Trends of Print Books Usage among Academic Communities: A Transactional Log Analysis

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Abstract: The purpose of the study is to examine the usage patterns of print books in terms of checked-out by subject, publication date, faculty, user categories, and months using the transaction logmethod. Checked-out books log data for one year was collected through library information system (MLIMS) taking the University of the Punjab's central library as a sample. The findings depict that undergraduate and graduate students checked-out most of the books, while academic and administrative staff checked out the least number of books. The library users from the faculty of education, science, and law checked out most of the books. The results also showed that literature, social science, and religion books were mostly checked-out as compared to natural science and technology books. The study is unique in the Pakistani scenario as no previous study investigated the usage patterns of print books in a university setting using log data of the checked-out books. The findings are consistent with other studies of the developed countries.

Keywords: Print books; Collection Assessment; Circulation Statistics; Use patterns, Transaction Log Analysis; Punjab University Library.

1. Introduction

The literature on the reading behavior of various groups of people keeps on adding. The area of usage of print vs. e-books has also got the attention of researchers. Despite the increase in providing enormous digital content to clients, libraries buy print books to fulfill the needs of their communities. Libraries and information centers build book collections for their maximum utilization and fulfillment of the information needs of users. Levine-Clark (2014) stated that libraries have historically been associated with their collections and even more directly with their collection of books. Joint (2008) found that users of university libraries in the USA and UK borrowed more print books year after year instead of decline. They were still borrowing and reading print books in greater numbers than their digitized versions. Payne (2007) conducted a study to address library storage facilities and the future of print collections in North America. He reported that libraries would continue to acquire print book collections in the future.

Libraries have been not only buying but also assessing their use to justify the budget spent and to identify the strengths and weaknesses of collection. Lancaster (1993) stated that the objective of analyzing collection use was "to identify strengths and weaknesses in the collection from present use" (p. 51). Nisonger (2005) stated that collection-centered versus client-centered was probably the most frequently used approach for classifying collection evaluation methods.

One of the common approaches towards assessment was to analyze the checked-out data of books. Wiles and Irwin (2016) stated that "physical book circulation is a traditional but still important aspect of library value and may be positively correlated with the academic success" (p. 207). Littman and Connaway (2004) also stated that "circulation analysis is one of the traditional approaches taken to use studies and collection evaluation in

libraries" (p. 257). They also found that results of circulation data could be applied to address many issues like evaluation, collection acquisition policies, allocating funding for materials, suggesting approaches to deselecting, and allocating physical space for materials. Burke (2016) investigated the use of books by circulation data to answer questions regarding print books. He stated that "circulation as a measuring stick indicates library use and worth as accurately as any instrument available to the researcher" (p.14).

Researchers examined circulation statistics of print books in academic libraries (Adams and Noel, 2008; Allison, 2015; Knievel, Wichet and Connaway, 2006; and Wiles, 2013). The studies were also conducted in Pakistan on the usage of library collections. Mirza (1996) studied public libraries' circulation services in Lahore. The research studies cited above showed that circulation statistics were helpful for libraries and information centers for investigating usage patterns of print books. However, there was no study found to find the usage patterns of the print books in academic libraries under the rising impact of digital content in the Pakistani context.

This study aims to examine the usage patterns of the print books taking Punjab University Library as a sample and using transaction log data of library information system (MLIMS). The PU library spends a large proportion of the budget on purchasing printed books and has the book collection of 200989. The findings of the library's book collection indicated the book usage patterns of academic communities. It may help libraries to build collections considering these trends.

