2020

Determining shelving accuracy via sampling in a community college library

John P. DeLooper
CUNY Lehman College

Devika Gonsalves
Teachers College at Columbia University

This is an Accepted Manuscript of an article published by Taylor & Francis Group in Journal of Access Services. It is available online at:
https://www.tandfonline.com/doi/full/10.1080/15367967.2019.1687308 (subscription required).

Full Citation:
DeLooper, J., & Gonsalves, D. (2020). Determining shelving accuracy via sampling in a community college library. *Journal of Access Services, 17*(1), 22–32. https://doi.org/10.1080/15367967.2019.1687308

Determining Shelving Accuracy via Sampling in a Community College Library

John DeLooper, Lehman College CUNY
Devika Gonsalves, Teacher's College

Abstract

During the Fall 2017 semester, staff at the Hudson County Community College (HCCC), Library began to notice that many books listed as available in the catalog were often not being found on the shelves when patrons attempted to retrieve them. This situation puzzled library leadership because HCCC had recently conducted an inventory and removed all missing items from its holdings. To determine the cause of this discrepancy, HCCC staff decided to sample the library's collection to determine if books were available at the expected locations. From this, the library found that a high percentage of its books were not present where they were expected to be. In response, library staff implemented a variety of changes to HCCC's shelving and access services operations.

Introduction

In the Summer of 2017, the Hudson County Community College (HCCC) Library migrated its circulation software from Sirsi Symphony to Koha. As part of the transition process,

the library's staff conducted an inventory of all holdings. When the inventory was complete, they removed the records for all items that were not found on the shelves during the inventory.

However, despite having conducted this inventory, library staff soon began to notice that books were frequently not being found on shelves when patrons tried to locate them. This result was especially surprising because library staff would often try to help patrons find their books, and the staff would not find the books either. At first, many of HCCC's employees assumed that these books were not being found due to the library's relatively small collection size (approximately 50,000 items across two campuses). Staff assumed that if a book was not found and not checked out, it was likely that the book was required by a course and/or related to a topic frequently researched by patrons. Library staff thus assumed that any missing book was likely a result of other patrons reading the item inside the library. However, after experiencing the missing book issue frequently during his shifts on the reference desk, the library's technology director suggested testing this assumption. He asked the HCCC's Dean of Libraries for permission to test the missing book hypothesis by sampling the shelving accuracy of the collection. The dean agreed and assigned one of HCCC's library associates to develop a plan of action and conduct a sample during the Fall 2017 semester.

Literature Review

Sampling has an extensive history as a tool for evaluating the quality of library collections and services. Early references to the practice include Robert D. Leigh (1951), who surveyed several types of libraries to create a sample of library book purchasing expenditures relative to size of collection. Other uses of sampling included sampling the work activities of library employees, as was done by Poage (1960) and Divilbiss & Self, (1978). Studies have also been conducted which tried to sample the typical usage of print materials, including Jain (1966,

1969) and Mundt (2003). In terms of sampling collections, Goldstein & Sedransk (1977) developed a method of qualitatively sampling the qualities and characteristics of collections based publication date, country of origin, publisher, format, and edition of items, and Chrzastowski (1989) measured the physical deterioration of items in the University of Illinois stacks using sampling.

Beyond collection accuracy and availability, O'Neil (1966) compared two sampling techniques, specifically sampling based on cards from a catalog (called shelf list sampling) and sampling based on drawing up a list of locations and choosing specific shelves or shelving units to evaluate (called location sampling) . In the location sampling model, sampling is random, while shelf sampling is "actually a cluster sample" because it relies on catalog cards, and at his and other institutions, several volumes are typically represented by a single card. O'Neill tried both techniques at his library, and indicated a preference toward location sampling, noting:

> Both the shelf list and the location sampling have been used to sample at the Purdue University libraries. Each technique has some advantages which under special conditions make it superior to the other technique. However, the shelflist sampling was found to be much more time consuming than location sampling. The use of the shelflist sampling would be recommended only under special circumstances.

Drott (1969) also studied methods of sampling collection shelving accuracy as he considered several common scenarios during which sampling could be useful. One example Drott discussed was using the card catalog to create a sample to check whether books were on shelves or missing. In his example, this sampling could be done to determine if a full inventory was needed. Drott's method of sampling shelves relied taking on taking records out of card catalog drawers at even intervals and called for ignoring certain areas if too few cards were present.

