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Usage patterns of Punjab University Library website: a transactional log analysis study

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Abstract
Purpose – This paper aims to assess the usage patterns of a university library website to find out user’s behaviour of monthly use, its top most used resources and services and search phrases used to reach the library website.

Design/methodology/approach – Transactional log analysis (TLA) – an unobtrusive research method – was used to identify and analyse data of website-using patterns. The log data of website use from January 2011 to March 2011 were analysed for this study.

Findings – The findings of this study revealed that the university library website was heavily used on campus by users; however, it was used by a significant number of clients residing off-campus. Free scholarly journals, resources downloaded, e-journals, e-books and donated personal collections were among the top most used resources and services. However, free scholarly journals were used more than subscribed e-journals accessible on-campus only.

Originality/value – This study first used the TLA method to trace user behaviour of website use in a local scenario. Assessing the usage of e-resources is imperative to determine the effectiveness of the library website in providing these services to its on-campus and distant users. The findings of this study are valuable for librarians and webmasters of the library website to redesign and reorient their services.

Keywords Web sites, Electronic journals

Paper type Research paper

Introduction
The present competitive environment requires that information professionals work hard to meet users’ needs by providing value-added services in the presence of their direct access to information. The expectations of users have increased due to the rapid access to a wide range of electronic information resources in a limited time as compared to print resources. The role of libraries has altered significantly from merely providing in-house traditional library services. Users now access libraries mainly through websites to use the online public access catalogue (OPAC), e-journals, e-books, chat reference services and other electronic-based services.

Jansen et al. (2009) wrote that the development of digital and communication technologies helps to overcome the limits of physical library services by time, cost, distance and speed. Library websites have reduced some issues of physical libraries by providing services to distant users anywhere and anytime. Libraries remain engaged in improving website use through their redesign improvements to meet users’ expectations.
Research studies on library usage and information services’ evaluation provide an insight into users’ information-seeking behaviour. Findings of such studies help with improving and redesigning library services. Hence, the traditional usage and evaluation measures have been expanded to include the use of technological applications in the library. More recently, website use statistics are being studied to trace the usage patterns of clients, such as monthly use, most used pages, on-campus and off-campus use, search phrases used to reach library websites and other indicators of usage (Covey, 2002; Franklin and Plum, 2004; and Asunka et al., 2009).

Usage patterns of electronic information resources can be assessed by using various research methods including surveys, usability testing, focus group studies and transaction log analysis (TLA). Covey (2002) highlighted the fact that one of these methods is TLA, which provides a method to unobtrusively study users of information systems interacting with the system. The method provides significant information about the behaviour of users while they use these information systems. When a user searches and seeks for information in a particular website, it is stored in the form of a log file that contains the date, time, IP address and type of content. The file is frequently referred to as a web server log.

Bauer (2000) defined a web server log as a record of transactions from website views established when a request is sent from a user’s browser to the server where the website is hosted or stored. The web server log file can be interpreted manually or by using a statistical software package, and this process is termed as “Log Analysis”. White and Kamal (2006) mentioned that the resulting statistics help researchers learn about the type of traffic and activity on a website, using statistics such as access times, hours, downloads, IP ranges, page views and more. The findings of website log analysis help webmasters and librarians evaluate website usage by close and distant users.

The present study aimed to determine usage trends of an important university library website in Pakistan through TLA. The University of the Punjab is one of the oldest and largest institutes of higher learning in Pakistan. In 2012, the university had 4 campuses, 13 faculties, 10 colleges, with more than 63 departments, centres, institutes and a variety of affiliated colleges. The university had 730 permanent faculty members and more than 30,000 on-campus students (University of the Punjab, 2012).

**Punjab University Library and website**

Each academic unit of the university has a library to serve its particular students and faculty members. In addition to these departmental libraries, the university has a main library known as the Punjab University (PU) Library.

PU Library was established in 1873. At the time of partition, there were 144,204 books in the library. At present, its collection of books, journals, manuscripts and other reading material is approximately 525,000 items and includes some very precious personal/special collections. The collection at PU Library consists of materials in nine major national and international languages and many different types of material, such as print media, CDs, DVDs, floppies, microfilms, microfiches, video and audio cassettes and manuscripts (Punjab University Library, 2012).

