Finding Hidden Treasures in the Data

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Introduction

Librarians rely on statistics to capture who their users are and what resources and services they use. For an academic campus, the number of students, faculty, and researchers provide a sense of potential users of library services and resources. But who uses the services and resources and what do they use? Library staff can spend a lot of time tracking, consolidating, and analyzing the amount of materials that circulate, usage of e-resources, instructional sessions taught, questions asked at service points, and consultations in order to identify resources and services that need be supported and continued. Those numbers could also help identify areas of users' needs that that the library staff could address.

With the widespread adoption of and patron preference for e-resources, the data collection process can be somewhat easier with vendor-provided statistics. While these reports reveal how many times e-resources were accessed and articles were downloaded, they do not capture all aspects of user behavior nor do they provide a big picture perspective regarding overall usage. On the other hand, locally collected evidence obtained from the library's authentication system can be utilized to illustrate a broader picture of users' behaviors with e-resources, particularly the differences between user groups.

Literature Review

Shifting collections from print to electronic format has made it easier for libraries to gather usage numbers. In a print-only environment, circulation statistics and in-house use browse-counts can be employed. However capturing journal use is challenging. Shelving counts for journals used in a library are an option, but require staff resources to track numbers, especially if done at the title level, and treat the use of an individual issue the same as a bound volume with multiple issues.[1] In addition, staff cannot tell who used the journals and how much of the journals were used.

In contrast, usage of e-resources can be collected by vendors and then passed along to the libraries for analysis. Initially, the challenge with analyzing electronic usage was the lack of standards and established practices for data collection and reporting. Part of that challenge has been addressed with Project COUNTER's code of practice regarding what usage to count and how to report those counts. Published results of surveys have identified the kinds of data that librarians collected and how they used that information.[2] One use for that data is to inform the collection development and management process. Some librarians have incorporated usage reports into decision models for subscription renewals.[3]

In addition to the vendors' usage reports, librarians and researchers have made use of other vendor reports and locally collected statistics to determine usage and identify users' behaviors. Sources of statistics included web server logs,[4] OpenURL link resolver reports,[5] consortial usage reports,[6] Google Analytics,[7] vendor reports,[8] and EZproxy server logs.[9]

Attempts to get more granular data about patrons' behavior is not new. Responses from a survey of 22 libraries in the Association of Research Libraries in 2000 indicated that libraries were mapping click-throughs to IP addresses in order to identify schools and departments on the campus. Only one library indicated that it was using its proxy server to collect user information, while another had plans to do so.[10]

One of the proxy server systems available to libraries, EZproxy, is specifically mentioned in a small number of published articles. Most described using EZproxy to enable, manage, and monitor remote users' access to library resources.[11] There are even fewer studies using EZproxy log data as a tool to track patron usage of electronic resources in place of vendor-provided statistics.[12]

Method

The University of Hawai'i at Mānoa Library, serves an "R1" research land-, sea-, and space-grant research institution. The library requires almost all of its patrons to be authenticated through an EZproxy server in order to access e-resources even when they are on campus. There are a few exceptions. Staff and classroom computers directly connected to the UHM Library's computer network bypass authentication altogether. Some networked computers on campus are authenticated based on their IP addresses. Among total entries (346,955) into the EZproxy server, approximately 12,000 were from IP authenticated computers. Students and staff using other computers on campus with either network or wireless Internet access or computers off campus must login with their university username and password. This unique arrangement allows the library to collect rich data about its users' behaviors.

The EZproxy server logs all activities while users interact with resources once they login. This generates a tremendous amount of data. Because of the volume of data, this study limits its analysis to data recorded when users logged into the server (i.e., entry points) during a one-year period from July 1, 2016 to June 30, 2017.