Bookstein(1973) also analyzed the utility of sampling shelving accuracy, and noted some of the biases present in techniques such as those described by Drott and O'Neill. He pointed out flaws due to using a card catalog, noting that bias in the sampling could be introduced by thicker cards and missing cards. Bookstein recognized that libraries have a "desire to minimize user frustration" and that stacks maintenance, including shelf reading and conducting inventories, can be critical in achieving this goal. He noted, however, that programmatic shelf reading of an entire library collection can be a labor-intensive process, and thus considered sampling as a way to shelf read more effectively.

Study on this issue continued as Cooper and Wolthausen (1977) explored the phenomena of mis-shelving as related to shelf reading. In their study of mis-shelving, which they termed "misplacement," Cooper and Wolfthausen noted that books tend to physically move or drift from the location they are supposed to occupy on any given shelf. This is due to patrons picking out and returning materials to gaps between books on shelves, thus causing shelved items to become out of order. In their sample of a collection at a medical library, Cooper and Wolfthausen found that 5.6% of books sampled were misplaced, which was defined as not present on the correct shelf. 65% of their sample was found to be not in the right place, but on the correct shelf, which they deemed to be sufficient accuracy because they felt that readers tend to browse a shelf to find not just their intended item, but related ones. In this line of thinking, patrons are thus likely to view many items on a shelf.

Edwardy & Pontius (2001) also noted that that maintaining shelves in proper position is a labor-intensive task. In their search to use a statistical approach to determine when to shelf read, they considered a shelf of books as unit, rather than each individual book on a shelf when determining mis-shelving rates. They used simple random selection without replacement

(SRWOR) to estimate a ratio of mis-shelved books, as well as adaptive cluster sampling and control charts to monitor re-shelving accuracy. They noted issues with shelf reading burnout that could cause errors and proposed control charts to see if management intervention was leading toward improvement in shelving accuracy.

Finally, while much of the literature discusses methods of sampling using either catalog cards or printed lists of shelves, the importance of using electronic and computer-based tools for sampling has become more important in recent years. One notable example is El Rayess (2015) who demonstrated the utility of software such as Microsoft Excel for aiding with sampling processes.

Materials and Methods

The library associate chose to sample HCCC's Main Library stacks collection, as it was the college's largest collection and contained the majority of the library's print holdings. The associate then tried to figure out what percentage of books would need to be sampled in order to determine the overall shelving accuracy with confidence. To this end, she referred to the work of Self (2001), who noted that systematic sampling is one of the most popular methods for providing useful data, as well as the work of O'Neill and others who noted that simple random sampling without replacement was frequently employed by libraries. She then approached the technical services librarian and the library's technology associate for assistance. Together, they decided to run a report to determine the extent of the Main Library's stacks collection. This report showed that the stacks contained 28,241 books.

The associate then used the Raosoft Online Calculator to determine an appropriate sample size. She determined that a 100-item sample would suffice for a 95% confidence rate with approximately 10% margin of error. After checking with the library's dean that this was

sufficient, she decided to use the equiprobability method to gain a representative collection of books for the systemic sample. To this end, she divided the collection evenly, achieving the sample of 100 by selecting every 282nd book. She then worked with the library's technology associate to use Microsoft Excel to identify the call numbers for each of these items and generate a list of items to check.

When this list was generated, she formatted the list of call numbers into a pull list, with check boxes to denote several possible statuses for the book. These statuses included present, missing, and found but mis-shelved on the same range. This list was then distributed to the library's circulation staff, who worked in teams of two or three to search for each book. After books were searched and either located or not found, staff returned the pull lists, and the library associate transcribed each result into a master spreadsheet. At this point, she checked if any books had been checked out between the generation of the pull lists and the shelf list checks and marked those on the spreadsheet. Finally, she personally checked for each book that was reported missing as an additional layer of verification. She then analyzed the results of the test and reported them to the library's dean. From running the report to checking for the missing books, this project took three weeks.

Results

From the stacks sample of 100 books, 64 were found shelved in the correct location. 14 items were found on the same shelf range, but not in the correct spot on the shelf. One book was found in a display area but not noted as such in the catalog, and one book was checked out between the printing of the pull list and the transcription of the results. 18 items were not found at all during the search, and two were marked missing during the project by other members of the library staff who were not conducting the inventory. Thus, after excluding the checked-out book

(which we counted toward accurately shelved), 35 books (35%) of the sample were not in the correct (expected) location.

