Georgia Library Quarterly

Volume 58
Issue 2 *Spring 2021*

Article 7

4-1-2021

Measuring Use of the Academic Print Reference Collection

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PEER REVIEWED

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By Jennifer Putnam Davis

Academic libraries consider level of use a primary factor when determining which titles comprise the print reference collection. After all, this collection designates materials in high demand with non-circulating status, which are then placed in a prominent location within the library for convenient access. Within the last two decades, however, this place of prominence has rapidly diminished as academic libraries claim that use of the print reference collection is declining. Many libraries are now transitioning their reference collection to a largely electronic format and are replacing the physical shelving with collaborative learning spaces. This extensive depletion of the print reference collection is met with incongruent attitudes among academic librarians. Several, like Terrell (2016) and Alvin (2016) are blunt in their declarations that the print reference collection is dead, while others argue in defense for the place of the print collection in today's academic libraries (Lederer, 2016; Prosser, 2020; Verdesca, 2015).

While articles of opinion abound, less so do evidence-based articles that evaluate actual use of the print reference collection. In fact, this literature review found only 10 use studies. This gap in the literature implies that academic libraries manage this collection with anecdotal opinions rather than with empirical measures, which, as the use studies show, can have negative consequences in meeting user needs. Academic libraries therefore should use more measurable methods to correctly identify what is used and what is not used before transitioning the print reference collection.

Each article reviewed here provides valuable findings on assessing use of the print reference collection for academic libraries to consider as they address the future development of this collection.

Inclusion Criteria for Review

The scope of the literature reviewed here consists of academic libraries, both public and private, in the United States, and includes those of research universities, liberal arts colleges, and community colleges. Special collections and archives, medical, law, and corporate libraries are excluded because the focus here is on undergraduate students, who are a primary target for academic library resources and services. The roles of reference librarians apart from collection development, while are periodically mentioned below, are largely omitted from this discussion. The academic print reference collection is explored because this collection has historically endured the most changes from the print format: in the early 1970s two online search databases emerged, Medline and Dialog, both used by reference librarians to search indexes and abstracts at the request of patrons for those who could afford it (Singer, 2009); CD-ROMs materialized in the 1980s, which allowed for library users to perform searches autonomously; the 1990s saw the surge of the World Wide Web and with it, internet versions of reference resources; and today, the availability of online resources has only increased.

For the purposes of this review, the term "print reference collection" refers to those specifically in academic library settings and includes ready reference collections; other collections deemed as reference, such as those found in information or learning commons, are not considered. The term "electronic reference collection" is used here to describe those collections that require internet access and consist of standard reference sources, such as bibliographies, indexes, and encyclopedias, rather than general internet sources like Wikipedia. Additionally, the reader should consider the words digital, e-reference, and online reference as synonymous terms. Literature searches included the following information science databases: EBSCO's *Library, Information Science & Technology Abstracts* (LISTA) and *Library Literature & Information Science Full Text*, as well as ProQuest's *Library Science Database*. Key terms used include use, reference collections, print reference collections, e-reference, electronic reference collections, and academic libraries.

Use as a Criterion for Managing the Reference Collection

Discussions of managing the reference collection based on level of use surprisingly do not appear in the literature until the late-1980s, during which early survey studies revealed that while a majority of reference librarians considered the level of use items receive when deselecting resources in the reference collection, most librarians did not measure this use in any empirical way. Engeldinger (1986), for example, found that 54.4% of survey respondents (out of 377) considered low use a reason for weeding resources but only 6.1% of respondents indicated that they performed use studies. Biggs and Biggs (1987) also found that less than 10% of their survey respondents (471 in total) had conducted use studies, though the majority considered use level important for managing the collection. When asked to estimate how much of their reference collection receives use, respondents guessed that over 30% probably received no use in the past five years (Biggs & Biggs, 1987). If true, these collections would be greatly improved if the unused items could be identified.

Use studies determine which portions of a collection receive use and, more importantly, which do not. In a follow up article to his 1986 survey study, Engeldinger (1990) argued that to avoid false implications of use, academic libraries should examine use of the full reference collection as opposed to reviewing only certain areas of the collection when space is needed, referred to as "crisis weeding." The author explained that in such cases, the areas of the collection weeded are most likely those sections that receive the greatest use, and as a result, volumes receiving use are removed while sections that receive little to no use remain intact because space is not needed in those areas.

