

Engineering Educators and Scholarly Literature: optimizing expenditures for customer need

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ABSTRACT

The purpose of this paper is to provide engineering educators and librarians with a quantitative measure for ranking scholarly journals by relative value for use with cost-benefit analyses. The Serials Redesign Project at Louisiana State University Libraries is a major multi-year attempt to satisfy the actual needs of faculty and students in the face of rising subscription costs and fixed budgets. At the heart of the project is a user survey in which faculty have been requested to list titles that they individually need for research and teaching, and to indicate their choice between in-house subscription and electronic document delivery. In this paper we analyze preliminary results of the survey for the eight departments that constitute the LSU College of Engineering. Based on data provided, recommendations are made for identifying and deselecting the least valuable titles.

KEY WORDS

cost-benefit analysis, collection management, engineering education, academic libraries, engineering research, document delivery, journal subscription.

INTRODUCTION: THE PROBLEM AND ITS POSSIBLE SOLUTION

The traditional approach to the management of collections of journals and other serials has aimed at the ideal of a good collection. The librarian would, for example, consult engineering educators regarding the technical quality of articles published in particular engineering titles. Another method for building a "good collection" could involve the study of subscription lists of prestigious collections¹ (p.179.) One implication of following the ideal of a good collection is that some titles may be deemed crucial to the quality of the collection, even if faculty and students do not need them. Financially, this means that acquisition budgets need to be sufficiently high to accommodate subscriptions that go beyond actual need.

During the past decade, the total acquisitions budget of Louisiana State University Libraries has remained essentially fixed. Ever-rising subscription costs have forced repeated rounds of serials reviews and subsequent cancellations. Faculty have been provided with lists of serials in their area on which they marked their selections. Decisions have tended to reflect departmental views of what a good collection should include. As the number of subscriptions dropped, faculty frustration has risen. Unless additional monies are made available, it is clear that the traditional ideal must be replaced with a focus on the actual needs of the user and



the most efficient ways of satisfying these needs.

During this same period, electronic document delivery has emerged as an increasingly significant access method to scholarly information. CARL/UnCover, one of the vendors with whom LSU Libraries has gained some experience, accepts orders for journal articles in a variety of ways, including electronic mail messages. Articles are then sent to the user's FAX machine. The UnCover service features a database of 5,000,000 journal articles from more than 16,000 titles, over half of which are in science and engineering, and is available for free searching from any workstation that has access to the Internet (data supplied by the vendor). Delivery can be requested online for any citation found. An electronic alert service sends tables of contents of user-selected titles directly to the user's electronic mail account. The results of periodically executed search commands are similarly available. Payment is charged for individual articles and includes copyright fees. Among the benefits of electronic delivery are reduced turnaround times and convenience. For these reasons, the project tests electronic delivery as a possible complement of the in-house collection, and functionally distinct from traditional Interlibrary Loan Services. (Both functions are handled by the same office.) Funds come from the same budget that supports journal subscriptions.

The above mentioned benefits, along with coverage of many academic disciplines, are the major reasons for the prominent role of Uncover in LSU Libraries' solution to the crisis. For the first time in many years we have seen a possibility of improving access to scholarly literature.

In 1994, LSU Libraries embarked on a major multi-year project named The Serials Redesign Project. The general goal of the project is to improve our customers' access to the information they need, regardless of the method of access (subscription or document delivery). More specifically, we aim to identify specific titles that can be canceled, others to which subscriptions need to be initiated, and those for which electronic document delivery is a viable solution. It is not our intention to substitute document delivery for subscription across the board. The project aims to combine the two in the most effective way.

At the heart of the project is a comprehensive survey of faculty at the Baton Rouge campus. During the first year, the survey centered on all the departments in the sciences. For this project it was determined that the appropriate Library of Congress call-numbers range includes basic science (Q), medicine (R), agriculture (S), and engineering (T). This paper presents some preliminary results for the eight departments that constitute the college of Engineering. For this project, the appropriate call-number area was deemed to be the (T) range, excluding a few areas such as photography.

