**Evidence Based Library and Information Practice**

*Article*

# Three Evidence Based Methods to Compensate for a Lack of Subject Background when Ordering Chemistry Monographs

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**Abstract**

**Objective** – The aim of this article is to present evidence based methods for the selection of chemistry monographs, particularly for librarians lacking a background in chemistry. These methods will be described in detail, their practical application illustrated, and their efficacy tested by analyzing circulation data.

**Methods** – Two hundred and ninety-five chemistry monographs were selected between 2005 and 2007 using rigorously-applied evidence based methods involving the Library's integrated library system (ILS), Google, and SciFinder Scholar. The average circulation rate of this group of monographs was compared to the average circulation rate of 254 chemistry monographs selected between 2002 and 2004 when the methods were not used or were in an incomplete state of development.

**Results** – Circulations/month were on average 9% greater in the cohort of monographs selected with the rigorously-applied evidence based methods. Further statistical analysis, however, finds that this result can not be attributed to the different application of these methods.

**Conclusion** – The methods discussed in this article appear to provide an evidence base for the selection of chemistry monographs, but their application does not change circulation rates in a statistically significant way. Further research is needed

to determine if this lack of statistical significance is real or a product of the organic development and application of these methods over time, making definitive comparisons difficult.

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**Introduction**

It is often the case that the possession of a science degree of any kind leads librarians to subject responsibilities of a broadly scientific or technical nature. For example, a librarian with a bachelor's degree in geology might be charged with subject responsibilities for physics or engineering in addition to the geosciences. In the author's case, he collected materials for pharmacy and chemistry, areas of study related in different, incomplete ways to biology, the degree he earned as an undergraduate in 1988 and applied in research settings for 5 years after that.

Pharmacy, chemistry, and biology as fields of knowledge certainly all describe natural phenomena from a molecular standpoint. For instance, drug-receptor interactions, chemical reactions, and the processes of DNA transcription and translation all occur at this level. But this foundation for understanding is only useful for making broad, limited connections among these subjects. The knowledge that molecules are the common actors is a far cry from understanding the intricacies of the clinical pharmacology of cancer drugs, chemical vapor deposition polymerization, or DNA damage and repair.

While librarians need not know as much as graduate students or research faculty about a subject, a rigorous academic background ending in a degree would seem an ideal preparation for serving their information needs. Such a degree, whether at the bachelor, master, or Ph.D. level, enables the librarian to share an essential intellectual landscape with his patrons. This landscape consists of key signposts or terminology, central ideas or organizing principles, distinct conceptual geographies or sub-categories, and the palpable interconnections between all these features.

The aim of this paper is to add to the existing set of techniques for collection building for those librarians who are responsible for acquiring chemistry monographs without the benefit of a chemistry degree. This paper presents a case study of the experience of one librarian collecting in one subject area at a particular university. These techniques, however, are also generally applicable to subject librarians with minimal content-specific educational background, regardless of the field for which selection choices must be made.

**Literature Review of General Collection Building Methods**

The scope and depth of coverage of collection development and management in the library science literature is significant. A number of monographs published in the past ten years address general principles, guidelines, and universally-applicable best practices (Gorman and Miller; Jenkins and Morley; Clayton and Gorman; Mack; Johnson; Evans and Saponaro). A further set of recent monographs relates to collection building in a variety of specific subject areas, including the humanities (Owens); the health sciences (Richards and Eakin); literature in English (Day and Wortman); music (Maple and Morrow; McCants); area studies (Hazen and Spohrer); and business (Bergart and Lewis). Finally, the literature also includes reproductions of collection development policies (Sylvia; McAbee, Bevis, Poe, and

Whitesel). These policies typically focus on deselection criteria and the appropriate types and formats of materials to collect. They are meant to offer general guidelines, and so do not address the kinds of questions facing subject selectors in their day-to-day work, such as, "Should the acquisition of books on organometallic chemistry be given more priority than the acquisition of books on electrochemistry?"

Research which evaluates collections with materials-based and usage-based criteria offers broadly applicable methods to identify collection weaknesses and future acquisitions. Materials-based research compares collections to an exemplary collection or to lists of titles obtained from respected, representative sources, such as textbook bibliographies (Stelk and Lancaster) or citations from teachers' guides (Ching and Chennupati). Usage-based research examines circulation data from existing collections to determine broad areas of patron use. These studies range from global examinations of the use of collections over time (Montgomery, Bulick, Fetterman, and Kent; Burrell; Kao, Chang, and Lin); to evaluations of recent usage of monographs on general subjects (Fenske; Kraemer); to the use of interlibrary loan statistics to show collection weaknesses (Khalil).