The PU Library website was first launched in 2003 to provide e-resources and e-services to serve its patrons. The website has three main menus: top, main and left menu. The top menu provides links to the library set-up, hours, introduction to the various sections and rules. The main menu has links to the web OPAC, e-journals,
e-books, the newspaper index and many other resources, while the left menu provides information about library collections, downloads and virtual library services. A snapshot of the main page is shown in Figure 1.

Along with other services, the website offers on-campus access to full-text subscribed e-journal and e-book databases which are provided by the Higher Education Commission (HEC) to its authenticated users. HEC is spending an enormous amount of money on subscribing to electronic resources and providing access to public and private universities of Pakistan.

**Significance of the study**

This paper provides information on the most used resources and the services of the library website. The findings may help the website designers to reorient their website content based on usage trends. The designers can continue to link the most used resources and consider removing or replacing the services and pages with minimal use. There has not been any prior study conducted to assess the usage patterns of the PU Library website using TLA.

**Literature review**

Librarians continually gather statistics of traditional services such as use of collection, in-house use, reference questions answered and catalogue use. Lancaster (1993) provided useful techniques and procedures for the evaluation of the above-mentioned library services, while Conyers and Payne (2010) focused on library performance measurement in the digital age. Many studies have been conducted by researchers and librarians to ascertain the usage patterns of electronic information resources, such as the library website, e-books, e-journals and the OPAC.

Web server log statistics are useful for demonstrating the effectiveness of public service librarians particularly, as they can demonstrate their efforts with the designing of web pages. Welch (2005) noted that server statistics for library-generated web pages offer helpful data for public service librarians. She mentioned that OPAC searching,
e-journals, full text databases and remote access instructions were among the most used pages of the website.

Ghaphery (2005) conducted a quick links usage study of an academic library website over a four-year period to detect usage patterns. The findings revealed that the top two items of website use were external databases (Info Trac and Medline), and that these resources account for 40 per cent of the total resources. The e-journal link was more used from the home page link than from its quick link. The current study also discovered that “Quick Link” usage and a few of the library databases were more used than other links.

A university library website offers a variety of electronic resources and services to its users on- and off-campus. E-journals, online databases and e-books covering a variety of academic disciplines of scholarly importance are critical for students, faculty and staff for meeting their teaching and research needs. It seems obvious that a more usable website will lead to higher user satisfaction. Asunka et al. (2009) analysed the transaction logs to get usage patterns of a university library website. The findings revealed that access to scholarly material is a major reason that users visit the site. The study by Xue (2004) examined website usage statistics to improve the organization, access, searchability and structure of electronic government publications in a subject directory format. Konnur et al. (2010), in an evaluation of an academic library website, noted that the website had a lack of information organization and did not come up to the users’ expectations for virtual use. The library website resources were not fully exploited, possibly due to the lack of information organization and lack of high-quality website design.

The importance of the library website due to its scholarly material was also demonstrated in a recent study by Kannappanavar et al. (2011), which provided an informative review of the content and design of an engineering college website. The findings showed that links to open-access journals and e-book information were not available on their library website. A library website requires regular updating to let the library be the focal point of the institute and, thus, should depict all the necessary information on its website. Iqbal (2011), in a usability evaluation study of the PU Library website, found that users were overall satisfied with the website and that most of the users reported that the website was meeting the needs of the academic community.

The above review of literature indicated that library websites are heavily used due to their scholarly material – full-text databases, e-journals, e-books and OPACs. The TLA is a significant unobtrusive research method to detect usage patterns of library websites. Log analysis provided insights into the information-seeking behaviour of users and can be made even more useful when log file data were combined with other research methods such as questionnaires, focus groups and interviews to explore user’s perceptions and preferences. The TLA of library websites is useful in improving, redesigning and organizing the content.

Objectives of the study
The study’s main objectives are:
• to assess the overall usage pattern of the PU Library website through web server log analysis; and
• to determine the most used e-resources and e-services of the library website.
Research questions

RQ1. What is the overall trend/pattern of library website usage?

RQ2. Which of the website services and resources are most used?

RQ3. How can the website improve to satisfy users?

Limitations of the study

The limitation of the study was that the web server log file provided large amounts of data that are time-consuming, tedious and difficult to interpret and analyse. The researcher thus analysed log data from only one semester: for spring, from February to May 2011.