CONCEPTUAL BACKGROUND

Why cost-benefit analysis? The literature suggests that cost-benefit analysis may provide the means to rank journals competing for scarce subscription funds.

Kraft¹ says that, ideally, we would keep a complete record of scientific inquiry, but rising costs and limited funds force us to collect only the most important or useful items. We are therefore faced with a problem of optimizing the collection, the so-called "knapsack problem", in which the problem of journal selection is



approached through a cost-benefit analysis¹. (p.164).

The knapsack problem consists in having to make the best use of limited resources (space in the knapsack). Its solution consists of filling up the knapsack with items ranked in rising ratio of bulk to worth until the knapsack is full. The optimal collection is similarly obtained by first ranking all journals in order of rising cost to worth ratio, starting with the lowest. This ranks the items in decreasing order of value. Starting with the first, one then selects each item until the budget is exhausted¹. (p.169.)

The concepts of journal cost and journal worth (benefit) underlie the knapsack model. Cost can be measured as the sum of acquisition, processing, storage, maintenance (including binding and replacement of missing items), cost of usage, and subscription¹. (p.166.)

The worth of a collection is the sum of the worth of its individual journal titles. It rises when an included or added journal is useful, pertinent, or relevant. Also, the worth of a collection does not rise and may decrease if such journal is not acquired¹. (p. 167.) Indeed, the worth of a collection decreases both when a high worth item is not included or acquired and when a low worth item is. The rationale is that both cases constitute a failure to make the best use of scarce resources.

For a particular journal title, journal worth involves three factors: (1) usage, (2) relevance and (3) availability elsewhere¹ (p. 177.) Let us expand a bit on each.

(1) Usage is the first factor in calculating journal worth. The library seeks to acquire those items that the patron uses. Unused titles decrease the worth of the collection by consuming scarce resources that could be better used. Unacquired titles that are highly sought by patrons imply the same: Money is being spent on other, less desired titles¹. (p. 177.)

Usage is the weighted sum of several components. Depending upon local circumstances, it may include circulation data, observation of users, reshelving records, and photocopying data. For items not currently held, one may use interlibrary borrowing data and possibly data from comparable libraries. Finally, one could also ask patrons what items they would use and to which they want the library to subscribe. That is the path selected by LSU Libraries.

(2) Relevance (to the collection) is the second factor contributing to total worth of a journal. It is a "miscellaneous" category for all the rather subjective, non-quantitative measures of worth. Professional judgment is employed to arrive at selection decisions. Librarians consider the quality of paper and print, the length of a journal run already in the collection, local research and teaching, the judgment of experts regarding the quality of articles in a journal or the reputation of the journal's editor, whether the title is indexed in major databases, and its inclusion in prestigious collections elsewhere or in received lists of recommended titles.

(3) Availability elsewhere is the third factor of total journal worth. The worth of a title should reflect the fact that there are benefits in not acquiring items available elsewhere, or in acquiring items difficult or expensive to acquire elsewhere.



ANOTHER APPROACH

Citation analysis is a major alternative optimization model to the problem of selection. Rather than measuring usage directly, one collects citation frequency data for the titles to be selected (or deselected). Triolo² ranks individual titles in order of descending ratio of citation frequency/title cost. One then selects titles starting with the first, or conversely, one may deselect titles starting from the end of the list. In this approach citation frequency is the number of articles published in a journal title that are cited over a specified number of years under a specified discipline, in a bibliographic database appropriate for that discipline. Journal productivity is another name for citation frequency². (p. 149.)

The high cost of direct measurement of usage is the strongest rationale for citation analysis. Also, it can readily be performed for items not currently subscribed to. However, inferring journal worth or even journal usage from citation analysis is far from trivial.