This early literature identifies practical applications for conducting use studies, including evaluating the collection holistically to avoid crisis weeding and identifying items used and those not used in order to make informed decisions regarding the deselection of collection materials. These applications are further explored below in reviewing the use studies.

Measuring Reference Collection Use

Within the scope of this review, 10 use studies were found in the literature, all appearing from 1989 to 2020. Most studies apply the re-shelving method, in which items are marked with use in some way before employees re-shelve. This method requires little skill and no direct contact with library users, which makes it easy to incorporate (Arrigona & Mathews, 1989; Biggs, 1990; Kessler, 2013). Furthermore, the definition of a "use" is clear—an item is used if it needs to be re-shelved (Arrigona & Mathews, 1989; Colson, 2007; Engeldinger, 1990). Disadvantages of this method include underrepresentation (Biggs, 1990; Bradford, 2005; Kessler, 2013); if patrons re-shelve items

themselves, for example, the use is not counted. Similarly, items that are used in-between re-shelving are also not captured. Another disadvantage to the re-shelving method is that no qualitative data is collected, such as whether the information a user seeks is actually found and whether it meets their needs; however, Campbell (1974) argued that the less users are required to participate, the more successful the use study will be. Users will not, for instance, subconsciously alter their behaviors because they know they are being studied. It is more likely, therefore, that studying the use rather than the user generates more accurate representations of user interactions with the reference collection.

Arrigona and Mathews (1989), arguably the first use study of an academic reference collection to appear in the literature, presented usage data organized by Library of Congress (LC) classifications. Over a four-week period, reference librarians marked tallies on paper to indicate sources used from the reference collection. Additionally, library staff marked tallies for volumes they re-shelved. Arrigona and Mathews (1989) evaluated this data by comparing the total number of uses to the number of volumes held for each LC classification. This "index of use," as Arrigona and Mathews (1989) called it, reveals the relationship between a collection's use and its size. For example, a 1.00 index of use specifies that the LC classification was used as many times as the number of volumes it holds. What it does not determine, however, is which volumes are actually used; theoretically, a classification could hold 100 volumes but only one of those volumes could receive 100 uses, giving the (false) implication that the classification is well developed and well used.

Arrigona and Mathews (1989) further compared the librarians' indexes of use to the patrons' indexes of use to evaluate for any differences, which is a much more valuable measurement because it reveals what patrons ask and, more importantly, what they do not. Findings revealed that patrons used the education and biology indexes far more than librarians: 863 versus 274 for education indexes and 205 versus 96 for biology indexes, which implies that patrons knew where to find these materials, and that they knew how to use them, without the help of a librarian. Why this occurred is purely conjecture without qualitative data; it could be that abstracts and indexes were sufficiently covered in library instruction sessions or it could mean that patrons once found these materials beneficial and continued to re-visit them.

Engeldinger (1990) presented usage data from a five-year study, during which library staff placed dot stickers, up to five total, on reference resources materials before re-shelving them. The author then calculated how much of the collection received use on a scale from zero to five and determined that the majority of the collection received no use (34.8 percent) while 24.9% received the most use at five on the scale. Engeldinger (1990) explained that an acceptable use rate is situational, dependent upon curriculum needs, collection size, shelf space, and budget. For Engeldinger (1990), this was at least two, which accounts for 48.6 percent of the collection. Reviewing use in such simplified terms, as opposed to a more detailed examination like Arrigona and Mathews (1989) conducted, unfortunately leads only to generalizations. To illustrate, Engeldinger's (1990) findings only revealed that over the course of the study, almost half of the reference collection received adequate use and the other half did not.

The methodology Engeldinger (1990) applied does in fact allow for collecting the frequency of use for each reference volume, data which grants a more descriptive analysis, but the author concerned himself primarily with determining the collection's frequency of use overall. To measure the overall proportions of use, Engeldinger (1990) did however list frequency of use by LC classifications in table form (p. 125) but offered no commentary on

these statistics. Nevertheless, this data is valuable for the current discussion to draw comparisons across studies. For example, Engeldinger (1990) found similar results to Arrigona and Mathews (1989) in that both studies listed LC classifications L and HG–HJ among the top-five most used classifications, but each study listed different classifications for receiving the least amount of use.