Methodology of the study

The study was designed to assess overall information usage behaviour of university library website patrons. The site offered a number of e-services and e-resources to its users residing on-campus and off-campus. Usage statistics of the library website can be obtained through several methods, as noted in Poll (2007), who identified six methods for the evaluation of a website – surveys, focus groups, thinking aloud, observation, group tests and TLA.

This current paper uses the TLA method to gather data of transactions occurring between users and websites. Jansen et al. (2009) asserted that log analysis is a functional method of collecting data on the use of web and other information systems. TLA is an unobtrusive and indirect research method. The researcher is able to collect the data without introducing any formal measurement procedure. Hider and Pymm (2008) performed a content analysis study of the top Library and Information Science (LIS) journals for the frequently used research methods. The results showed that survey and experimentation are the dominant research methods. However, TLA has expanded to be a primary research method when looking at the performance of very large databases and information retrieval options. The TLA is an effective method to collect usage data from information systems without the direct involvement of users at the moment of data gathering.

The present study was carried out on the website of the PU Library accessible through the web link at www.pulibrary.edu.pk. A web analyser software, AWSTAT, was used to read log files from the web server. Each time a patron uses the website, the transaction is recorded in a log server file. Hepworth et al. (2006) defined log file analysers as software that read log files and transform that data into readable formats that offer information about user interactions with the websites.

AWSTAT generates data for a number of predefined parameters. The parameters selected for this study were frequency of website use by month, most used pages of the library website, use by country, on-campus and off-campus use and search phrases used in the search option of the library website. The data were tabulated and analysed by using MS Excel 2007 for mean and frequency measures. Pie charts and bar charts were used for the graphical presentation of the data.
Data collection and data analysis

This section presents the data analysis of spring semester 2011 using MS Excel 2007. The definitions of the selected parameters chosen for analysis and study are defined below.

Frequency of the website’s unique visitors, visits, pages and hits

According to PC Mag’s Encyclopedia (2012), a unique visit is a single visit to a website by one visitor. The visitor may view any number of pages during a visit. If the visitor leaves and comes back later, this counts as a second unique visit. Wikipedia (2012) defines visits as a “sequence of requests from a uniquely identified client that expired after a certain amount of inactivity, usually 30 minutes”. Page viewed is one successful request for a web page.

Figure 2 shows the graphical presentation of unique visitors, number of visits and pages viewed from February to May 2012. The highest number of unique visitors, visits and page views occurred during the month of March. It was found that unique visitors and number of visits were more frequent in the middle of the semester as compared to the beginning and end of the semester.

Website usage by countries

A large number of users who visited the library website were from Pakistan, followed by the USA and India, as shown in Figure 3. Other people who visited the website were from European countries. The data from website use by countries show access from visitors around the world. These data may help library managers to decide whether they should target international visitors and offer services in multiple languages.

Search key phrases (top ten)

The search key phrases tool looks at keywords used by visitors in search engines to reach the library website. Table I shows that users who directly approached the library website used the terms “Punjab University Library” and “PU Library”. The majority of users searched for “free scholarly journals and articles”.

<table>
<thead>
<tr>
<th>Figure 2.</th>
<th>Unique Visitors, number of visits and pages</th>
</tr>
</thead>
</table>

Downloaded by Professor Kanwal Ameen At 10:32 16 February 2015 (PT)
The data show that the number of requests for “free scholarly journals and articles” was more than other search phrases and that these resources seemed to be the predominant reason for using the library website. The reason for using “free scholarly journals and articles” as a search key phrase could be that users can access these free resources from anywhere and because of their ease of use, while HEC’s subscribed e-journals can be accessed on-campus only.

**On-campus and off-campus use**

The graphical presentation of website pages used by on-campus users and off-campus users (Figure 4) shows that the website was used more from on-campus locations (58 per cent) than off-campus sites (42 per cent). This study also corresponds to the study by Asunka et al. (2009), where on-campus use was 53 per cent and off-campus hits were 47 per cent. The result shows that the website receives significant use from off-campus users. However, it is worth noting that despite the website’s larger use by on-campus than off-campus users, the term “free scholarly journals” was highly used and HEC subscribed e-journals’ use was low even on-campus.

