Creative Ways of Demonstrating Your Value Using a Library Dashboard

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Abstract. The study primarily aims to explore visualisation approaches used by libraries in visualising analytics to present their value and impact on the academic community. It attempts to investigate and answer the following research questions: (1) What are the current practices of academic libraries in data sharing and visualisation?; (2) What kinds of data are displayed on library websites and dashboards?; and, (3) How do libraries visualise their data on the web? This study is a descriptive survey research design that employed content analysis to examine the library websites of the top 500 universities based on QS World University Ranking 2018 and ascertain the presence of public-facing data and availability of library dashboards. Website investigation and capturing of web pages were conducted from September 2018 to March 2019. A total of 157 universities published their library data on the web. Many libraries of top-ranking universities published their data online using textual facts and figures. Surprisingly, data show that only a few academic libraries around the world have developed their data dashboards. It implies that librarians have not taken full advantage of the benefits of data visualisation. Library data in dashboards are presented in a visually less appealing and interactive report using visualisation tools that delivers clear insights to library patrons, university administrators, and accrediting agencies. Published library data include reference transactions, usage of services, collections and spaces, library visits (physical and virtual), numbers of eBooks, online journals, open access resources and other collections, interlibrary and document delivery transactions, staffing, budget and expenditures, items checked out, library instruction sessions and attendees, equipment loans, digital image documents, new acquisition, and digitisation. Most data are text, numbers, and graphs, thus, not-interactive and real-time. The results of this study may prescribe best practices in communicating library data to its stakeholders, in which Filipino librarians may benchmark. Librarians can make better, more data-driven decisions to drive continuous improvement of library operations.
Keywords: library data, data dashboard, data services, data visualisation

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1. Introduction

Libraries utilise a broad array of statistics and metrics to collect, accurately monitor and disseminate transactions and activities. Using various software and tools (e.g., Springshare's LibAnswers, Google Analytics), they capture diverse library data, including but not limited to "transactional data on catalogue searches, items checkouts, log-ins to online resources and services, swipes through the entrance gates; manually collected statistics on space usage, student satisfaction, [and] external visitors to the library" (Showers, as cited in Burke et al., 2018, p. 5). Both quantitative and qualitative data are indispensable in today's libraries to demonstrate their value and impact on their institutional stakeholders and communities. When libraries leverage on data, it will help them drive their decisions (Eaton, 2017; Springmier, Edwards, & Bass, 2018) to develop new services and programs, acquire library resources, and get funding. However, library data, as stated by Murphy (2013), are intrinsically chaotic because libraries collect vast quantities of data from internal and external sources, frequently change platforms, and continuously upgrade software and systems.

Given this, there is a need for a systematic data collection, monitoring and evaluation to allow libraries to access and retrieve data efficiently, make an accurate comparison of data, meet growing user expectations and requirements, show their support in meeting departmental and institutional accreditation standards, and prevent costly duplication of data collection (Archambault, Helouvry, Strohl, & Williams, 2015; Jiang & Carter, 2018; Murphy, 2013). While libraries collect and manage their data, the International Federation of Library Associations and Institutions (IFLA) Library Statistics Manifesto states that librarians must compile collected data on a regional or national level (International Federation of Library Associations and Institutions, 2010). Furthermore, they should ensure accurate and timely delivery of correct, reliable and comparable data to maximise the usefulness of data.

The study primarily aims to explore visualisation approaches used by libraries in visualising analytics to present their value and impact on the academic community. It attempts to investigate and answer the following research questions: (1) What are the current practices of academic libraries in data sharing and visualisation?; (2) What kinds of data are displayed on library websites and dashboards?; and, (3) How do libraries visualise their data on the web?

This paper is one of the few studies on library data visualisation wherein results may prescribe best practices in developing data dashboard and management of library statistics, in which Filipino librarians may benchmark. Results may be used in finding creative ways of communicating library statistics to the academic community. Library data are presented in a visually appealing and interactive report using visualisation tools that deliver clear insights to library

patrons, university administrators, and accrediting agencies. Consequently, libraries can make more data-driven decisions for the continuous improvement of its services and operations.