A staff member in the library's information technology department extracted the entry point data from the log files. ***Grep*** and ***sed*** commands and shell scripting were used to connect commands and batch process the log files down to a common string that appears once per user session when the user is required to enter a username and password. That common string, ***connect?session***, appears in the log as follows:

> ***<IP address> - <user ID> <time stamp>***
> ***https://eres.library.manoa.hawaii.edu:443/connect?session=<session code>&url=<URL of the e-resource being accessed>***

Once the line of entry point data was extracted, additional steps were taken to clean up the data so that only the following information remained:

- IP address of the computer being used;
- User ID number;
- Date and time stamp identifying when the user logged into the EZproxy server;
- URL of the e-resource (e.g., database, e-journal, journal article, or e-book) being requested.

The filtered data was loaded into a Microsoft Access database to perform additional data clean up and to facilitate the analysis process. Microsoft Access enabled the matching of user ID numbers to user group categories (i.e., undergraduate student, graduate student, faculty/staff) with information extracted from the library's integrated library system (ILS). Once user groups were added to the data set, the user ID numbers were changed to random numbers to make them unidentifiable. Microsoft Access was also used to convert the date and time stamp (e.g., 7/1/2016 10:22:25 PM) into a day of the week (e.g., Tuesday) and hour of the day (e.g., 18). Once adjustments to the data was completed, the data was then sorted, counted, and queried in Microsoft Access.

Findings and Discussion

Who Used the Resources? How Often Did They Use Them?

During the 12-month period, the EZproxy server log recorded 334,821 entries by 18,911 unique users. Those unique users represent a large proportion of the UHM population (82.7%) which totaled 22,856 individuals during the fall 2016 semester. Out of the 13,132 undergraduate students, 77.7% logged in at least once during the year; 89.7% of the 4,822 graduate students logged in at least once; and 91.3% of the 4,800 faculty/staff members logged in at least once.

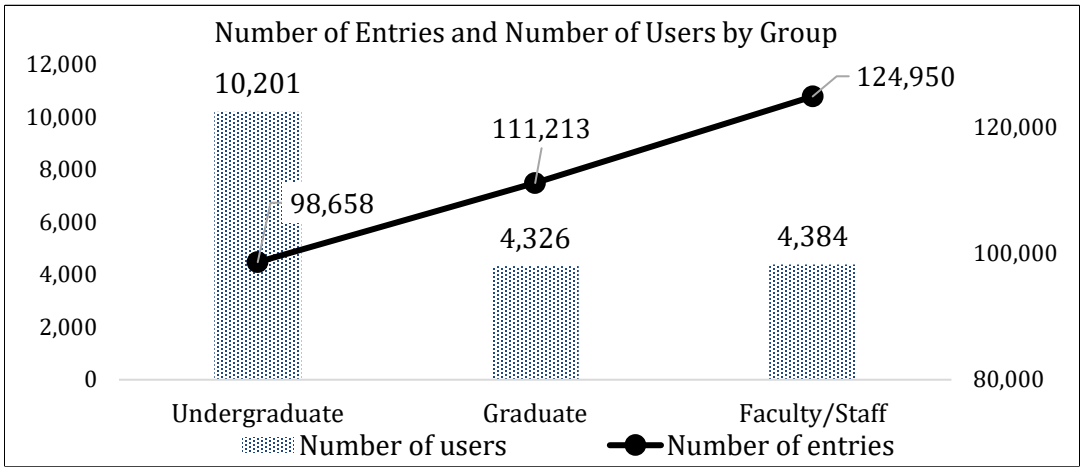
Table 1. Number of users who accessed e-resources vs. the campus population in the fall 2016 semester.

Group	Users	Potential Users	%
TOTAL	18,911	22,856	82.7%
Undergraduates	10,201	13,132	77.7%
Graduate students	4,326	4,924	87.9%
Faculty/staff	4,384	4,800	91.3%

The large percentage of faculty/staff members who accessed e-resources was unforeseen. Since the library's ILS does not distinguish between faculty members (i.e., faculty, researchers, extension agents, specialists, and librarians) and support staff (i.e., clerks, secretaries, grounds and maintenance staff), we did not expect the percentage to be as high as it was. With support staff making up 46% of this group, having 91.4% of the entire group logging in at least once was surprising since support staff generally are not expected to use library e-resources.