Another broadly-applicable area of research in collection development and management relates to the development of expert systems or decision support systems. This research seeks to build systems that can standardize and automate best practices in order to streamline the selection process and improve its output (Sowell; Johnston and Weckert; Uzoka and Ijatuyi). These systems are either weak at incorporating subject content into the decision-making process or fail to include actual usage data.

**Literature Review of Collection Building Methods Applied to Chemistry**

Sources in the literature that specifically address the challenges of chemistry monograph selection can be grouped for convenience into two categories. The first of these sources are lists of recommended titles which can be based on article length (Sapp; Culp; Rudman) or book length (Bottle and Rowland; Maizell; Douville) and feature annotations of recent works in a variety of categories. Titles, authors, prices, and ISBNs are provided to aid the selector. These lists evaluate and recommend specific titles which are topical, current, and essential. As such, they are quite helpful. Their scope is limited, however, and by their nature they are decontextualized. Because of their "top ten" nature, these lists feature books that would be appropriate for any academic library with a chemistry collection.

A second category features sources that address context-specific strategies for selection. These include selection based on textbook citations (Powell), citations from faculty-published scholarship (Farina and Snyder 146), direct consultation with faculty (Barnett), and the use of approval plans (Farina and Snyder 141-42).

Selection based on textbook citations reflects the recommended readings that both faculty and enterprising students will encounter in the course of study and teaching. These readings, however, are likely to be much more useful for faculty instruction than for faculty research. On the other hand, selection based on citations from faculty scholarship could be quite valuable for faculty research. Monographs, however, are not frequently cited in the chemistry research literature (Barnett).

Direct consultation with faculty members could ensure that their instructional and research needs for monographs are met.

Only a few faculty members, however, respond to requests for selection suggestions, and they are often unaware of the holdings at The University of Houston Libraries (Library). As well, suggestions from faculty are often already part of the Library's collection.

Approval plans are arrangements that libraries make with vendors for the provision of recently published books, as well as electronic or printed descriptions (called "forms") of current or forthcoming titles. Books that fit an agreed-upon set of criteria are automatically sent by the vendor to the library for review. The books are then either selected by subject librarians for inclusion in the library's collection or sent back to the vendor. Subject selectors likewise examine the electronic or printed forms and decide either to discard them or use them as a means for ordering the books they describe. The Library uses Blackwell's Book Services as its approval plan vendor.

Approval plans offer the advantage of timely, automatic delivery of monographs and monograph descriptions based on a specific set of criteria. Sets of criteria form profiles of subjects such as chemistry. The selection derived from an approval plan profile depends upon the degree to which the profile can be calibrated for specificity by the selector. For instance, the vendor may use the criterion "electrochemistry" when sending books or forms to a library. For a library serving patrons that are most interested in the electrochemistry of polymers, this criterion will often prove too general and result in books and forms being sent which are of marginal value to this library.

**Aims**

As discussed above, a biology degree with minimal chemistry course work offers limited fluency in the lexicon of chemistry and only a basic understanding of its underlying principles. Fluency is greater in areas of interdisciplinary study such as biochemistry, biomolecular science, environmental science, and medicinal chemistry, but the bulk of chemical specialties are beyond this level of fluency. A limited acquisitions budget makes this large gap in knowledge a serious difficulty. For without the ability to buy every currently published chemistry monograph, actual purchasing choices must be made from an array of sources, including: approval plans, *Choice* reviews, and publishers' catalogs. Informing these choices are the questions, "Will these books be relevant to the needs of faculty and students?" and "What evidence can I offer in support of relevance?" Three methodologies are presented below that provide evidence to make these choices more relevant. These methods will be described in detail, their practical application illustrated, and their efficacy tested by analyzing circulation data.

**Methods**

*The Integrated Library System (ILS) Method*

The Integrated Library System (ILS) Method refers to the strategic use of ILS-derived, title-level circulation statistics for making collection decisions. The ILS referred to is Millennium, Version 6.0 from Innovative Interfaces, Inc., this being the one used at the Library. Other ILSs likely have the same functionality.