Research Site: The University of the Punjab and its Central Library

Established in 1882 at Lahore, the University of the Punjab is the largest and the oldest seat of higher learning in Pakistan. This university has played a leading role in higher education in the country and it strives to provide a conducive environment for the

pursuit of academic activities. There are 13 faculties and seventy-three departments. According to Punjab University Library (2019), besides fifty-six independent libraries of the teaching departments, constituent colleges, and institutes, the University of the Punjab has a central library, which is called 'Punjab University Library'. It was established in1873 as 'Punjab University College Library'. Punjab University Library (PU Library) holds the biggest collection of books in Pakistan having more than nine local and foreign-language scripts like English, Urdu, Arabic, Chinese, Punjabi, Pashto, Sanskrit, Hindi, Gur-Mukhi. The library has separated book collections into two main sections by language- English and Oriental languages. At the time of the birth of Pakistan, there were 1, 44,204 items in the library collection. The print books in the year 2015 were 1, 88,125 and in the year 2016, there were 2, 00,989 books.

The PU library is spending a huge amount of budget on purchasing print books allocated to various subjects. According to Punjab University Library's fiscal documents, the total amount of budget allocated for print books of the year 2014- 2015 was 1,50,00,000 PKR. The budget allocated for the year 2015-2016 was60,00,000 PKR. The budget allocated for the year 2016-2017 was the same 1, 50,00,000 PKR as in the year 2014-2015. The number of print books acquisition for the year 2014 was 13783, for the year 2015 was 6727 and for the year 2016 was 7091. The library was automated in the year 2002 and provides circulation data for books. The automated system provided extensive data collected over a considerable period using Multilingual Library Information Management System (MLIMS).

Literature Review

A review of the related literature shows that researchers conducted several studies to examine the use patterns of library print books. Renaud, Britton, Wang, and Ogihara (2010) analyzed patterns of library use by academic departments, patterns of book use over 20 years, and correlations between library use and grade point average using data mining technique. The results of data

analysis depicted that undergraduate students checked-out most number of the books, followed by graduate and faculty. The users from the humanities and social science disciplines were more frequent users of the library than science users. Rose-Wiles (2013) analyzed circulation statistics of print books at Seton Hall university libraries by using World Cat Collection Analysis (WCA) tool to generate a picture of the print book collection. The findings of the study depicted that only 21.5 % of the print book collection was circulated from 2005 to 2009 and circulation of the print books varied by subject. The books of Arts, Sociology, and History had the highest checkouts from 2005 to 2009. The circulation was higher for subjects with more current collection.

Allison (2015) measured the academic impact of libraries by analyzing undergraduates' and graduate students library use and their grade point average (GPA). The results of the study showed that there was a correlation between greater library use and students' GPA. The study found that undergraduates with a GPA above the mean university GPA used the library more than those with a GPA below the mean. Gammon and Neill (2011) conducted a study to gain a better understanding of Ohio LINK libraries' resource usage and to identify the limited usage of resources of Ohio LINK member libraries resources. The circulation data for all books were collected and analyzed and the results of the study revealed that circulation patterns varied widely by subject, language, institution, and age of the material.

Knievel, Wichet, and Connaway (2006) analyzed holdings, circulation, and interlibrary borrowing requests of the English language monograph collection at the University of Colorado. The researchers found that monographs of anthropology (43 %), sociology (41 %) and computer science (40 %), and psychology were popular and were highly checked-out by users. Ochola (2002)analyzed the use of circulation and interlibrary loan statistics gathered from the automated circulation of university libraries. The results of this study demonstrated that language &literature, social sciences, and history gained the highest score in circulation and interlibrary loan rates. The language and literature alone contributed 41 % of circulation.

Christianson (2005) examined the circulation patterns of both print books and e-books of Louisiana State Library and found a difference in print and e-books use. The most popular subjects in print books among users were literature, education, library science, and economics. The findings also showed that print book checkouts soared just after the end of the semester in May. Williams and Best (2006) conducted a study to analyze circulation patterns for print and electronic books in the field of political science, public administration, and law. They found that students preferred print materials. They stated that "students will continue to rely on print as the primary means of providing access to the information published in book format to its user population" (p. 477). Japzon and Gong (2005) conducted a study to see public libraries' use in New York City. He used library circulation data of materials to represent public library use. They compared different characteristics of public library users like their education, income, and race, etc. with circulation data. He found that circulation data could be used to measure library services because library circulation data was systematically recorded.