Surprised at these results, the library associate decided to conduct less formal samples of the library's other collections for comparison and verification purposes. These too showed high rates of mis-shelving, but due to the less formal approach, these results are included in Appendix A.

Discussion

After receiving the results of the sample, the library associate analyzed them and created a presentation for library leadership that that examined the scope of the shelving problem. She concluded that the number of books shelved improperly was problematic for ensuring adequate quality of service and likely indicated a series of problems with the library's shelving and stacks maintenance operations. She then brainstormed several possible causes and potential solutions. At this stage, she also realized a flaw in the research method: she started seeking every 282nd book with the lowest call number book in the collection. For a proper equiprobability sample, she should have used a random number generator to find a random book from the collection to start with, then selected every 282nd book from there. After consultation with the dean, this flaw was not considered significant enough to re-run the sample, so she used the existing data in for her analysis.

The associate noted several possible causes of the shelving issues. First, the supervisor of circulation had retired a year earlier, and had not been replaced. This meant that there was nobody formally responsible for overseeing shelving operations. The library associate then found out via informal discussion with circulation staff that after the circulation supervisor's retirement, training on shelving and shelf reading with the library of congress classification

system was now being done on a sporadic and ad hoc basis rather than programmatically. Budget cuts had also yielded a smaller library staff, and employees who left the institution were not replaced. The library had thus become heavily dependent on student labor, since workers hired through federal work study did not impact the library's personnel budget. During her interviews, the library associate also found that the student workers reported that they did not receive the same level of training as other staff members nor did they work as many hours per week as full or part time staff.

Searching for missing materials in teams also revealed that many staff and student workers did not actually know the specifics of the Library of Congress classification system, and thus were incorrectly shelving and shelf-reading during their shifts. Furthermore, a previously established shelf reading schedule had broken down due to the smaller staff and lack of supervision. The library associate speculated that the high number (14%) of books found on the same range but not the correct spot may have been related to this cause. This speculation mirrors findings by Cooper and Wolthausen (1977) who found that robust and regular shelf reading operations are key to maintaining the proper order of materials on stacks and for correcting the mis-shelving events that occur when patrons pull books from stacks and return them in the wrong spot.

In addition, staff identified one confusing section of stacks, where items in the Q section ended in one range and then continued a short distance away, and the relevant end caps were seldom read and rarely updated by library staff. As a result, items at end of range or beginning of the next were often mis-shelved in either location. Also, there was some confusion with other collections such as ESL, which used the same call numbers as the stacks items and were only differentiated by small stickers on each item's spine.

Aside from these stacks maintenance issues, the associate also identified several circulation related issues. During her circulation desk shifts, she observed that some staff had disabled the circulation software's audio prompt notifications, which indicated when a patron's record was not found or if the patron was delinquent and thus not eligible to borrow. In addition, these staff were observed to be not watching the screen for the system's visual prompts which also noted borrower status errors. Errors stopped the circulation transaction, and failure to note them thus led to a situation where books were being loaned with no circulation record kept. In addition, staff on circulation desks were observed clicking past messages that indicated books that belonged to the library's branch campus, which led to employees preparing returned items for shelving instead of transport. The library associate worked at both campuses and noticed that this occurred in both library locations.

Another possible cause of mis-shelving considered by the associate was materials theft. This speculation came from staff who observed that patrons sometimes exited the library and set off alarms at security gates as they left the building. The building design was not conducive for stopping patrons when alarms went off, and no statistics were kept on how frequently alarms were triggered. In addition, staff observed that the alarm system had a high degree of inaccuracy, with both false positives and false negatives, and patrons sometimes left the library with books that were not checked out but also did not set off alarms. With these factors in mind, the associate could not determine how factors like theft, shrinkage, and accidental failure to properly check out books affected the library's shelving accuracy.

Another cause considered related to how the library conducted its ILS migration inventory. In the Koha integrated library system, there are two methods for conducting inventory. In the first, barcodes are scanned into a text file, then uploaded to the ILS, which then

notes the inventory date. The second uses a live shelf list where books are checked and their status noted one at a time against the list. Due to time and staff constraints, as well as limited availability of laptops with internet access, library staff used the first method and conducted the migration inventory by scanning each book's barcode without removing it from the shelf or checking whether it was in the correct location. This thus showed only if books were present, not if they were at the right campus nor if they were in the correct location on any given shelf.

Finally, the associate considered the original speculation that any missing books might be caused by patrons reading books in library. However, since only one book was checked out during the audit, and because she did not locate any previously reported missing books during her final check, she concluded that this is not a likely cause.