The Search/Holds feature in the Millennium circulation module searches the Library's holdings using a variety of fields. The title, author, and keyword fields may be searched as needed depending on the level of specificity required for an evidence based selection decision. A title search may reveal an earlier edition in the holdings. The circulation information for this edition,

including the checked out, renewed, and last out fields in its Millennium record provides sufficient evidence upon which to base the purchase of the newer edition. A new edition of a monograph is ordered if the old edition has been checked out an average of once/year or has been checked out in the past two years. These decisions can be justified in the first case because of the book's long-term use and in the second case because of a recent spike in use.

For first edition titles, one or more keyword searches are performed to determine the relevance of the book. Poor circulation of recent subject-related titles indicates that the book in question is of marginal value to the collection. Recent circulation of old titles indicates the need for more recent titles, so the prospective purchase would be made in this case.

This method was used to select *Handbook of Size Exclusion Chromatography and Related Techniques*. A search of the ILS revealed a heavily-used previous edition of this title, which had circulated ten times since 1995 and was currently checked out. A search of the ILS is an ideal starting point for prospective titles that are also subsequent editions. It can often reveal the performance of earlier editions, which is sufficient evidence for a selection decision.

A clear advantage of this method of making selection decisions is that, assuming the ILS software is functioning properly, the selector has evidence that books similar to the one he is considering for purchase either have or have not been checked out by patrons from his library. Circulation statistics from these related books are akin to results of experiments in which books were placed before patrons and a specific response was measured (i.e. did patrons check them out or not?). This evidence provides some certainty that the experiments the selector sets into motion with his new acquisitions will yield the same results, and that he was justified in not performing some experiments at all.
This method is not necessarily effective at identifying titles that, if purchased, would fill a *new* or *re-emerging* pedagogical or research need. This may be because patrons choose not to check out books that are topically relevant but are judged by them to be out-dated. Also, patrons may not check out books on a given topic because no such books exist in the collection. The ILS method might help in some of these cases if the subject matter of existing books in the collection is closely related to that of the book in question, since then circulation data are available. But for monographs whose topics are historically new or only distantly related to topics covered by the existing collection, the ILS approach will not be helpful. In this case, testing for the utility of prospective purchases requires different methods.

*The Google-Mediated Method*

Google-mediated searching of faculty and departmental web pages uses Google's advanced search feature. Key terms taken from book titles, descriptions in publishers' catalogs, descriptors from approval plan forms, etc. are entered as phrases or individual words. The search is then limited to the departmental domain name. In this case, "chem.uh.edu" is used to limit the search to the Department of Chemistry's website at the University of Houston. The results of this kind of search vary. They may include course syllabi, learning outcomes, PowerPoint presentations, descriptions of research interests on faculty members' departmental and personal homepages, e-prints, post-prints, bibliographies, and curricula vitae.

The first edition of a book published in 2003, entitled *Computational Materials Science of Polymers*, was selected using this method. A

search was performed using the terms "computational," "materials science," and "polymer." The ten results were a variety of documents related to the UH Department of Chemistry, including: one syllabus, one set of course notes, one description of the undergraduate program, two faculty web pages describing research interests, and five full-text journal articles in PDF format maintained by faculty authors on their web pages. In the majority of these cases, the search terms lacked sufficient proximity to one another to make the results relevant. A typical example of unrelated terms found by the search above is the "course notes" result, which summarizes the occurrence of the terms in bold in its text as "…b. You do not have to read all of this **material**. …See **Science**, 266, 1359 (1994…vii) A nice **computational** example is provided by the reaction of ketene (CH 2=C=O …"

The result that did provide the needed evidence was one of the faculty web pages outlining research activity. On this web page, which has since been updated, is a numbered list of research interests. Among these topics were two of particular importance, captured in the relevant summary of the site as "… (6) Development of **computer** simulation methodology for **material science** and biotechnology. (7) **Polymer** correlations in composite **materials**. …" (Pettitt). The favorable impression given by this summary was confirmed by a visit to the site itself, which made clear that this faculty member's research involves computational methods applied to polymeric materials. The book was ordered on the strength of this evidence.

This method has the virtue of connecting directly to faculty research and teaching interests, which, in the case of faculty homepages, are often articulated in descriptive paragraphs and overviews. These narratives provide scope and context for faculty research. Since they are written at a more general level than, for example, a journal article abstract, they address broader concepts, are dense with key terms and phrases, and make connections between concepts or fields of study. This means that these narratives are more easily comprehensible to the uninitiated, including librarians with little or no subject background. This also means that these text and content rich pages are good candidates for keyword searching by search engines such as Google.