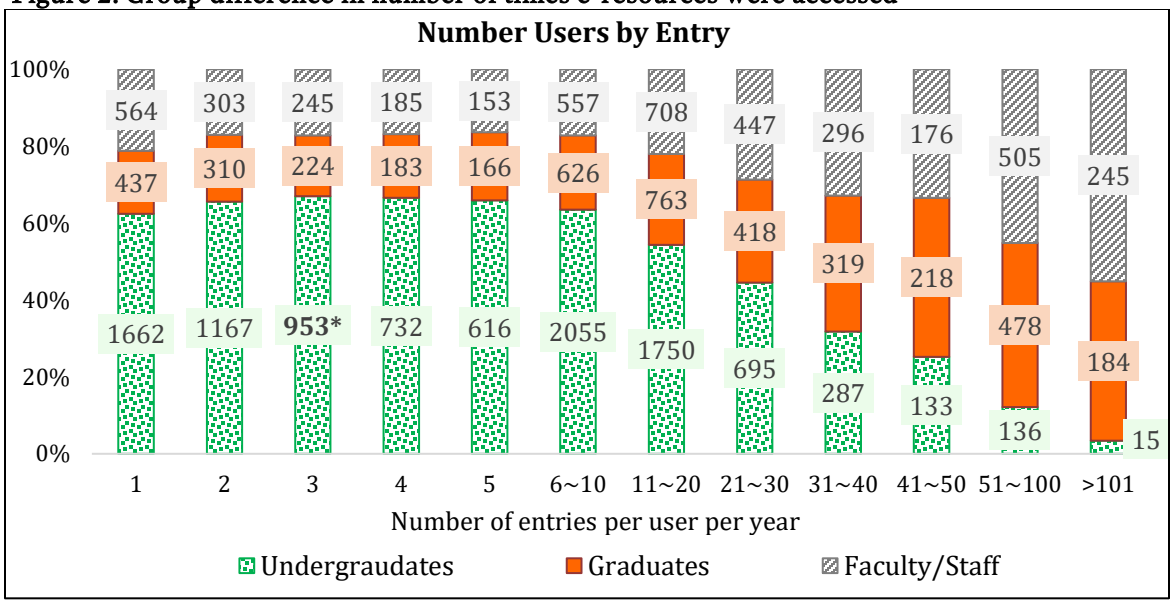
Faculty/staff members recorded the most entries compared to graduate students and undergraduate students. Even though more than half of the unique users were undergraduates, they had the least entries compared to graduate students and faculty/staff as shown in Figure 1.

Figure 1. Number of users who accessed EZproxy at least once and total entries by each group



As a result, those who used library resources very little (i.e., five times or fewer in the year) were mostly undergraduates (64.9%). Figure 2 shows that those who used resources at least once a week were primarily faculty/staff members and graduate students. Out of the 1,563 users who logged in over 50 times during the year, 48.0% were faculty/staff members and 42.3% were graduate students, while undergraduates made up only 9.7% of heavy users.