2. Literature Review

Data visualisation also is known as information visualisation refers to "use of computer-supported, interactive, visual representations of abstract data to amplify cognition" (Card, Mackinlay, & Shneiderman, 1999, p. 6; Datig & Whiting, 2018, p. 6). As explained by Few (as cited in Murphy, 2013), it includes "all types of visual representations that support the exploration, examination, and communication of data" (p. 466). Hamming, as cited by Card et al. (1999) said that "the purpose of visualisation is insight, not pictures," while insights are used for "discovery, decision making and explanation" (Card et al., 1999, p. 6). Data visualisation enables patterns and relationships recognition to convey a message in the most compelling and attractive way (Archambault et al., 2015). Thus, making library stories more visible, effective and accessible to patrons. Data visualisation is more approachable, user-friendly and powerful because human beings process visual information more efficiently than words or numbers. Hence, there is no need for advanced prerequisite skills to "discover and interpret information hidden in the data" (Jiang & Carter, 2018, p. 14).

There is an increasing demand for data visualisation in libraries (Jiang & Carter, 2018) because of the advances in computing technologies, innovations in visual presentation, and availability of ubiquitous devices and software (Rall et al., 2016). Traditionally, libraries used Microsoft Excel and Powerpoint to visualise library statistics. Nowadays, libraries are using numerous data visualisation software applications with advanced features, such as "database query, cloud and Web-browser-based connectivity, drag and drop interfaces, graphics style variability, powerful analytic engines" (Jiang & Carter, 2018, p. 14).

Research has shown that librarians have acknowledged the value of modern data visualisation techniques to library statistics by creating a dashboard. Few (2004) describes a dashboard as "a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" (p.1). Phetteplace (2014) reviews library dashboards and identifies some data sources, such as "checkouts and renewals, print volumes and other materials holdings, interlibrary loan, gate counts, computer use, and reference questions". Finch and Flenner's (2016) work visualises the annual book acquisition, student enrolment per year, and book expenditures.

Literature also identified several data visualisation tools, such as Infogr.am, Easel.ly, Tableau Public, Many Eyes, Google Charts, CiteSpace, Network Workbench, SocialAction Network analysis tool, Identity Map, Baker & Taylor collectionHQ, Innovative Interfaces' Decision Center, Intota Assessment, Plotly,

Google Chart API, ProtoVis, Microsoft Excel, Highcharts, Python programming language, D3.js, Tableau Public©, among others (Archambault et al., 2015; Finch & Flenner, 2016). Archambault et al. (2015) further discussed the general rules and strategies for visualising quantitative relationships of data.

Beagle (2003) applied the concept of c-space using VisualNet to graphically display the size of library holdings based on LC subject classification. Several papers demonstrated the utilisation of the Tableau Public in visualising library data (Buhler, Lewellen, & Murphy, 2014; Datig & Whiting, 2018; Lewellen & Plum, 2014; Lowery, 2011; Murphy, 2013, 2015). Buhler et al. (2014) and Murphy (2015) explore how the Ohio State University (OSU) Libraries used Tableau to visualise special collections and library survey results. Lewellen and Plum (2014) employed Tableau to usage statistics of electronic resources at the University of Massachusetts Amherst. Datig and Whiting (2018) demonstrate the use of Tableau Public for visualising the library headcount, reference statistics, library instruction learning outcomes, and space utilisation at the Nazareth College.

Other studies discussed the applications of different tools, such as Many Eyes, Viewshare, R, Google Chart Tools, and Piktochart. The University of Illinois at Chicago (UIC) visualised its atlas collection using Many Eyes (Lowery, 2011). To view and navigate electronic resources data, S. & Naik (2017) introduced the use of the Viewshare, a free open source software developed by the Library of Congress National Digital Information Infrastructure and Preservation Program (NDIIPP). Also, Jiang and Carter (2018) illustrated the application of R, a modern data visualisation tool onto the University of Alabama's dashboard for library entrants and usage of an institutional repository. Kingsborough Community Library developed a web application called SeeCollections to interactively visualise its book and e-book collections (Eaton, 2017). Payne and Curtis' (2014) case study detail the development of StatBase, a data gathering and visualisation tool with customisable web entry forms (e.g. reference, door count, patron registration, acquisitions). StatBase has improved data collection processes and streamlined the data entry workflow of the Newport News Publication Library System.