While Google-mediated searching of a chemistry department's web pages can yield a considerable amount of unique information upon which to base monograph acquisition decisions, this information may be both incomplete and out-of-date. These problems are related to the decentralized nature of web authoring on the UH Department of Chemistry's web site (Chemistry). Much of the content on this site is maintained by individual faculty members. As one might expect of a site run by busy researchers and administrators, faculty-specific content may not always be kept updated.

To test this assumption, the faculty pages listed at <http://www.chem.uh.edu/Faculty/> were examined, excluding those pages from adjunct and joint faculty, emeritus faculty, and visiting professors and lecturers. These pages were excluded because their owners were either part of another department with different web-authoring norms (joint faculty); were less professionally active (emeritus faculty); or were, due to affiliation, perhaps less likely to actively maintain their sites (adjunct faculty, visiting professors, and lecturers). While no "last updated" or "last modified" date is part of these pages, dated information listed in both the "Honors, Fellowships, etc." and the "Recent Publications" sections of these sites

was assumed to be a reliable measure of when the pages were last updated. The results of this analysis illustrate the varying levels of attention faculty authors pay to their sites. As of July 13, 2007, 50% (13) of the faculty pages had last been updated five years ago or more and only 15% (4) had been updated in 2007. See Table 1: Faculty Web Page Updating in the UH Department of Chemistry.

To confirm that a substantial number of these web pages were out-of-date, author searches were performed on July 18, 2007 in SciFinder Scholar, a comprehensive database of the chemical literature. These searches showed that a great deal of content in the form of published article titles was missing from faculty web pages. After comparing the publication lists from these pages with the SciFinder Scholar search results, it was found that only 19% (5) of them were up-to-date and reflected the actual published output of faculty members.

*The SciFinder Scholar Method*

Searching SciFinder Scholar (Scholar) was the third method used for collection building. Keywords derived from book descriptions were entered in the "Research Topic" search of the "Explore" feature of Scholar, which accepts natural language queries and provides users with different result sets based on different combinations of key terms. The results were limited before the fact by entering "Department of Chemistry, University of Houston" in the "Company name" filter. The results obtained by this method included journal articles, abstracts from conference proceedings, books, and patents published by current and former UH Department of Chemistry faculty members. A portion of these results were irrelevant because they are products of institutions having "Houston" in their titles or addresses. It is unclear how to avoid retrieving these irrelevant results. Result sets were typically less than 20 items, depending upon the specificity of the search terms.

Table 1
Faculty Web page Updating in the UH Department of Chemistry

| Year of the Most Recent Web Page Update | Number of Faculty Web Pages Updated (26 total) | Percentage of Faculty Web Pages Updated | Number of Faculty with Most Recent Publications in a Given Year | Number of Up-to-Date Faculty Web Pages |
|---|---|---|---|---|
| 2007 | 4 | 15% | 20 | 4 |
| 2006 | 6 | 23% | 3 | 0 |
| 2004 | 2 | 8% | 2 | 1 |
| 2003 | 1 | 4% | 1 | 0 |
| 2002 | 1 | 4% | | 0 |
| 2001 | 5 | 19% | | 0 |
| 2000 | 7 | 27% | | 0 |

Evidence for ordering the book, *Peroxides at the Beginning of the Third Millennium: Synthesis, Properties, Applications* came from searching Scholar using the term "peroxides." This produced 29 results.

Sixteen of these results, more than half of the total, were not published by UH faculty. This is not an uncommon outcome with the Scholar method, since it searches the institutional name and address by keyword. The unwanted results came from Rice University (in Houston, Texas) and Sam Houston State University. More useful, but still not exactly addressing the target audience, were seven articles published by members of the UH Department of Chemical Engineering. These intra-institutional results are valuable as secondary justifications for monograph purchases, particularly if there are frequent collaborations between certain departments or if faculty members have joint departmental appointments.

The remaining six results were authored by faculty in the UH Department of Chemistry and addressed in some part the application of peroxides as reagents in a variety of chemical reactions. This record of scholarly output was sufficient justification for the purchase of the monograph.

The searches in Scholar illustrate one of this resource's primary strengths, its timeliness. Since Scholar is continually updated, searching with this database is the method best suited to probing the agreement between a book's description and the most recent published chemical literature.