Figure 2. Group difference in number of times e-resources were accessed



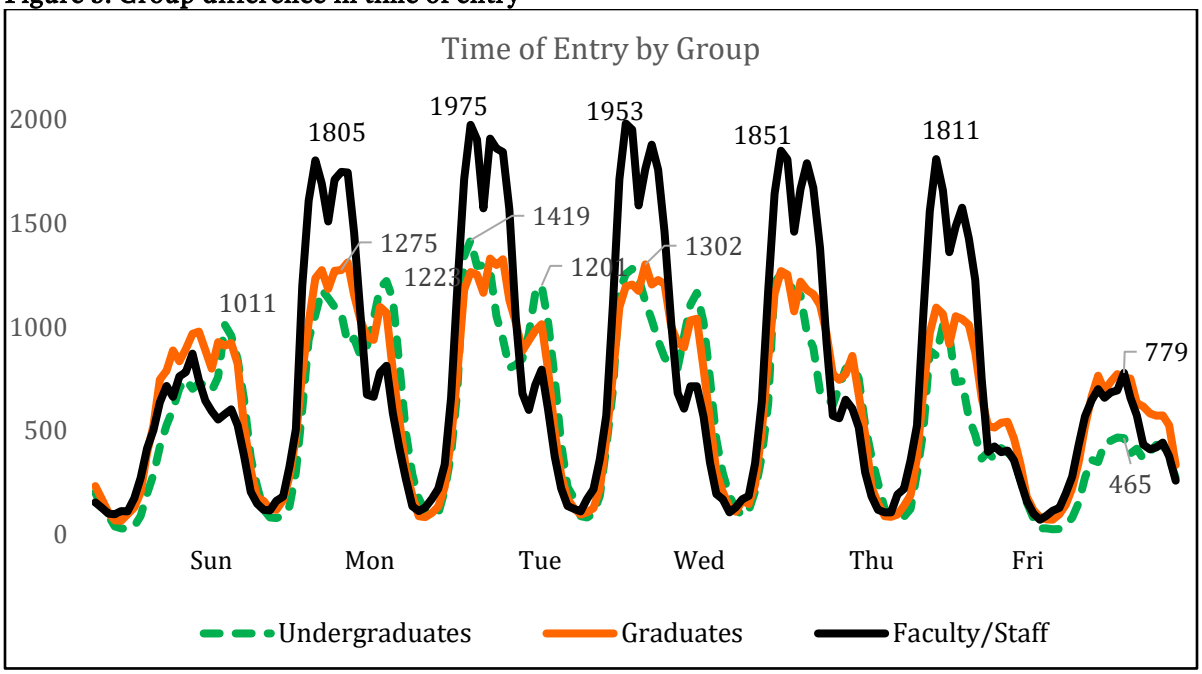
***How to read the graph: There were 953 undergraduate students who accessed EZproxy three times between 7/1/2016 and 6/30/2017.**

When Did Users Access Resources?

The time stamp in the EZproxy log identified patterns in when users accessed library e-resources. Overall usage was high during the day, with a slight dip during mid-day (i.e., lunch time), tapered off at the end of the day, and went up again during the evening. Over the course of the week, usage on Sundays had a slight rebound after a period of low usage that began Friday evenings.

When comparing the data between groups, differences surfaced as seen in Figure 3. Faculty/staff members' usage was much higher during weekday work hours. It tended to slow down in the evening while both undergraduate and graduate students rebounded to almost the same level as during the daytime. While both student groups accessed e-resources during the weekends at a slightly lower rate, usage by faculty/staff members was about half of what it was during weekdays.

Figure 3. Group difference in time of entry



This study complements the findings of previous studies that analyzed e-resource usage. Tenopir and Read analyzed 93 academic libraries usage of resources from a single database aggregator to see the time of day, week, and month academic users were accessing databases.[13] The data which was collected over a six-month period showed similar patterns of use when it came to the busiest time of day (11 a.m. to 5 p.m.) and days of the week (Mondays and Tuesday). In their 2001 review of use data from 51 vendors, Blecic, Fiscella, and Wimberly obtained data about uses by the hour from only four vendors.[14] Although the data from the vendors could not be consolidated because they covered different time periods, the authors saw fairly similar patterns between the vendors when it came to high and peak usage across the e-resources. The usage patterns are also described in a later study by Tripathi, Kumar, and Jeevan which looked at JSTOR download patterns at Indira Ghandi National Open University (IGNOU).[15] Most of the requests (86.6%) were made between 11:30 a.m. and 6:30 p.m. with the peak period occurring between 4:30 p.m. and 5:30 p.m.). Since JSTOR was restricted to IP addresses on the IGNOU campus, usage primarily took place during the day. However, requests were made outside of the library's normal business hours (9:30 a.m.–6:00 p.m.) reflecting the possibility that patrons would access resources from home, if it were possible, and thereby spread usage throughout all hours of the day.

Where Were Users When Accessing Resources?