Morton-Owens and Hanson (2012) set up a dashboard for the New York University Health Sciences Libraries using a MySQL database, Perl scripts and Google Chart Tools to display the electronic resources data extracted from EZproxy, LibraryH3lp, Google Analytics, and interlibrary loan system. The dashboard aims to help librarians and library managers in strategic planning. Also, Chapman and Woodbury (2012) analyse and visualise the transactional data of the North Carolina State University (NCSU) Libraries' device lending program. They experimented with free and open source visualisation toolkits, such as ProtoVis, HighCharts and Google Chart API to recognise the usage patterns in terms of demand and waiting time and volumes of circulation. Furthermore, NCSU Libraries use Google Chart to visualise the transaction log

of its Course Tools application and usage of reference services (Morton-Owens & Hanson, 2012).

The literature suggests the following best practices when developing library dashboard using data visualisation tools (Datig & Whiting, 2018):

- Create a team of librarians and staff who are fascinated with exploring data visualisation
- Collaborate to different sections or departments within and outside the library
- Consider the legal and ethical issues of library data to ensure that personal information of patrons is always protected.
- Spend time data cleansing to avoid missing values, unnecessary fields and outliers
- Ensure that library dashboard allows patrons to identify and visualise trends, gives an updated and dynamic view of data, and facilitate data sharing

3. Research Methods

This study is descriptive survey research that employed content analysis to examine the library websites of the top 500 universities based on *QS World University Ranking 2018* and ascertain the presence of public-facing data and availability of library dashboards. Content analysis is a tool to systematically and quantitatively examine the "presence and meaning of concepts, terms or words" in a set of recorded information (Maier, 2018; Stan, 2008). Though the content analysis is time-consuming and labour intensive, it is the most straightforward way to determine the presence of library dashboards and explore its contents and data visualisation. This study used *NVivo*, a qualitative data analysis software to process several web contents efficiently.

The sample of this study was chosen to have a heterogeneous composition of libraries, in terms of sizes, research initiatives, and academic programs. The authors also believed that academic librarians from the sample university have the resources and expertise in data management enterprise. Website investigation and capturing of web pages were conducted from September 2018 to March 2019. The following steps were performed to collect the data:

- Visit the library website of each university and check the presence of public-facing data and library dashboards
- Examine the web contents in terms of themes/topics (e.g. fiscal year services, visits and study room usage), types of data, presentation or visualisation of statistics (i.e., style, text, numbers, graphs, interactive), and tools/software used to develop the dashboard
- Download the dashboard web pages using *NCapture*, a web browser extension.

A word frequency query was also performed using NVivo to find for the most frequently occurring library data (QSR International, n.d.). Data from website investigation were organised using Excel, analysed using frequency count, and presented in graphs and word cloud.