Ameen (2010) concluded that most university libraries seek informal feedback and evaluation of collection. The findings showed that making a formal, planned evaluation of the existing collection was a seriously overlooked aspect in the process of collection management in university libraries in Pakistan. The findings depicted that there was an absence of an overall culture of collection evaluation in university libraries of Pakistan.

A review of previous studies showed that libraries used circulation statistics to evaluate the collection and used findings in collection management decisions. Researchers highlighted trends of book usage, interlibrary loan usage, holdings of the library. There appears a lack of studies in the Pakistani academic context particularly university library to investigate the use patterns of print books using log data of the library system.

ResearchObjectives

The research objectives of the study are:

1.   To investigate the subjects of the most used and less used printed books;
2.   To ascertain the usage patterns of library print books by gender, faculty, user category, and date of publication.

Methodology

The design of the research study is quantitative, and the research method used was Transaction Log Analysis (TLA). This method was developed about 25 years ago to evaluate system performance. Over a decade, it evolved as a method to study unobtrusively interactions between online information systems and the people who use those (Banks, 2002). TLA can be used for managerial purposes in the library. This method has predictive value for library managers. Troll (2002) stated that libraries conduct transaction log analyses to identify user communities, identify patterns of use, project future needs for services and collections, and assess user satisfaction. The PU Library was taken as a sample to determine the usage trends as it has books on all the subjects offered by the University in addition to many specific donations.

Transaction log data of library information system (MLIMS) was used to analyze the usage of print books in Punjab University Library covering the year 2016. The data was collected in January 2017. The researchers sorted out variables of interest of study with the help of IT administrative staff. These variables included gender, program, faculty, user category, date of publication, and subject classification number. The faculty variable included the faculty of science, education, behavioral and social sciences, law, life sciences, arts and humanities, economics and management sciences, oriental languages, engineering and technology, commerce, Islamic education, pharmacy. The user category

included students (Bachelor, Masters, MPhil, and Ph.D.), academic staff (Professors, Associate professors, Assistants, and Lecturers), and administrative staff (Registrar, Treasurer, and Librarians). Print books usage by publication date was also analyzed. Books usage by subject classification was determined by dividing the subjects into ten main Dewey Decimal Classification (DDC) numbers from 000 to 900. To make the data analysis easy, the log data from the Structured Query Language (SQL) database was converted to an excel file. The data analysis of the transaction log was done by using descriptive statistics – Frequencies, Bar chart, line chart.

Results

This section presents the results of circulation log data analysis and usage patterns of print books by gender, faculty, subject, publication date, user category, and month.

Books checked-out by Gender

Figure 1 shows that both male and female users borrowed a total of 33475 books during the year 2016.The majority of male users checked-out 16954 (51 %) books and female users checked out books 16521 (49 %). It shows that male users checked-out slightly more books than female users.
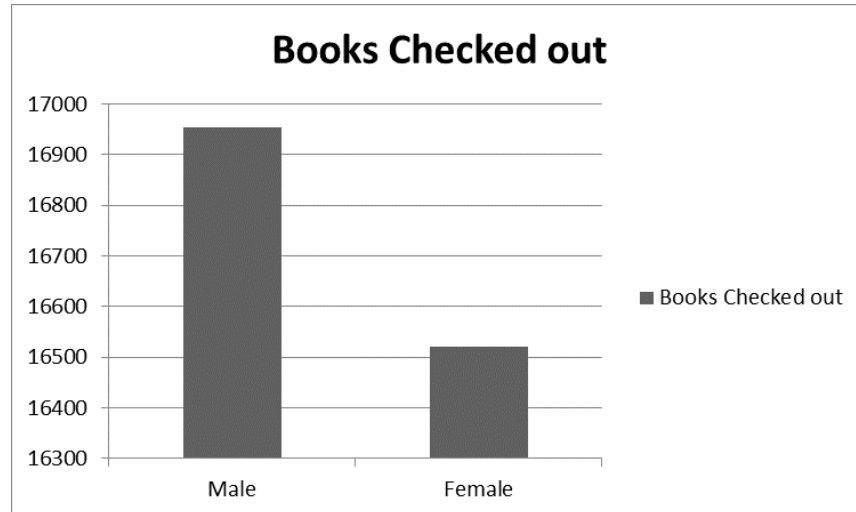
Figure 1 Bar Graph of Books Checked-out by Gender