In addition to timeliness, Scholar is comprehensive. It covers the chemical literature back to the mid-1800s, with ~9,500 journals indexed ("SciFinder for Academics"). It also covers scientific conferences and meetings, MEDLINE for biomedical and biochemical searching, and patents from U.S. and foreign patent offices. The thoroughness of Scholar's coverage makes it highly likely that monograph descriptors used as search terms will retrieve the corresponding faculty-authored literature, assuming it exists.
Scholar's comprehensiveness has value in other ways. Through patent results, Scholar has the virtue of revealing commercial applications of faculty research and thus providing connections between chemistry, technology, and engineering. By including abstracts from conferences and meetings, Scholar may reveal areas of research that are just beginning to be explored and presented by faculty. This information can make selection decisions more proactive and make monograph collections more sensitive to trends in research.

With this said, a disadvantage of this method may lie in relying too much on or overstating the value of Scholar searches for determining emerging areas of research interest. No matter how timely, Scholar is still a record of *published* work. While papers or posters presented at conferences may describe research in a more preliminary and provisional way than journal articles, they are nevertheless at a level of organization and development to be made part of the scientific record. For information about research interests that have yet to be expressed in publication, faculty web pages may be a better source, if they have been updated. Direct communication with faculty members would also be invaluable in this regard.

*Method of Analyzing Circulation Statistics*

To support the claim that these three methodologies can build a collection of local value, the circulation statistics of chemistry monographs ordered from 2002 to 2007 were analyzed. This time period begins with the author's first year of making monograph purchases at the Library and

ends two years after the author's coordinated application of his three collection building methods. These methods were developed organically over time, so that prior to 2005, they were being used in a limited fashion for book selection. The year 2005 is nevertheless an important point of demarcation because it was at the beginning of this year that the methods were applied for the first time in a rigorous and comprehensive manner for selection decisions.

This time marker offers a convenient point around which the impact of the methods on the circulation of selected monographs can be measured. Consequently, data about monograph selections were arranged in two tables in Appendix 1: Chemistry Monograph Orders 2002-2004 (Excluding Approval Orders and Added Copy Orders) and Chemistry Monograph Orders 2005-2007 (Excluding Approval Orders and Added Copy Orders) (see separate file). The first table shows monographs selected without rigorous application of the methods (2002-2004), and the second table shows those selected with rigorous application of them (2005-2007). The circulation rates of these two groups were then compared to determine if the consistent use of the methods resulted in a higher rate of circulation.

The 2002-2004 and the 2005-2007 tables represent the circulation of all the chemistry monographs ordered for the Library during these time frames, 254 and 295 monographs respectively. The following types of monographic orders were excluded:

- Approval orders - these are monographs that are sent automatically from Blackwell's Book Services because they fit a relatively broad descriptive profile. They are often also judged by the author using the methods before acceptance or rejection. These monographs are not included, however, because their physical presence may engender an acceptance bias.
- Added copy orders - these are excluded because the methods were not involved in their selection. They were selected based on their appearance on lists of highly-used monographs.
- Orders for monographs that are non-circulating - Internal-use statistics could be used for these books, but these data are only gathered periodically. So, this circulation data is excluded.
- Orders that have been cancelled, have not yet been received, have been withdrawn, are being processed, or are missing - These orders have no circulation information.
- Orders to fill a patron suggestion or to alert a specific patron about a particular monograph - In both of these cases, a patron is notified about the book and the book is held for them. Unlike the other selected books, these have inducements to circulation, so their circulation data is excluded.

The following data accompany the monographic information in the tables in Appendix 1 (see separate file):

- Order date
- Received date
- Date on shelf (estimated to be approximately one month after receipt)
- Circulations (excluding renewals) as of May 1, 2008
- Circulations/month as of the date on the shelf

The order date, received date, and circulations were all taken from the records for monographs in Millennium. The date on shelf was calculated by adding a month to

the received date and rounding to the nearest month. The roughly month-long time frame for processing received monographs to shelf-readiness was arrived at through consultation with technical services staff at the Library. The circulations/month figure was calculated by dividing the number of circulations as of May 1, 2008 by the number of months elapsed between the date on shelf and May 1, 2008.