4. Results

4.1 Public-Facing Library Data

The results of an environmental scan to know how academic libraries were sharing library statistics show that 157 out of 500 libraries of top-ranking universities have published their statistics on library websites. Most of these academic libraries are from the United States (54 out of 157 libraries), then followed by Canada (14 libraries) and Germany (13 libraries). The identified public-facing data are fact sheets (125 libraries), annual reports (44), infographics (16), and dashboards (9). The most common form of data sharing is a "Facts and Figures" type-page with varying titles, such as "By the Numbers," "Library Statistics," "Quick/Fast Facts." Among the libraries sharing their data via websites, 78 libraries published their data in the "About the Library" page. Other libraries in this study shared their data in the "Assessment," "Services," and "Collections" pages. Some public-facing data are deeply buried in the library website and are accessible after searching or clicking several links to reach library data page.
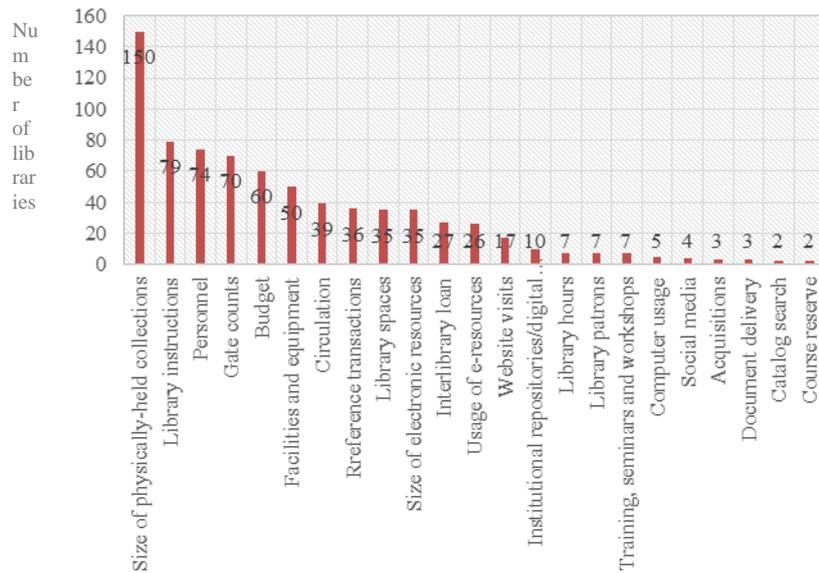
4.2 Presence of Library Dashboards

Surprisingly, data show that only ten of the top 500 universities in the world have built their dashboards to visualise library analytics and metrics, namely: Yale University Library, University of Pittsburgh University Library System, Duke University Libraries, University of Washington – Seattle University Libraries, University of Barcelona's Learning and Research Resources Centre, University of Texas MD Anderson Cancer Center, KU Leuven Libraries, National Taiwan University Library, and National Tsing Hua University. In terms of visualisation tools, they used Tableau (4 libraries), Springshare (1), Microsoft Sway (1), Piktochart (1), and HighChart (1). Dashboards were commonly created to visualise library visits, utilisation of services and spaces, and assessment studies.

When the authors further searched Google using the search terms "university library dashboards," results reveal that several academic libraries not included in the top 500 universities have also developed their library dashboards. To name a few are Boston College Library, Indiana State University Library, and the University of Connecticut Library. Additionally, the Marmot Library Network (https://www.marmot.org/content/marmot-member-library-statistics) created dashboards using Tableau to communicate their library statistics on circulation, collection analysis, patrons, and weeding among its members. However, library dashboards of Marmot require users to log in to view the data.

4.3 Most Occurring Library Data

A total of 23 categories of data are published on the websites of 157 libraries (see Figure 1). Almost all the libraries (95.5%) in this study presented the size of their physically-held collections, including print books, journals, theses, dissertations, magazines. Some other most occurring library data on websites are the number of library instruction sessions, size of personnel, gate counts, and budget. Usage of print collections, facilities and equipment as well as number of reference transactions are frequently shared. The least shared library data are social media followers, number of acquired materials, catalogue searches and usage of course reserve.

On the other hand, all libraries with dashboards on their websites visualise usage of electronic resources in terms of the number of downloads, sessions, searches, and hours per search (see Figure 2). The next top-most occurring data in library dashboards are website visits, gate counts, library instructions, and size of physically-held collections. Each library reported an average of five categories of data on its dashboards. Figures 3 and 4 present the most occurring words available on library websites with data displays and dashboards.

Figure 1 Categories of library data shared on websites

Figure 2 Categories of data presented on library dashboards

| **Figure 3 Most Recurring Words on Library Websites with Data Displays** | **Figure 4 Most Recurring Library Data in Dashboards** |

4.4 Data Visualisation Techniques

Nearly all libraries (96%) in this study used text and numbers in tables or bullet lists to report their analytics and metrics. One-fourth (25%) of the libraries with

data displays on websites presented data using graphs and charts. Of the libraries with dashboards, the majority visualised data using a combination of line and bar graphs. While several commercial and free visualisation tools are already available in the market, libraries in this study utilised Tableau (5 libraries), Piktochart (1), Microsoft Sway (1), HighChart (1), Springshare (1) and HTML (1). Libraries with dashboards but not included in the top 500 QS World University Ranking also employed Tableau.