Sendi (1996) employed counting methods used by both Arrigona and Mathews (1989) and by Engeldinger (1990) in her one-year use study. Unlike the two previous studies, however, Sendi (1996) designed hers with very specific parameters, including what they counted, how they counted, and when they counted. These parameters most likely were implemented as a way to combat the chances of patrons re-shelving items themselves or using items in between shelving. Additionally, Sendi (1996) is the only use study that incorporated qualitative measures. The author distributed surveys to patrons using the reference collection to obtain more information on the demographics of reference collection users and to gather insight on how well users perceived their use of the collection, such as whether they found needed information. Sendi (1996) also distributed questionnaires to faculty in order to collect information about the subjects and types of reference information they use for their teaching and research needs.

Despite the intricate efforts of the study design, Sendi (1996) listed only one statistic: 43% of the ready reference titles did not receive any use during the one-year study period. While the lack of reported data is severely limiting to the current discussion, Sendi (1996) discussed use of indexes in slightly more detail. The *Wilson* indexes received the most use, while indexes covering the medical and health fields, and those covering the humanities, received the least amount of use. Although the author did not identify which *Wilson* indexes received use, this finding still indicates that the need for indexes varies by discipline. Sendi (1996) offered no insight for this difference in use, but one possibility is that students were required to use the *Wilson* indexes for an assignment. This inference further illustrates the importance of developing the reference collection to support current curriculum needs.

The qualitative data of Sendi's (1996) study is certainly more valuable than the limited use statistics. The results of the surveys, for instance, revealed that most patrons who used the reference collection do so more frequently than what the librarians had estimated, and most respondents indicated that they successfully found the information they needed; however, this data was collected through a user study rather than a use study (Broadus, 1980), which has its own disadvantages. Biggs (1990) explained that methodology which involves questioning study participants directly can be challenging because of low response rates (reliance is on user participation). Even more challenging is ensuring that the selection of a user sample and the time frame of use is representative of true behaviors. If either the sample or time frame (or both) does not capture accurate user activity, the study results are more likely to be unreliable. Sendi (1996) experienced both of these challenges during the faculty questionnaire portion of her study.

Welch, Cauble, and Little (1997) presented findings from a two-year use study and are the first investigators to have used automation as the methodology for collecting data. Librarians scanned reference titles into the integrated library system (ILS) before re-shelving. This methodology imitates Engeldinger's (1990) technique of marking resources with dot stickers, but automation allows for faster data collection and for potentially capturing more accurate and comprehensive data since item records should be included in the online catalog. Contrarily, the ILS Welch, Cauble, and Little (1997) used could not provide the level of detail needed, so they created an in-house database to capture more information.

Nevertheless, by using automation, Welch, Cauble, and Little (1997) were able to determine which reference titles received use and how frequently. The authors reported the five most heavily used LC classifications (Table 3) and the five most heavily used indexes, as well as titles which received over 100 uses during the study period (seven in total). Collecting data by titles can reveal patterns of use, which allows academic libraries to anticipate the needs of their users and ensure that they provide adequate access to needed resources. This can include updating resources to the most recent edition or acquiring additional copies if the demand warrants it.

Bradford, Costello, and Lenholt (2005) conducted their use study over a two-month period in both fall 2002 (October and November) and spring 2003 (March and April) semesters. Similar to Arrigona and Mathews's (1989) methodology, librarians manually recorded sources they used while staffing the reference desk, but they also indicated the type of resource used among twenty-three categories, which included traditional reference resources as well as digital reference resources, open websites, and even the librarians themselves. Organizing the data in this way allowed Bradford, Costello, and Lenhold (2005) to identify not only which traditional resources received use, but also which sources beyond the print collection the librarians consulted. Librarians manually entered reference titles into Excel spreadsheets; however, the authors found inconsistencies in the categorizing of sources due to unclear category definitions, particularly for that of the "librarian" category. Along with the reference titles used, librarians also recorded the questions received, which allowed the authors to further evaluate the number of sources used to answer each reference question.

The authors reported that librarians used 1.8% of the print reference titles (173 out of 9587) to answer patron questions. Though an irrefutable low statistic, measuring use by titles rather than by volumes may not represent accurate use because titles do not take into account individual volumes; for example, encyclopedias consist of multiple volumes but are counted as only one title. Bradford, Costello, and Lenholt (2005) also determined that librarians referred to electronic resources more frequently than print (23.92% versus 9.38%), and that librarians referred to only one source to answer 75% of the questions received. This finding led the authors to question whether the reference librarians found electronic resources easier to use and more authoritative or were they simply unfamiliar with the print reference collection and need more in-house training. This is an important differentiation for libraries to consider to ensure that their librarians are well versed with the reference collection to effectively assist users.