**Results**

When compared, the 2005-2007 cohort of monographs showed an increase in its average monthly rate of circulation versus the 2002-2004 cohort. The 2005-2007 average rate of circulation was 0.058 circulations/month, while the 2002-2004 average rate was 0.053 circulations/month. See below for Table 2: Statistical Features of the 2002-2004 and the 2005-2007 Monograph Cohorts. This appears to represent an increase of approximately 9%, with the numbers of circulations/month on average 9% greater in the cohort using the evidence based methods in a consistent manner.

However, when these two cohorts are considered as two large independent samples and standard statistical analysis is performed, this apparent increase in circulation is seen to be due to natural variations in rates of circulation among the two samples. In other words, there is no statistical evidence that the observed difference in rates of circulation among the 2002-2004 and the 2005-2007 cohorts is attributable to an increasingly rigorous application of the evidence based methods described here.

In order for the difference in circulation between the two cohorts to be attributable to differences in monograph selection techniques, the test statistic $z = \frac{\overline{X} - \overline{Y} - D_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ must have a value less than − 2.33 (Stephens 213-14). In this formula, $\overline{X}$ and $\overline{Y}$ are the means of two populations, in this case the average circulations/month of each cohort. $D_0$ represents the null hypothesis, in this case the state in which the average monthly circulation of the two cohorts is the same. This is the situation which results when the rigor with which the monograph selection methods are applied has no impact on circulation. The symbols $s_1$ and $s_2$ are the standard deviations of samples from the two cohorts. The symbols $n_1$ and $n_2$ correspond to the sizes of the samples drawn from the two cohorts for analysis. In this case, each sample size equals 30. The value of z derived from the data found in Appendix 1 is − 0.294, considerably more than − 2.33, as can be seen below in Table 2: Statistical Features of the 2002-2004 and the 2005-2007 Monograph Cohorts.

Table 2
Statistical Features of the 2002-2004 and the 2005-2007 Monograph Cohorts

| | 2002-2004 Cohort | 2005-2007 Cohort |
|---|---|---|
| Average Monthly Circulation (Mean) | 0.053 | 0.058 |
| Standard Deviation | 0.058 | 0.080 |
| Sample Size Analyzed | 30 | 30 |
| Test Statistic (z) | − 0.294 | |

The methodologies for decision-making discussed in this article are three possible

approaches to building a collection of chemistry monographs. Other methodologies are conceivable, and a number have been used to a limited degree, such as: selection by approval plan, selection via patron suggestions, selection by publisher, and imitative selection based on another institution's collection. While these strategies were once considered sufficient on their own terms, they are now validated by using the ILS, Google, or SciFinder Scholar methods. For instance, chemistry books that come on approval are not accepted until evidence has been identified in the ILS, online, or through Scholar for their future use. For while the fact that a book has been selected by an approval plan is itself a form of evidence, given that it must fit a certain profile of desired material, it may be judged as insufficient, since this profile is sometimes overly-broad. A judgment of insufficiency may also apply to selection by patron suggestion, since individual interest may not reflect institutional interest; to selection by publisher, since not everything by an essential publisher will be locally relevant; and to selection by imitation, since no two institutions have identical sets of research and teaching interests.

Regarding questions of sufficiency related to the three methods, it is fair to say that each method has somewhat different types of evidence and therefore different ways of measuring what amount of evidence is sufficient. For the ILS approach, the evidence reflects actual monograph usage in a local context. As a result, this method is the most directly suited to answering the question, "If I purchase this book, will anyone check it out?" In some situations, making a decision is very straightforward, as in the case of a new edition of a monograph whose earlier edition has circulated well according to the ILS. Other situations are less clear, as when no earlier edition exists and keyword searching reveals related titles with no clear pattern of circulation. Investigation of this title using one of the other two methods may be warranted in order to establish a solid case for or against a purchase.

In the case of the Google-mediated method, results vary widely in their utility as evidence. They must be investigated carefully to determine the extent of their conceptual match to a monographic subject as opposed to simply a keyword match. Given that the use of all these methods reflects to some extent an absence of conceptual understanding of chemistry, it would seem that making this kind of distinction among results would be difficult. In practice, however, it is relatively straightforward and rests largely on both the proximity of terms in the results and their context within larger documents. Spurious results can be easy to identify owing to the occurrence of search terms at widely dispersed points in texts. In useful results, by contrast, the search terms occur in close proximity to one another and tend to be in parts of texts that serve summarizing functions, such as titles, abstracts, or introductions. In cases in which the significance of search terms within the larger text is ambiguous, the clarifying use of one or both of the other methods is recommended.