<table>
<thead>
<tr>
<th>Serial no.</th>
<th>Search key phrases</th>
<th>No. of requests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Punjab University</td>
<td>191</td>
</tr>
<tr>
<td>2</td>
<td>Scholarly Journals Online Free</td>
<td>179</td>
</tr>
<tr>
<td>3</td>
<td>Free Scholarly Journals</td>
<td>173</td>
</tr>
<tr>
<td>4</td>
<td>Punjab University Library</td>
<td>120</td>
</tr>
<tr>
<td>5</td>
<td>PU</td>
<td>99</td>
</tr>
<tr>
<td>6</td>
<td>Free Scholarly Articles</td>
<td>76</td>
</tr>
<tr>
<td>7</td>
<td>Free Scholarly Journal Articles</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>Free Scholarly Journals Online</td>
<td>63</td>
</tr>
<tr>
<td>9</td>
<td>Free Online Scholarly Journals</td>
<td>58</td>
</tr>
<tr>
<td>10</td>
<td>PU Library</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 1. Most used search key phrases
The log analysis data showed the most used pages of the library website. The top ten pages used on-campus and off-campus are shown in Table II. The data show that the library website link for free scholarly journals was highly used, followed by the links for “Resources Downloaded” and “Section/Units” pages. The link for free download resources included the newspaper index, APA Style Manual, the list of personal collections and other resources. The Section/Units page contains information about library sections and services, and it was also among the most used pages. Popular new features as well as HEC subscribed e-journals and e-books were also significantly used pages.

Subscribed e-journals provided through HEC on a variety of subjects by publishers such as Emerald, Science Direct, JSTOR, Springer Link, Taylor & Francis, Project Muse and many others were also among the top most used pages. However, it is important to note that the subscribed journal usage is much less compared to free scholarly journals.

Findings and discussion
A review of the literature established that TLA is a useful method for collecting data about the use of the website. The resulting statistics are useful for library managers and website designers for redesigning, monitoring of the website and understanding user behaviour. TLA can be combined with other methods, such as interviews, focus groups.

<table>
<thead>
<tr>
<th>Serial no.</th>
<th>Most used pages</th>
<th>Requests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Free Scholarly Journals</td>
<td>1,744</td>
</tr>
<tr>
<td>2</td>
<td>Resources Downloaded</td>
<td>532</td>
</tr>
<tr>
<td>3</td>
<td>Section Units</td>
<td>512</td>
</tr>
<tr>
<td>4</td>
<td>Popular New Features</td>
<td>421</td>
</tr>
<tr>
<td>5</td>
<td>HEC Subscribed E-journals</td>
<td>395</td>
</tr>
<tr>
<td>6</td>
<td>RSS/News</td>
<td>372</td>
</tr>
<tr>
<td>7</td>
<td>HEC E-books</td>
<td>320</td>
</tr>
<tr>
<td>8</td>
<td>Personal Collections</td>
<td>198</td>
</tr>
<tr>
<td>9</td>
<td>Resources/Online Chat</td>
<td>176</td>
</tr>
<tr>
<td>10</td>
<td>RSS-Feedback</td>
<td>136</td>
</tr>
</tbody>
</table>

Table II.
and questionnaire surveys, to get insights into the perceptions and preferences of website users.

The results of TLA showed that the PU Library website is heavily used especially for accessing free scholarly journals and articles on-campus and off-campus. E-journals and e-books provided by HEC are less used when compared to the free scholarly journals. This finding also corresponds to an earlier study conducted by Tahira (2008), who highlighted that users preferred general web sources over the HEC online subscribed databases and the library’s print subscriptions for obtaining information from journals. A reason for the lower use of HEC journals than free scholarly journals might be the lack of awareness about these resources, as well as the lack of information searching and retrieving skills for the various databases; in other words, a lack of information literacy skills. The library website is an effective means of providing electronic resources and services to its users residing both on-campus and off-campus.

Conclusions and suggestions

The library website offers various electronic information resources and services to its own community on- and off-campus, as well as to users from all over the globe. Among the electronic information resources, the free scholarly electronic journals were the most accessed. An in-depth study is needed to explore the reasons for the higher use of free scholarly journals than for the HEC subscribed databases.

HEC and university librarians should take steps to provide off-campus availability of HEC journals to its community for maximum utilization. Library managers should continue to add useful links to free scholarly journals covering disciplines other than the health sciences and medical sciences, such as those in the humanities, social sciences, management science and behavioural sciences. PU Library and the departmental libraries must initiate aggressive information literacy instruction programmes to promote the use of scholarly subscribed resources.

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