a difference. A much stronger correlation would be needed before costs could be completely ignored and citation counts alone used as a criterion for selection and deselection.

Tables III and IV show the titles from each of the lists of most used and most cost-effective titles that are not owned by the library. The titles in these tables are good candidates for new subscriptions. Particular attention should be paid to three titles that appear in both Tables III and IV: *Archives of Neurology*, *Bulletin of the Psychonomic Society*, and *Neurology*. Appearance of a title in both tables means it is one of both the most cost-effective and the most-used titles in the study. These titles also meet another criterion for journals that are ordered for the psychology department, that is, they are indexed in the PsycLIT database.

Deselection decisions

The titles listed in Table V that were not cited in the study, but are purchased by the library using funds allocated for psychology journals, are candidates for cancellation. Cancellation of these subscriptions would enable the library to shift funds to purchasing some of the candidates for new subscriptions. In addition, Table VI gives a list of the journals that St Mary's holds that were least cost-effective in this study. These titles would also be good candidates for cancellation except that most of them are not purchased with the budget allocation for psychology journals. These titles are purchased with funds allocated for other departments and should be more frequently used by students in those departments.

Only one of the titles from Table VI is purchased with funds from the psychology allocation and that is the *Journal of Organizational Behavior*. This journal, then, is also a deselection candidate. It is crucial that deselection decisions be made with input from other sources such as reshelving data. If other data do not converge with citation analysis data, we can conclude that perhaps sampling error or some other artefact was at fault. However, if other data agree with the citation data, then cancellation of unused titles is in the best interests of the library and its users. In a study such as this one,

where only one department was surveyed, care must be taken that journals are not canceled that are heavily used by other departments.

Swigger and Wilkes (1991) found the majority of most heavily cited journals were not the most heavily used according to reshelving statistics. This result was confirmed in the academic library in a citation analysis of psychology and counseling Master's theses (Sylvia and Leshner, 1995). The most heavily cited journals in psychology and counseling theses were not necessarily the most heavily used materials on the shelves. However, since reshelving statistics reflect use by all library clients and the citation analysis study dealt only with a very restricted sample of graduate students, this was not an unexpected result. But the result does lend credence to the importance of considering all available sources of data in deselection decisions.

Table VII shows that 60 percent of the citations in the study came from the decade of the 1990s despite the fact that the data were collected during 1994-1995 when the decade was less than half completed. Only 2 percent of the citations were pre-1970. This information suggests that most older journals may safely be converted to microform or moved to storage to save space without seriously inconveniencing the students. It also suggests that when purchasing new psychology journal subscriptions, the library should be cautious about buying backfile volumes more than a few years old since use will probably be low.

Future research using citation analysis should concentrate on sampling a wider variety of students on the campus. Citation analysis for a single department, while useful, does not give an idea of the overall amount of library research being done. A wider sample must be taken to give an overall picture of the use of the whole collection. Another suggestion for future research involves gathering more information on the types of errors that occur in citations.

Citation analysis of student research papers, particularly when coupled with subscription price data, can contribute important details to the information needed for effective library collection development and evaluation. However, data from citation analysis should not be used alone to determine what journals are held by the library. The method has limitations and the best

results for collection development should be obtained by using convergence of data from all available sources.

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