5. Discussion and Conclusion

Libraries of the top 500 universities worldwide were chosen for this study on the assumption that they effectively communicate their value and gain institutional supports through data visualisation as their library websites are visually appealing and informative. Contrary to the assumptions of the authors, only 31.4% of the top 500 universities communicate their library data to their internal and external audiences through the web. Remarkably, a fewer number of academic libraries visualising public-facing data using dashboards. Similar to findings of Terrill (2018) and Springmier et al. (2018), data sharing among libraries of the top-ranking university is a not prevalent activity. While many libraries have "About the Library" page, they do not publish library analytics and metrics on the web.

Furthermore, the results suggest that libraries have not fully recognised the advantages of data visualisation to better communicate the meaningful stories and impact of academic libraries in an online environment. While it is possible that this group of academic libraries have utilised some visualisation techniques in their annual reports and assessments, many of them have not developed a real-time, living dashboard to increase the visibility of key performance indicators and eliminate data silos. Viola, as cited by Chen (2005) added that data visualisation helps the library to make data more accessible, improve transparency within the organisation, and build trust by communicating visually.

Libraries being studied frequently published "facts and figures" pages to show data on library holdings, library instruction sessions, size of personnel, gate counts and budget. According to Springmier et al. (2018), libraries have regularly collected and organised such data for external reporting. Hence, they most likely share these data on the web. The authors examined the characteristics of the library dashboards in this study based on Few's (2004) description of a useful dashboard. They further observed that public-facing data pages are less creative and much less visually appealing. Though not interactive and not real-time, the library dashboards in this study include a smaller number of metrics covering data in the last two years (2017-2018). Unfortunately, only two libraries have 2019 data. A few libraries presented multiyear trends of library statistics as early as 2010. Given this, reporting of library metrics using a dashboard does not provide a clear, complete picture of libraries' performance and value. It seems that library dashboards observed in this study failed to tell wider stories about the libraries and their impact on the community.

It is also important to note that libraries in this sample used a variety of metrics to measure library performance. For example, usage of electronic resources is measured in terms of the number of downloads, eBook chapter views, searches, sessions and queries. Other examples are metrics for website visits: number of visits, page views, unique website URL, and sessions. Not all libraries with dashboards use all the metrics to visualise usage of electronic resources and website visits. Consequently, compiling all data published in several library websites and dashboard would be difficult because of the lack of standardisation of metrics used by this group of libraries. Also, some metrics are not known to the authors, more so to an external audience who are not information professionals. To help librarians with library statistics, IFLA in collaboration with UNESCO and the International Organization for Standardization (ISO) developed a model questionnaire with standardised data and methods to be used by libraries in the collection and compiling statistics (IFLA, 2010). The ISO 11620 provides a list of standard library performance indicators and calculation instructions for each indicator, such as "loans per capita, downloads per document digitised, percentage of successful interlibrary loans, cost per user, percentage of collection expenditures on e-collections, and percentage of staff in cooperative partnerships or projects" (Terrill, 2018, p.242). Also, Standard library metrics allow libraries to compare their performance with peer institutions over some time.

Today's libraries must understand the principles of data visualisation and maximise its potentials to have the edge over their competitors and remain relevant to the community (Chen, 2005). They should invest in developing data visualisation skills of librarians, acquiring visualisation software, and implementing dashboard to communicate library performance effectively. Best practices of libraries in developing dashboards must be thoroughly documented and shared to serve as a benchmark for other libraries.

6. Future Research Directions

An exploratory study of library dashboards developed and maintained by academic libraries not included in the top 500 universities and other types of libraries may be conducted to support the findings of the study. Further study on data collections, reporting and sharing practices of libraries is also recommended to understand the challenges and issues in library analytics and metrics. Moreover, the authors recommend investigating further the use of library data to improve manage acquisition budgets, customer service, and influence decisions.

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