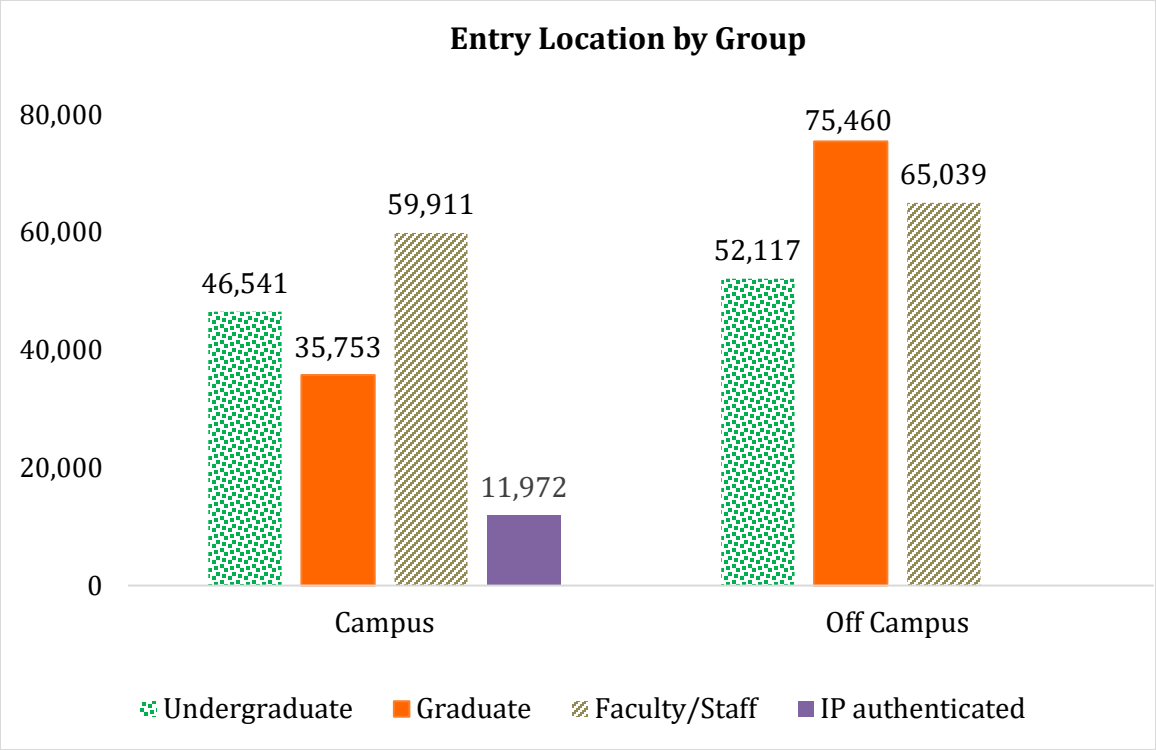
Location of users were determined by the computers' IP addresses recorded by the EZproxy server. There are three ways that users are authenticated when they access the library's e-resources. The first one is bypassing authentication. This applies only to the staff computers and a few classroom and public computers connected to the library's network. Since users on these computers do not have to log into the EZproxy server, their activity is not recorded.

The second one is by the computer's IP address. Only two sets of computers fall in this category: those at the East-West Center (EWC) and those in the medical school's library and computer lab. EZproxy recorded 11,972 entries from these computers. EWC had 1,468 accesses which were most likely from the Center's researchers. The medical school logged 10,504 accesses which were probably by medical school students who are the primary users of the computers in the library and computer lab. This method unfortunately does not document who the users are. Because of this, the data for these entry points are excluded from this study's analysis.

The third way is authentication by logging in with one's school username and password. Users need to login from all computers, other than those described in the previous paragraph, to gain access to the library's e-resources. These computers included those that are networked across the campus, those that use Wi-Fi access on campus and in the dormitories, or those located off-campus.

Of the 334,821 entries for this third method of access, users in all groups were more likely to access the library's e-resources from off-campus computers (see Figure 4). Off-campus accesses accounted for 57.5 % of all accesses. For the 142,205 entries made on-campus, EZproxy documented 86,714 entries via the campus Wi-Fi (61%) and 55,491 entries via networked computers (39%). Among the entries from on-campus networked computers, 65% were from faculty/staff; 23% from graduate students; and 13% from undergraduate students.