Books checked-out by Faculty

There are thirteen faculties at the University of the Punjab. Figure 2 depicts that the users from the faculty of education checked-out the highest number of books 5794 (17%) than all other faculties. Followed by the faculty of education, users from the faculty of science checked-out 4990 books (15%). Users from the faculty of Law and Behavioral and Social Sciences checked out books (11%). The faculty of Islamic education (4%), pharmacy (1%), and commerce (4%) had the lowest number of checkouts. The faculty of Pharmacy is on the old campus (quite far from Punjab University Library) and this might be a reason for its fewer check-outs.
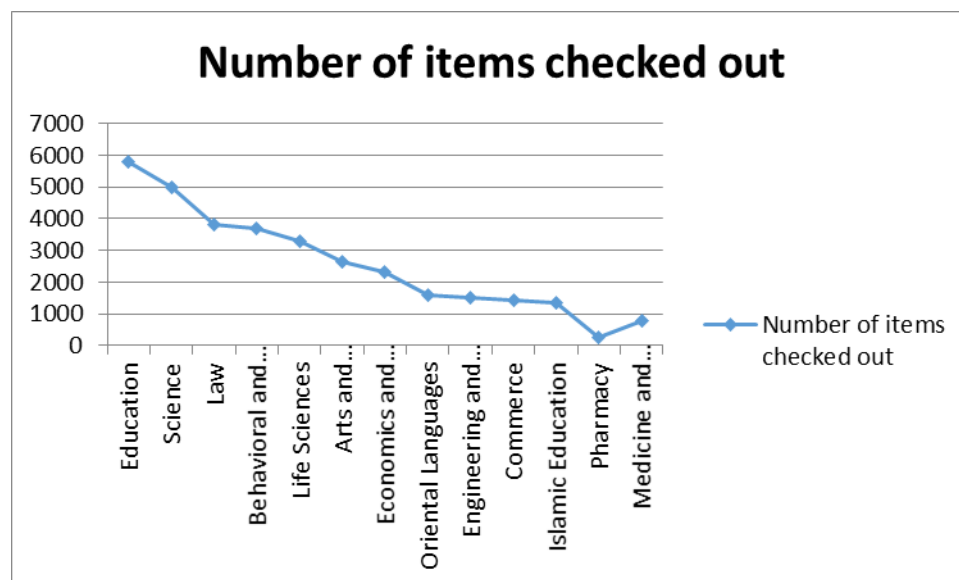
Figure 2 Line Graph of Print Books Checked out by Discipline

Books Checked-out by User Category

The university community comprises of students, academic and administrative staff. Table 1 presents the books checked-out by user category and depicts that an overwhelming majority of books (95 %) were checked out by the students. However, among students, the highest checkouts 14925 (44 %) were of bachelor students following by the master's students 11756 (35%) books. MPhil students checked out 3688 (11 %) number of books. The lowest number of book checkouts was by administrative (1 %) and academic staff (2 %).