Following this first study, Bradford (2005) conducted a second use study to evaluate print reference sources used by both librarians and by library users. Bradford (2005) used the same time frame and the same months (October, November, March, April) as in her first study, but this time, librarians scanned item barcodes into the library's ILS instead of manually recording titles. Like Welch, Cauble, and Little (1997), Bradford (2005) found that automation saves time in collecting data, but the author also discovered that allowing multiple people to scan without having a clear communication plan caused discrepancies in data collection, such as duplicate entries or missing entries altogether.

Bradford (2005) reported that librarians and patrons used 8.5% of the total reference volumes during the four-month study period and noted that the use of each LC classification was proportional; that is, the classes which hold the most volumes generally received the most use. Bradford (2005) counted use of LC classifications by both frequency of use received, as Arrigona and Mathews (1989), and by unique uses, that is, the number of volumes receiving at least one use versus those volumes which did not receive use. The author

compared this result to the 1.8% use rate found in her previous study (Bradford, Costello, & Lenholt, 2005) and concluded that library users consulted the reference collection more often than librarians. This finding is similar to the results of Arrigona and Mathews' (1989) study, which further corroborated that users will seek the reference collection without being directed towards it by librarians. It is important to note here that Bradford (2005) compared 8.5% of reference volumes to 1.8% of reference titles, the difference of which is not actually possible to calculate because volumes and titles are two different units of measure; however, Bradford (2005) included the use by titles in figure seven of her second article, which can be used here to determine the difference in use between the two user groups. Use by titles for the second study is 9.7% (Bradford, 2005, p. 552), which means that patrons used the print reference collection 7.9% more than the librarians. As demonstrated, comparing the same units of measure can support conclusions more effectively because the data is more informative.

Drawing implications on why users sought the materials in this case is difficult without qualitative data such as that which Sendi (1996) collected, but Bradford (2005) was able to identify frequently used titles which provides some insight; for example, *Readers' Guide to Periodical Literature* was used 28 times in spite of the library subscribing to the online version. Bradford (2005) concluded that this high use rate of the print version is most likely because the online version only indexed back to 1983, which demonstrates that there is an obvious need, at least among Bradford's (2005) library users, for older print volumes.

Colson (2007) replicated Engeldinger's (1990) study. Library staff marked reference volumes using dot stickers before re-shelving them. Unlike Engledinger (1990), however, Colson (2007) used different colored stickers to represent each year of the five-year study. Moreover, Colson (2007) initially did not limit the number of stickers for each item as Engeldinger (1990) did, but Colson (2007) explained that this became too time-consuming, and so she limited each item to a maximum of ten stickers per year. Still, Colson (2007) was able to utilize a much larger scale than Engeldinger (1990), from zero to 50 uses compared to Engeldinger's zero to five uses, which captures frequency of use in more detail. Nevertheless, Colson (2007) found similar frequencies of use as Engeldinger (1990); both authors determined, for example, that 35% of their respective reference collections received zero use over five years. Additionally, both authors also found that throughout their individual studies, more than 50% of the collection received less than two uses. Therefore, it seems that while Colson (2007) attempted to capture more detailed data than Engeldinger (1990), the difference in technique shows to have had little impact on the results.

Colson's (2007) study essentially evaluated use by titles, which, as discussed with earlier studies (Arrigona & Mathews, 1989; Bradford, 2005; Engeldinger, 1990; Welch, Cauble, & Little, 1997), can reveal patterns of use. The author's incorporation of different colored stickers may help to identify patterns more visually; for example, reference volumes found to have colored stickers from every other year could indicate that while these volumes do not receive consistent use each year, they still meet the needs of elective courses that are offered on a rotating course schedule. Colson (2007) found that LC classifications BR, BS, PA, and PN received the most use, a finding which correctly reflected curriculum offerings according to the author. Colson (2007) agreed with Arrigona and Mathews' (1989) argument that libraries should measure classes by intensive use, but rather than using their methodology for measuring frequency of use by volumes, Colson (2007) used Bradford's (2005) method of measuring number of unique uses for each LC class. This method of measuring use reveals more accurate proportions. Unfortunately, Colson (2007) offered only minimal data from these

measures, but those that are presented show overall a large intensive use rate.