After completing this analysis, the associate pondered what an acceptable level of loss is. No formal state, nationwide, or international service standards exist for this, but the issue has been studied before. When Kiger and Wise (1996) conducted an audit, they found 2.5% (10/400 books) were missing from their sample. In contrast, Cooper and Wolthausen(1977) found 65% of their sample was on the correct shelf but not correct location, but just 5.6% of the books they sampled were what they deemed as misplaced (not on right shelves.) Cooper and Wolfthausen thought this level of accuracy was sufficient, as in their estimation, patrons looking for books will usually browse and look at several items on the same shelf. However, in an era of electronic catalogs, and at HCCC where the relatively small collection meant that patrons are often looking for a specific item, the associate and the technology director were uncertain if the Cooper and Wolthausen numbers were a good measure, and thought the library should aim for a collection accuracy level more similar to that found by Kiger and Wise.

Thus, ignoring the one book that was checked out during the sample, 35% of the books sampled books were not where they were expected to be, which represented a severe issue with books being readily available for patron use. With a 10% margin of error, the library is 95% certain to have between 25% and 45% of books be unable to be easily located, far more than the 2.5% ideal found by Kiger and Wise.

Accordingly, this project led directly and indirectly to several operational changes. Based on the findings from the sampling, the library associate developed a "stacks maintenance triangle" plan consisting of training, supervision, and evaluation. To ensure that the training was being done adequately, she created printed online guides for training staff on the library of congress classification system. She also developed new processes and procedures for circulation staff. These included weekly schedules for shelving and shelf reading that ensured that these tasks were done on a consistent basis. She also hosted a "refresher" workshop/Q&A session about shelving and circulation issues for circulation staff and work-study students. In terms of evaluation, she also had multiple workers shelf-read the same sections in order to notice issues with shelving as they arose. Furthermore, she also set a schedule where she conducted periodic spot checks of areas that had been shelf read.

To fix the supervision issues, especially the issues related to staff not properly charging books to patrons at the circulation desk, the library's dean used the results of the sample to help push for hiring a long vacant Director of Patron Services position to supervise the library's access services and stacks maintenance operations. Thanks in part in part to the awareness the sampling project generated, the director of patron services role was eventually filled in 2019.

In addition, the library also considered other potential long-term service improvements. These included converting the library's inventory control tools from tattle-tape and barcode

readers to an RFID checkout system. It was thought that such a system might reduce confusion with book check-ins and check-outs. Another potential tool in maintaining collection accuracy considered was to make the collection "float" (i.e. the circulation software updates item locations on return so that each item returned is shelved at the branch where it is returned) to prevent items from being shelved at wrong library. As the library's dean was on interim status during the inventory and its aftermath, he decided not to pursue any of these as they would require longer-term planning. Accordingly, he decided not to pursue either of these solutions and instead to wait for the hiring of a permanent dean. Finally, the library associate and the technical services librarian noted that they would aim to use the live shelf method in Koha for any future inventories.

Future research:

To determine if the changes resulting from the sample were successful, the library could rerun this test and see if the rate of missing or improperly shelved items has changed. In addition, a sample of the branch campus's collections could also be conducted to determine if a widely discussed perception that the branch's collections were better maintained was correct. More accurate samples of the library's other collections including English as a Second Language, DVD, Young Adult literature, and children's literature could also be conducted. The library could also determine a minimum level of service criteria that states what level of shelf accuracy is acceptable to meet patron information needs and check this on a regular basis, for instance, once a year. Sustained assessment via control charts (as per Edwardy and Pontius) could show whether the changes were truly effective or not.

Conclusion

This study was designed to investigate whether books in the library's stacks collection were present at the location where the catalog said they were. We found that 33% of all books were not in the correct location, which library staff felt was not a sufficient rate of accuracy. Analysis of the sample also revealed some structural weaknesses in the library's staffing levels, operational practices, and training procedures. Thanks to this data, the library was able to successfully lobby to fill vacant roles and implement revised training processes such as the "stacks maintenance triangle." More broadly, it demonstrated that the use of quantitative evaluation, especially via statistical sampling, can be an important tool for creating systems of improvement in libraries.