SciFinder Scholar results have more certain relevance because they are products of matches between search terms and a variety of summarizing elements in document records, including titles, abstracts, and index terms. The locations of terms in these results should be studied carefully, however, because they may co-occur in a way that makes them unrelated to one another or causes them to have different meanings. Also, if search words are elements or compounds, these may match with index terms because of their roles in reactions that are tangential to or irrelevant to the subjects of the monographs being

investigated. It should also be noted that indexing does not exist for every record in Scholar, and so potentially relevant connections may be missed. In this case, the Google method, which searches full text, might be employed.

Because of the limitations of these three methods, they are frequently used together until the ambiguity of a situation is resolved or until all avenues for evidence-gathering have been exhausted. The methods are typically used sequentially in this order: ILS, Google, and Scholar.

With regard to the analysis of circulation statistics, a monthly rate of circulation was used because monographs were compared that were ordered at widely different times. The circulations taken from Millennium records show how often a book has been checked out by patrons. When comparing monographs that arrived on the shelf several years apart, these circulation numbers will tend to be higher for monographs that have been on the shelf longer.

This comparison may give a false advantage based on longevity, since a younger monograph might circulate as much or more than an older monograph, given time. Calculating the rates of circulation can overcome this longevity bias. For instance, a book on the shelf on May 2002 that has circulated eight times has a higher number of circulations than a book on the shelf on May 2006 that has only circulated four times. However, the 2006 book has a higher rate of circulation/month (4/24 = **0.167**) than the 2002 book (8/72 = **0.111**), as of May 1, 2008.

Conversely, the calculation of circulation rates may introduce a regularity bias by falsely assuming that books will circulate at a constant rate. Given that the 2002-2004 and 2005-2007 cohorts of monographs are close in age and young in relation to the May 1, 2008 reference point, however, it seems likely that their average rates of circulation will remain steady for some time. This assumes that Library patrons will be guided in their use of all these monographs in the near future primarily by subject-fit with their information needs and not by dates of publication. This also assumes that the information needs of patrons will not as a group change radically in a short time. During the six-year course of this case study, the Department of Chemistry has consistently maintained its major programs of research.

A more convincing test of a long-term increase in circulation attributable to the use of the methods would involve revisiting the two cohorts at the effective end of the useful life of their monographs. Circulation statistics of the cohort monographs could be compared when the majority of them have reached obsolescence, in perhaps another five to ten years.

**Conclusion**

The methods outlined above were developed over time by a monograph selector seeking to compensate for a lack of academic background in chemistry. As such, these strategies are necessarily influenced by and flow from the selector's particular experiences. So while these methodologies are rational and hopefully of value to others, they do not encompass the universe of approaches to this problem. Other strategies could be employed, including chemistry coursework, extensive dialog with faculty members, reading chemistry textbooks, etc. The methods are admittedly reactive and somewhat inefficient, but they have formed a trusted and effective means of both addressing selection uncertainty and building a collection of local value. The three methods may thus be considered supplements to

other approaches, an echoing of what librarians may already be doing in a modified way, or a process already superseded by better methods. In fact, the present study may perhaps best be viewed as an installment in the education of a chemistry librarian.

The ILS, Google-mediated, and Scholar methods may be considered evidence based in two senses. In the first sense, these are methods which require the inputs of locally-relevant evidence, whether in the form of circulation statistics, faculty web pages, or citations of departmental research. In the second sense, however, there is no statistical evidence that the use of these methods to select monographs increases their circulation. Following the 2002-2004 and 2005-2007 monographs through the lifetime of their usage, to a point when their members have for the most part stopped circulating, may change this picture and show a statistically significant effect of these methods.

Another test of the effectiveness of these methods to increase circulation of chemistry monographs would involve a more controlled adoption of them. The results of this research are complicated and to some extent undermined by the fact that the methods were adopted incompletely or in a piecemeal fashion for some portion of the analysis time period (2002-2004). This reflects the fact that these methods and the use of these methods as a coordinated system were being developed as they were being applied to real selection decisions. The application of the methods or some variant of them by librarians relatively new to chemistry collection development and collection development in general, would offer a much more controlled test of effectiveness.

Finally, the criteria for measuring sufficient evidence for monograph purchases may need to be reexamined and refined. Studies could be conducted which investigate the relative importance of different kinds of evidence to the circulation of selected monographs.

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