Kessler (2013) evaluated use over the 2010 fall semester following the same methodology as Welch, Cauble, and Little (1997) as well as Bradford (2005), in which library staff scanned items before re-shelving them. Kessler (2013) reported a 7.1% use rate of the total reference volumes, which is slightly less than Bradford's (2005) finding of 8.5%. Kessler (2013) attributed this minimal finding to the short length of study and to an increased reliance on web-based reference resources. Alternatively, however, the author found that while the library subscribed to *Literature Resource Center (LRC)*, the third most frequently used print title during the study was *Contemporary Authors*, which *LRC* includes in its content. This finding could suggest that library users are unaware of the online version or could indicate that they prefer the print format of this resource.

Unlike Bradford (2005), Kessler (2013) stated that the use rates for all LC classifications during the study was disproportionate to their number of holdings. Kessler (2013) applied a different methodology from earlier studies to determine this; the author first calculated a classification's percentage of use and then compared it to the proportion of which the classification comprises the reference collection as a whole, rather than comparing percent used to the size of the classification itself. For example, Kessler (2013) reported that LC class A received 3.4% use and A comprised 9.4% of the collection. According to Kessler's (2013) logic, use of LC Class A is not proportional because it is not equal to its proportion within the reference collection (i.e., 3.4% does not equal 9.4%). If Kessler (2013) had used Bradford's (2005) method, however, and compared strictly by numbers and not by percentages, the use of each LC classification is contrarily slightly more proportionate to the size of their class holdings. In other words, based on the data Kessler (2013) listed in her article, it is determined that the LC classifications which hold the most volumes received the most use; however, as Engeldinger (1990) explained, the acceptable use level depends on local needs, and therefore it can only be hypothesized whether Kessler would find the use proportional when measured using Bradford's (2005) methodology.

Rose-Wiles and Irwin (2016) presented data from a one-year study of collecting in-house use statistics, including the print reference collection. Library staff scanned barcodes into the ILS before re-shelving them. The authors reported an overall use rate of 2.3%, with an average of 2.3 uses per unique title for the print reference collection. Like previous studies, this study also organized use by LC classifications in percentages, which shows what proportion of each classification received use. Unlike earlier studies, however, Rose-Wiles and Irwin (2016) performed a Pearson correlation (r) test to investigate correlations between number of holdings and number of recorded uses. The authors found no significant correlation between the size of an LC classification and the number of uses the classification received during the study period (r = 0.246). This result does not support assertions from previous studies that a large classification size will likely

Total Average % of Collection Used	**2.3**
Medicine (LC Class R) % of Collection Used	32
Science (LC Class Q) % of Collection Used	9.3
Philosophy, Psychology, and Religion (LC Class B) % of Collection Used	4.2

Table 1: LC Classification outliers from Rose-Wiles and Irwin (2016) data

receive a large number of use (Arrigona & Mathews, 1989; Bradford, 2005; Kessler, 2013). In other words, the size of a classification has no effect on the number of uses it will receive.

Determining proportional use of classifications is nevertheless important for comparing the results to each other to identify outliers. Rose-Wiles and Irwin (2016) found four outliers in their data (p. 210) [see table 1]. The authors further investigated the medicine and science outliers and found that nursing books especially experienced high use. This finding is not surprising given that the authors already knew that nursing students preferred print versions of their textbooks rather than the electronic package, because the library previously negotiated purchasing the print texts for the reference collection. Why the nursing students preferred print over electronic textbooks is not explained by the authors, but this finding does demonstrate that format preferences can vary by discipline, which suggests that academic libraries should approach managing the reference collection from various discipline perspectives. Another explanation for such high use in the medicine and science classifications is the collections' currency. Rose-Wiles and Irwin (2016) stated that these sections in particular are curriculum-focused and so the resources are often the most recent editions. This finding implies, and corroborates earlier studies, that developing reference collections based on curriculum needs increases the collection's likelihood of receiving use.

In a follow-up study, Rose-Wiles, Shea, and Kehnemuyi (2020) presented use data collected from 2015–2018. Library staff scanned item barcodes before re-shelving, following the same methodology implemented in the previous study. The authors determined that 5.3% of the reference collection received use over the four years (Table 2).