References

Bookstein, A. (1973). Models for Shelf Reading. *The Library Quarterly*, *43*(2), 126–137. https://doi.org/10.1086/620127

Chrzastowski, T., Cobb, D., Davis, N., Kruger, J., & Betsy, N. (1989). Library Collection Deterioration: A Study at the University of Illinois at Urbana-Champaign (Research Note) | Chrzastowski | College & Research Libraries. *College and Research Libraries*, *50*(5), 577–584. https://doi.org/10.5860/crl_50_05_577

Cooper, M. D., & Wolthausen, J. (1977). Misplacement of Books on Library Shelves: A Mathematical Model. *The Library Quarterly: Information, Community, Policy*, *47*(1), 43–57. Retrieved from https://www.jstor.org/stable/4306756

Divilbiss, J. L., & Self, P. C. (1978). Work analysis by random sampling. *Bulletin of the Medical Library Association*, *66*(1), 19–23. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC225293/

Drott, M. C. (1969). Random Sampling: A Tool for Library Research. *College & Research Libraries*, *30*(2), 119–125. https://doi.org/10.5860/crl_30_02_119

Edwardy, J. M., & Pontius, J. S. (2001, April). Monitoring book reshelving in libraries using statistical sampling and control charts. *Library Resources & Technical Services*, *45*(2), 90-. Retrieved from http://link.galegroup.com/apps/doc/A95105251/AONE?u=lehman_main&sid=AONE&xid=4b46aa02

El Rayess, M. (2015). A Quick, Accurate, and Free-of-Cost Inventory and Shelf-Reading Solution. *Journal of Access Services*, *12*(3–4), 104–117. https://doi.org/10.1080/15367967.2015.1096209

Goldstein, M., & Sedransk, J. (1977). Using a Sample Technique to Describe Characteristics of a Collection. *College & Research Libraries*, *38*(3), 195–202. https://doi.org/10.5860/crl_38_03_195

Jain, A. K. (1966). Sampling and Short-Period Usage in the Purdue Library. *College & Research Libraries*, *27*(3), 211–218. https://doi.org/10.5860/crl_27_03_211

Jain, A. K. (1969). Sampling and Data Collection Methods for a Book-Use Study. *The Library Quarterly*, *39*(3), 245–252. https://doi.org/10.1086/619765

Kiger, J. E., & Wise, K. (1996). Auditing an academic library book collection. *Journal of Academic Librarianship*, *22*(4), 267–272. https://doi.org/10.1016/S0099-1333(96)90116-0

Leigh, R. D. (1951). The Public Library Inquiry's Sampling of Library Holdings of Books and Periodicals. *The Library Quarterly*, *21*(3), 157–172. https://doi.org/10.1086/617789

Mundt, S. (2003). Sampling In-Library Use. *Statistics in Practice -- Measuring and Managing*, *32*, 61–66. Retrieved from https://www.lboro.ac.uk/microsites/infosci/lisu/pages/publications/statsinpractdownload.html

O'Neil, E. T. (1966). Sampling University Library Collections. *College & Research Libraries*, *27*(6), 450–454. https://doi.org/10.5860/crl_27_06_450

Poage, S. T. (1960). Work Sampling in Library Administration. *The Library Quarterly*, *30*(3), 213–218.

Self, J. (2001, December). *Using Sampling to Assess Library Collections*. Retrieved from https://www.arl.org/wp-content/uploads/2007/03/sampling.pdf

Appendix A: Sampling Tables

Collection	Size	Number of Books Sampled	Percentage of Collection	Confidence	Margin of Error
Stacks	28,241	100	3.5%	95%	9.78%
Children's	1,371	96	7.0%	95%	9.65%
DVD	1,399	13	0.9%	95%	27.06%
ESL	3,165	11	0.35%	95%	29.50%

Collection	Correct Location	Incorrect Location (Same Range)	Checked out /Display	Item not found/Missing	% Found Accurately Shelved	Quantity Sampled
Children's*	87	5	2	2	90.6%	96
DVD	10	2	0	1	76.9%	13
ESL	1	2	0	8	9.0%	11
Stacks	64	14	2	20	66.0 %	100

*Children's Literature are shelved alphabetically, not by Library of Congress Classification

Appendix B: Sampling Chart Example

Book Title/Call Number	Correct Location	Incorrect Location	Checked out /Display	Item not found/Missing
BF121.M935 2014			1	
BF576.F45 2007		1		
BF723.S75M33 2000	1			
BL238.R87 2007	1			
BP109 2009	1			
BS2445.S62 2004	1			
CD950.H86 1997	1			
D804.3.M612 1991				1
DC97.5.T82 1978		1		

Appendix B: Stacks Accuracy Figure