Triolo² cautions against uncritical application of theoretical models such as citation analysis. In particular, a specific title may meet several theoretical criteria, including high citation frequency, yet not meet the particular needs of certain local users. This can occur when, for example, a clinical journal in a certain medical discipline fails to satisfy the need of some users for articles on social policy within the same discipline. Journals covering social policy must be selected even though the theoretical model does not account for this concern. Direct measurement of usage may avoid this difficulty. Similarly, some journals of foreign origin or those publishing in foreign language may show both high citation frequency and low usage by local users.

Citation analysis may still be able to address difficulties that arise from local needs and local usage patterns. Modification of the model might be considered, by which greater emphasis would be placed on local publishing patterns. Citation analysis would thus be performed on articles authored by local users.

SURVEY METHODOLOGY

Faculty members were asked to request any title they deem necessary for their own research and teaching. A single faculty member could not "vote" twice for a particular title. Up to forty-five titles per faculty member were allowed. Collaborative decision-making was discouraged and a focus on the actual needs of the individual faculty member and his/her students was encouraged. Faculty members were also instructed to disregard library holdings in their selections.

We applied the cost-benefit model by measuring journal worth (benefit) in terms of the number of subscription requests for a particular title. We used the survey results to compile three major groups of titles. Journals that were requested for in-house subscription only once by the entire body of participating faculty members constitute one group of titles. The next group consists of titles that were each requested twice. The last group consists of titles that were requested three or more times. All titles within a certain group are thus of equal worth. Titles belonging to the first group are of lower worth than those belonging to the second (or third) group. We measured cost by summing up 1995 subscription costs for all titles within each group.

RESULTS & DISCUSSION

Column A of TABLE 1 lists the total number of times a particular journal title was stated by faculty



members as needed in the form of conventional subscriptions. For example, in Line 5, the entry of "2" means that two faculty members from the entire population surveyed specified that they needed a certain title and that they needed it as a subscription, not through document delivery. This entry, as explained above, is our measure of worth.

Column B lists the total number of titles thus requested. For example, 80 titles were requested twice each. Column C is obtained by summing up the subscription costs of all the individual titles under B. Again, the 80 titles requested twice each cost \$43,764. Column D lists the average 1995 subscription price for items in a certain group. It is obtained by dividing the figure under C by the one under B. ($43764/80=547.$)

Column E lists the cost/benefit ratio for each group of titles, providing us with the data required for solving our knapsack problem. It is obtained by dividing the entry in column D by the one in column A.

Column F lists the percent of titles whose cost is higher than twice the average for that group. Nine (9) out of 80 journals requested twice each (11%) cost more than \$1094. ($547 \times 2 = 1094.$) Finally, Column G lists the subscription cost for the single most expensive title in its group.

The first line of TABLE 1 provides data about those engineering titles to which LSU Libraries currently subscribes, and for which there were no requests for document delivery. Since there were no subscription requests either, these represent \$26,851 worth of unneeded titles. No other line lists data exclusively for titles to which we currently subscribe. The cost/worth ratio is infinite, because the worth (the number of subscription requests) is zero.

The second line lists data for those titles for which all requests were for document delivery alone. These 113 titles represent \$43,457 worth of subscription costs that can possibly be "saved" by satisfying any future demand through document delivery. (Tentative estimates from Interlibrary Borrowing Department suggest that document delivery costs about \$13.50 per article on average, calculated for all the departments that participate in the project.) The cost-benefit ratio for this line, too, is infinity, because the number of subscription requests is zero.

The third line aggregates all the engineering titles for which there is at least one request for subscription. It represents the group of titles that were requested for traditional subscription. If we were to subscribe to the 350 titles requested, the cost would be \$172,925, or about 7.9% of the total annual budget for acquisition of both serials and non-serials (books).

The next three lines (4,5,6) list data for titles requested once, twice, and three or more times each, respectively. Data in Line 4, listing titles requested once, was calculated from data provided in Lines 3, 5, and 6. For example, our data told us that 350 titles were requested at least once. It also told us the respective numbers for items requested twice and those requested three times or more. To obtain the number of titles requested only once, we performed the following calculation: ($350 - 80 - 88 = 182$). Total cost was obtained in the same way.