Year	Percent of Collection Use
2015	2.5
2016	1.5
2017	1.1
2018	0.7
Total	*5.3*

Table 2: Percentage of use by year in Rose-Wiles, Shea, and Kehnemuyi (2020)

Additionally, the authors calculated the rate of change for use from the first year of the study to the last and find a decrease of 79%. When examining the use rates for each ascending year, however, the data shows a less dramatic decline. As Table 2 shows, use in the second year decreased by only 1% from the first year and use in the third and fourth years decreased each by a mere 0.4%. Therefore, the decline in use is not as severe as the rate of change implies, but instead is rather steady and consistent. This becomes even clearer when comparing this data to Rose-Wiles and Irwin's (2016) first study, which found a use rate of 2.3% over one year (2013–2014).

Rose-Wiles, Shea, and Kehnemuyi (2020) further investigated the change in use from 2015 to 2018 for broad subject areas, including the humanities, social sciences, and STEM. The authors calculated the rate of change for use from 2015 to 2018 as 78%, but in both years the usage rate of these resources exceeded the use rate of the total reference collection (2.8% versus 2.5% in 2015 and 0.9% versus 0.7% in 2018), which means that library users consulted these resources more frequently than other materials in the collection. The authors did not report subject use for each year of the study, so comparisons cannot be made like those discussed above in regards to the total reference collection. Notwithstanding, this study shows that evaluating use based on polarized data (i.e., first year versus last year of a study) can lead to exaggerated conclusions, but comparing use among shorter time periods allows academic libraries to identify trends that

can help predict future collection use and needs.

Discussion

Measuring use involves two components: the methodology used and the period of time during which use is measured (Broadus, 1980). All of the above studies employed the re-shelving method. The tally technique that both Arrigona and Mathews (1988) and Sendi (1996) applied, and the scanning barcodes technique incorporated by several studies (Bradford, 2005; Kessler, 2013; Rose-Wiles & Irwin, 2016; Welch, Cauble, & Little, 1997) seem to be the fastest methods for collecting use data but are not the most efficient methods, since some the use studies reported that vital information like titles and volume numbers were not always captured. In contrast, the sticker method that Engeldinger (1990), Sendi (1996), and Colson (2007) applied and the method of manually entering data that Bradford, Costello, and Lenholt (2005) implemented, seem to be the most labor-intensive techniques, but, if performed correctly, are arguably the most effective methods for capturing use data. Notwithstanding, all of these methods allow for measuring the overall use of the reference collection, measuring collection use by LC class, and allows for measuring use title-by-title or volume-by-volume.

Additionally, these studies demonstrate that presumably, the longer the study, the more use the collection will receive. A primary illustration of this is Rose-Wiles and Irwin (2016), which determined 2.3% use rate over one year, compared to Rose-Wiles, Shea, and Kehnemuyi (2020), which calculated a 5.3% use rate over four years. Furthermore, both Engeldinger's (1990) and Colson's (2007) studies support this assumption as both conducted five-year studies and both determined an overall large percentage of use in contrast to those studies that covered shorter periods of time (Table 3). Moreover, the findings of Colson (2007) could logically imply that the longer a source is available without any electronic alternative, the more use it will receive. In fact, Colson (2007) made specific mention of how electronic reference resources caused minimal impact on the study's data (p. 171). This is an important finding for academic libraries when faced with inevitable budget restraints.

Time notwithstanding, the overall use of the collection only satisfies curious assumptions, as no valuable conclusions about the collection can be drawn from it. One statistic does not reveal, for instance, which portions of the collection are being used; however, comparing the overall use statistic between different user groups like some of the studies presented (Arrigona & Mathews, 1989; Bradford, 2005;

Study, in Order of Publication Date	Percent Used	Length of Study
Arrigona and Mathews (1989)	21.3 percent of reference volumes	4 weeks
Engeldinger (1990)	65.2 percent of reference volumes	5 years
Bradford, Costello, and Lenholt (2005)	1.8 percent of reference titles	4 months
Bradford (2005)	8.5 percent of the reference volumes	4 months
Colson (2007)	64.7 percent of the reference volumes	5 years
Kessler (2013)	7.1 percent of reference volumes	4 months
Rose-Wiles and Irwin (2016)	2.3 percent of reference volumes	1 year
Rose-Wiles, Shea, and Kehnemuyi (2020)	2.3 percent of reference volumes	4 years

Table 3: Findings of Overall Reference Collection Use. Not all studies report overall use of the print reference collection. Those who do are listed.

Bradford, Costello, & Lenholt, 2005) can lead to significant findings, such as how much library users are consulting the collection without the help of a librarian.