Table 1

Books Checked out by User Category (N=33475)

User category	Number of items checked outs	Percentage
Ph.D. Students	1598	5
MPhil Students	3688	11
Master Students	11756	35
Bachelor Students	14925	44
Administrative Staff	833	3

Academic Staff	675	2
Total	33475	100

Books checked out by broad subject

Table 2 presents the books checked-out by a broader subject using the first summary of the Dewey Decimal Classification (DDC) scheme comprising ten main classes. However, the oriental collection of the Punjab University Library – Arabic and Persian collection was organized using a local classification scheme, therefore, it was presented in Table 2 separately. Similarly, the 'Biography' collection was organized separately in the library using capital B for biography collection. The results of data analysis show that the highest number of books checked-out by users, were of literature books 12048 (36 %) and this use was 44 % of total holding of literature books. Following literature books, social science books gained the highest check-out of 6510 (19 %). The religion books were also checked out by 4204 (13%) users. Arabic, Biography, and Language had the lowest checkouts 1 %.

Table 2 also shows the holdings of the library under ten broad classes and it is obvious that the literature books gained maximum use (44 %) of its holdings. Following literature books, religion books had usage (27 %) of its total holdings. Arabic and Persian books were used only 2% of their holdings respectively. Results also depicted the fact that total book usage in the year 2016 was only 17 % of the total book collection.

Table 2
Books Checked out by Subject Classification

Classification Notation	Description	Total Collection	Number of items checked-out	Percentage % Checked out	Usage % by respective collection
000	Generalities	8549	894	3	10
100	Philosophy	8889	1195	4	13
200	Religion	15515	4204	13	27
300	Social sciences	46699	6510	19	14
400	Language	3414	381	1	11
500	Natural sciences	20839	2295	6	11
600	Technology and	23250	2116	6	9

	applied sciences				
700	Fine arts and recreation	4250	164	0.5	4
800	Literature	28728	12572	38	44
900	Geography and history	18280	2241	7	12
Ar	Arabic	11062	265	1	2
B	Biography	3564	470	1	13
P	Persian	7949	168	0.5	2
Total		**200989**	**33475**	**100**	**17**

Books checked out by Publication Year

Table 3 presents print books checked out pattern by its publication date. The highest number of book checkouts 14,492 (43 %) were of publication date from 2000-2010. The books published in the years 2011-2017 were highly checked-out 8810 (26%). Following that books published between1950-1999 were highly checked out (17%). Books published before 1900 (1200 – 1899) 1700 had fewer checkouts 278 (1 %). Results showed that books published between 2000-2016 were checked out by the majority of the users as compared to books published before 2000. Others included the books having no publication date mentioned in the log data of OPAC.

Table 3

Books Checked out by Publication Date (N=33475)

Publication Year	Number of items checked out	Percentage
Pre 1900 (1200 – 1899)	278	1
1900-1949	295	1
1950-1999	5800	17
2000-2010	14,492	43
2011-2016	8810	26
Others	3800	12
Total	**33475**	**100**

Book checked out by Months

Table 4 presents monthly checkouts for the year 2016. The results revealed that Punjab University Library members checked out the highest number of books in January and February 5971 (18%) and 5068 (15%) respectively. The lowest checkouts were in June 733 (2%) and July (2%) respectively. This decrease in book checkout might be due to summer vacations in June, July, and August.

Table 4
Books Checked out by the year 2016 (monthly checkouts Year 2016)
(N=33475)

Month	Number of items checked out	Percentage
January	5971	18
February	5068	15
March	4164	12
April	4029	12
May	3675	11
June	733	2
July	579	2
August	1053	3
September	1095	3
October	1337	4
November	2318	7
December	3453	10
Total	33475	100

Conclusion and Discussion

The study aimed to analyze the usage patterns of PU Library print books using circulation log data of library information system. The findings revealed that both male and female users checked-out library books and the majority of print books were checked-out by male users (51 %) followed by female users (49 %). The library users checked-out most of books were

from the faculty of education (17 %), science (15 %), law and, behavioral and social sciences (11 %). However, the lowest checked-out books' percentage was from the faculty of Islamic education (4 %), commerce (4 %), and pharmacy (1 %).