Utilizing the data provided in Columns A and D, we can analyze the cost-benefit ratio for average titles of each line. The lowest (and best) ratio is provided in the last line. It is no greater than \$212 per subscription request. (Divide entry in Column D by that in Column A.) For items requested twice the ratio is 273.5. For items requested once it is even higher, 402. This suggests that subscriptions for items requested three or more times may be easier to justify than those for which fewer requests were registered. This is the case despite the interesting fact that average subscription cost rises with the number of subscription requests.

We now have the data we need for solving our "knapsack" optimization problem. As we said earlier the solution is obtained by first ranking all journals in order of rising cost/worth ratio, starting with the lowest. Then, starting with the first, we select each item until the budget is exhausted. Our 88 titles listed in Line 6 are therefore selected first, since their average cost/benefit is the lowest. Should funding permit, we will want to add the 80 titles listed in line 5. The 182 titles listed in Line 4 will be the last to be selected for traditional in-house subscription. The items in Lines 1 and 2 will not be selected, since they were not requested for in-house subscription.

If it is unavoidable that we must prepare for massive cancellations, we now have a quantitative basis for rational decision making. It should be noted that if we subscribed to only the titles requested three or more times each, we would have subscribed to only 25% of the titles requested (88/350) and spent only 32% (56000/172925) of the funds needed to support all requested titles. This means that the most highly prized segment of titles represents 68% savings over the cost of the entire body of requested titles. It should also be noted that the 88 titles requested three or more times (as well as those requested once or twice only) may include new titles not currently subscribed to by LSU Libraries.

Why select the titles requested three or more times as a unified group rather than rank and select the titles individually? We certainly can do just that. Happily, however, it so happens that, for this group as a whole, the cost to worth ratio is the lowest of all groups. Also, it may be simpler to justify our cancellations to faculty members in terms of a single block of titles identified exclusively by number of requests and overall cost-to-worth ratio.



TABLE 1:

Engineering Journal Titles - Survey and Cost Data

	A	B	C	D	E	F	G
	# of Sub- scription Requests	Number of Titles	Total Cost	Average Cost	Cost/ Worth	% of Titles >2x Average (number)	Highest Cost Title
1.	0	143	\$26,851	\$188	infinite	12 (17)	\$1,990
2.	0	113	\$43,457	\$385	infinite	16 (18)	\$4,777
3.	>=1	350	\$172,925	\$494	<=494	13 (46)	\$5,958
4.	1	182	\$73,161	\$402	402	15 (28)	\$5,958
5.	2	80	\$43,764	\$547	273.5	11 (9)	\$5,772
6.	>=3	88	\$56,000	\$636	<=212	11 (10)	\$3,778

SUMMARY

In this paper we illustrate a cost-benefit analysis for engineering journal subscriptions. Survey results are shown to be readily amenable to such analysis, thereby providing a quantitative measure with which to approach selection and deselection decisions. We have shown that under our model it would be easiest to justify subscription to the block of 88 titles requested three or more times each. Given that we currently subscribe to 143 unwanted titles, it is clear that the Serials Redesign Project helps us focus the collection on actual need.

Under cost we included the subscription costs alone. A more complete treatment will have to incorporate other components, such as the cost of cataloging, binding, and shelving. For benefit or journal worth we used the number of subscription requests as expressed in a faculty survey. We did not explore other possible quantitative measures of the worth of subscription, such as the number of requests for electronic document delivery. Nor did we explore components of worth that are less obviously quantifiable, such as the quality of print.

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AUTHOR'S RESUME

Gad Engler began his employment at Louisiana State University Libraries in 1994 as the Science/Engineering & Patents Reference Librarian. He serves as a liaison to 10 science departments, including the 8 departments of the College of Engineering. He has a Master of Science degree in Information Science (1994) from University of North Texas and a Master of Arts degree in Philosophy (1992) from University of Oklahoma.