As opposed to the overall use statistic, measuring use by LC classification can reveal use patterns and help libraries determine how proportionate the class holdings are to their perceived use. Some similarities are found across the use studies; many, for example, list the same LC classes for receiving the most use (Table 4). There is also a noticeable difference in the overall decline of use with some classifications, particularly with classes A, L, and K.

It is important to reiterate here that counting use of unique titles and omitting frequency of use counts can eliminate the possibility of generating false levels of use. To illustrate, a classification range could be used proportionally at 100% but theoretically, one title could be used the same number of times as the number of titles being held within that class. The studies which take into account unique use are Engeldinger (1990) and Bradford (2005), both of which can therefore serve as prime examples for future use studies.

Finally, these studies show that measuring use by frequency collects the most insightful information regarding use, but this is dependent upon in what ways frequency is calculated. Listing frequency by titles, like Bradford (2005) and Kessler (2013), provides the most in-depth data as opposed to generalizing through scales (Colson, 2007; Engeldinger, 1990;) and averages (Rose-Wiles & Irwin, 2016; Rose-Wiles, Shea, & Kehnemuyi, 2020). Knowing exactly what of the collection receives intensive use can ensure a useful collection overall. Frequently used titles can also provide information on format preferences and user needs; for example, Rose-Wiles and Irwin (2016) discovered that nursing students preferred resources in print, and Bradford (2005) found that users frequently consulted the print *Readers' Guide to Periodical Literature* because it dated back further than the online version. Additionally, frequency of use could indicate a need for more instruction, such as Kessler's (2013) finding that users may be unaware that the online *Literature Resource Center* contains all print issues of *Contemporary Authors*.

As academic libraries continue to repurpose spaces, these studies model how best to conduct use studies of the print reference

Study	Top Ten Most Frequently Used LC Classification Ranges									
	1	2	3	4	5	6	7	8	9	10
Arrigona and Mathews (1989)	A	T	L	Q	Phonebooks	P	H	Z	K	C
Engeldinger (1990)	Z	P	H	K	D	Q	G	L	M	T
Welch, Cauble, and Little (1997)	A	H	L	P	K					
Bradford (2005)	P	H	G	B	L	A	D	Q	J	K
Kessler (2013)	H	P	D	E	G	A	B	Z	L	J
Rose-Wiles and Irwin (2016)	R	P	Q	B	D	H	K	G	N	Z	C	M	A

Table 4: Most frequently used LC classification ranges. Not all studies report use by LC classification range. Those who do are listed below. Additionally, for comparison purposes, LC classification ranges were examined among the studies by broad LC class.

collection and why it is important to do so. Use studies reveal format preferences as well as the information needs of users and identify gaps in knowledge of reference resources of both users and library staff. Regardless of which technique used to measure use, the acceptance levels of use should be determined by answering the following three questions: How much of an LC classification has to be used in order to be considered proportionately used (over a given time period)? How many LC classification ranges have to receive proportionate use in order for the full collection to be considered proportionally used? And, finally, how many times does a title have to be used in order to be considered adequately used?

Conclusion

A limited number of use studies on the print reference collection are found in the literature, even though every one of these studies argue for academic libraries to continuously assess use in order to ensure user needs are sufficiently met. This gap in the literature suggests that academic libraries are still likely using anecdotal observation rather than empirical measurements of use that Engeldinger (1986; 1990) so fervently advocated. Engeldinger's (1986) question still remains today: why are there so few reports on use? Libraries may assume that use studies take an extensive amount of time and effort. The studies here, however, demonstrate that collecting use data can easily be incorporated into current re-shelving activities. Proactive planning of the study methodology can prevent the inconsistencies experienced by some of these studies, such as ensuring that the desired metadata is accurately captured and clearly defining the data collection responsibilities for library personnel involved. In fact, in spite of the drawbacks experienced, all of the use studies reported that the time and effort expended was advantageous to their reference collection development and management.

Apart from the general need for more use studies on the reference collection, further research is needed from academic libraries who have already transitioned their reference collection on how this transition is impacting library users. Are users finding the reference information they need, for instance? How much use are online reference resources receiving? Can comparisons of use be drawn between reference electronic resources and reference print resources? Are electronic reference resources supporting curriculum needs? Whether managing a digital reference collection or planning for the transition to one, assessing user needs with more measurable methods allows for accurately identifying which reference materials are used and which are not. This in turn allows academic libraries to make decisions regarding the reference collection based on empirical data rather than anecdotal observations.

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