The print books usage by user category showed that the highest check-out was made by bachelor students 14925 (44 %). Following bachelor students, master students checked out 11756 (35 %) and MPhil students checked out 3688 (11 %) most of the books. Administrative staff (3 %) and academic staff (2 %) checked out the lowest number of books. This study finding is consistent with Renaud, Britton, Wang, and Olighara (2010) finding that undergraduate students checked out the greatest number of books and followed by undergraduate students, graduate students and faculty issued most of the books.

It was interesting to note that the language and literature books had the highest number of check-out12048 (38 %) among all ten broad subjects of university library books. Following the literature, social science 6510 (19 %) and religion books gained the highest check-outs 4204 (13 %). This finding is consistent with Christianson (2005) study that examined the circulation patterns of both print books and e-books of Louisiana State Library and found that the most popular subjects in print books among users were literature, education, library science, and economics. Rose-Wiles (2013) also concluded that the circulation of print books varied by subject and arts; sociology and history books had the highest checkouts. Ochola (2002) demonstrated that language &literature, social sciences, and history gained the highest score in circulation and interlibrary loan rates, and language and literature alone contributed 41 % of circulation. However, fine arts and Persian books of PU library have the lowest checkouts that are respectively of total checkouts (33,475). The reason for the lowest checked-out in these subject areas might be because these departments were located at the old campus quite far from the university central library location (New campus).

In the year 2016, the highest number of book checkouts 14,492 (43 %) were of publication dates 2000-2010. Then books published in the years 2011-2017 were highly checked-out 8810

(26 %). It indicates that recently published books 2000-2010 had high percentage than older books 1900-2000 percentage 6095 (18 %). This study finding was confirmed by Rose-Wiles (2013) that circulation was higher for subjects with more current collection. In the year 2016, PU Library members checked-out the highest number of books in January and February 5971 (18 %) and 5068 (15 %) respectively. The lowest check-outs were in June 733 (2 %) and July (2 %) respectively. This decrease in books checked-out rate in June and July may be due to summer vacations.

PU Library develops print books collection on a wide variety of subjects, keeping in view subjects being taught at the university. However, university departmental libraries aim to fulfill the specific subject needs of their department community. The present study concludes based on the findings that library users prefer to borrow print books on literature, sociology, and religion more than all other subjects while users from education and science discipline checked-out most of the books. The research studies also confirmed that users visited the university central library to borrow books on humanities and social science subjects more than science books. It might be possible that library users visit the university central library not only to read and acquire textbooks and subject related books but also for their leisure reading - literature particularly. However, more studies are needed to explore users' perceptions and expectations regarding university library collection. Future studies could be conducted to further investigate the usage of narrow specialties of literature, social science, and religion books. The results of the study recommend that librarians should generate reports of library book checkouts regularly to monitor the usage of print books and share with the library staff for improvements. The budget should be spent on the latest books. Further investigations are also needed to examine the checked-out patterns of the independent departmental libraries.

The findings of the study imply comprehensive weeding of old books based on its publication date, and decrease of the number of circulations, with the help of library committee and subject experts. There is also need to explore the reasons why library users from the department of education and science utilize

the central library more than all other disciplines of the University of the Punjab. What are they doing in the central library that they cannot do in their own department library, and what are they checking out? The study analyzed University of the Punjab's 13 broad disciplines. However, the puzzle of circulation patterns among the different sub-disciplines of broad faculties remains an area for further research. The next level of analysis will review check-out patterns more narrowly divided by department. Other institutions may benefit from a similar inquiry as a means to improve user services based on data patterns. Conducting this research at several universities may reveal similarities that can be generalized to other institutions.

Limitation and Delimitation of the Study

The study investigated one-year log data of circulation due to time and human resource constraints. These findings showed usage patterns of checked-out books and did not investigate in-house use. PU Library does not maintain in-house use statistics of print books; therefore, this study does not cover the in-house use of books.

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