Figure 4. Entry location by group



Since undergraduate students have limited access to the networked computers on campus, it makes sense that their access via networked computers were least among the three groups. Among the undergraduate students' 7,143 entries from networked computers, roughly half of them (3,460) were from the computer labs in the library. Because the computers labs are managed the campus's information technology department, they are connected to a network separate from the library's. Because of this arrangement, computer lab users are required to login to use library e-resources even though they are in the library building.

The lack of access to networked computers also contributed to undergraduate students' on-campus Wi-Fi accesses to be the greatest among the three groups:

- 85% of their 46,541 entry points on campus came through the Wi-Fi
- 2,308 undergraduate students used only the campus Wi-Fi
- 2,682 only accessed from off-campus computers
- 4,964 used both

Undergraduate students' on-campus usage at night (11 p.m.–2 a.m.) was higher than graduate students' usage. This difference may be attributed to the fact that on campus residences are primarily for undergraduate students.

Figure 5. Undergraduate student entry points by location and time

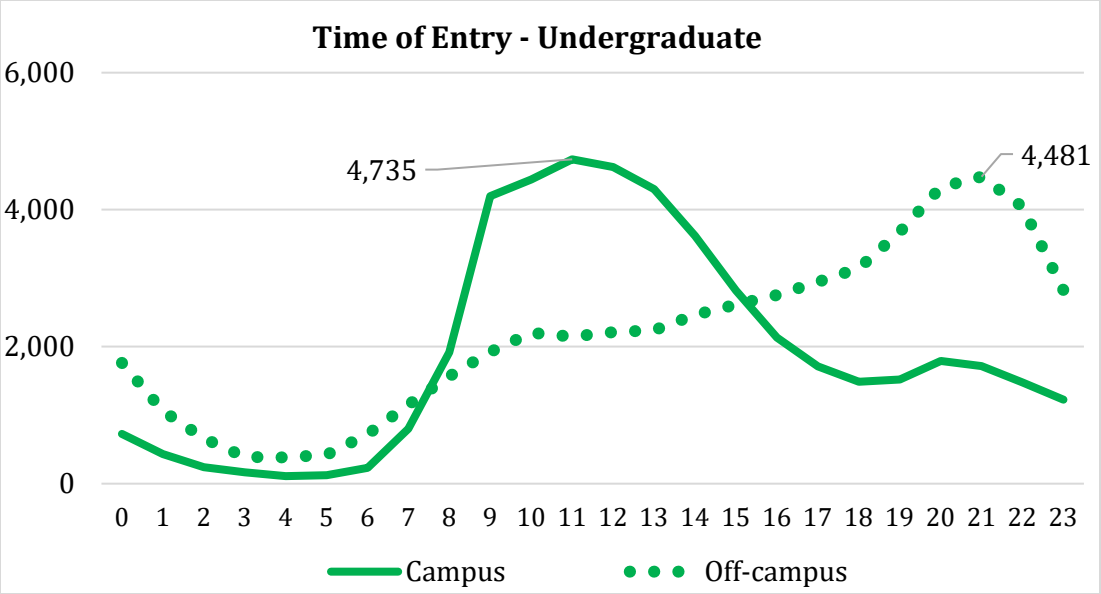


Figure 6. Graduate student entry points by location and time

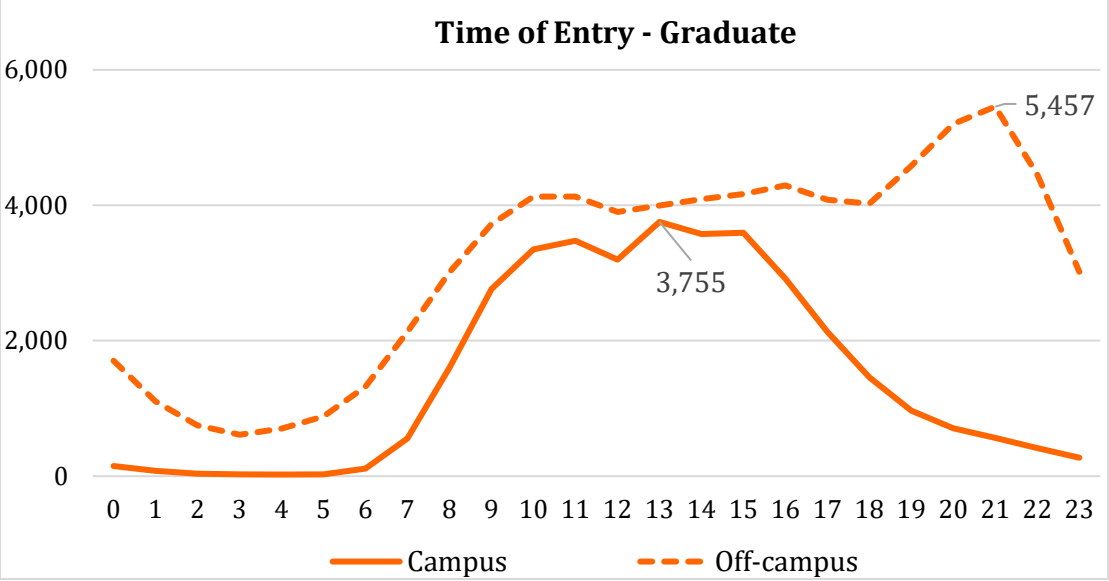


Figure 7. Faculty/staff entry points by location and time

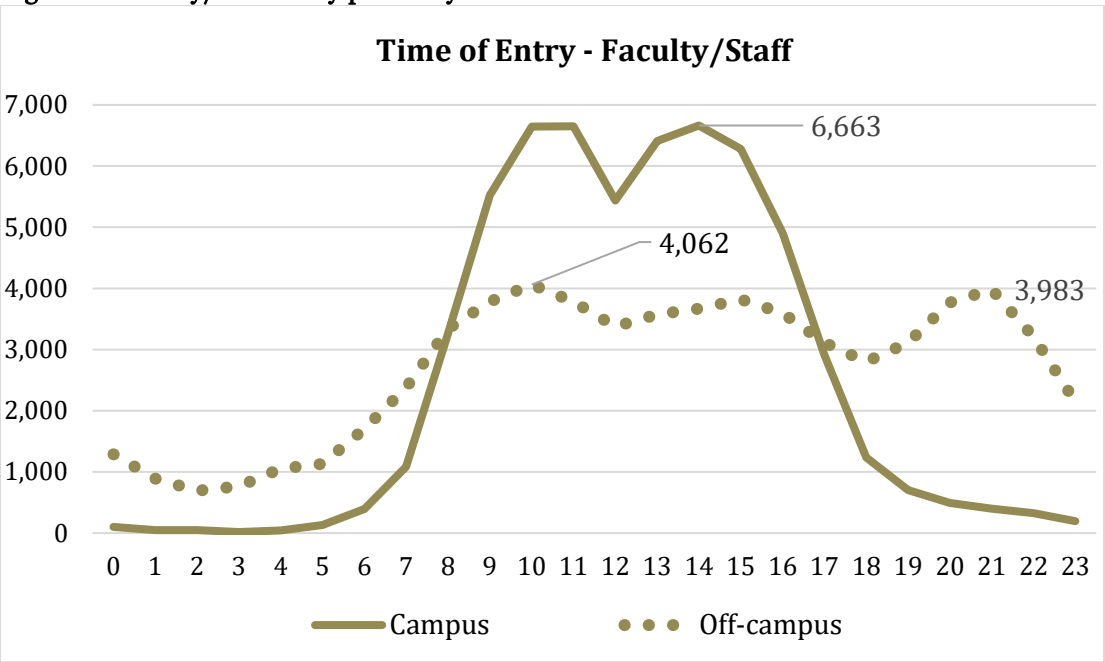


Figure 7 shows that faculty/staff usage by location and time also dropped in the evenings like both student groups. As expected, faculty/staff on-campus usage in the evenings did not rebound since they do not have on campus housing. In addition, due to the campus' energy conservation practices, some offices do not have any air conditioning after 5 p.m.

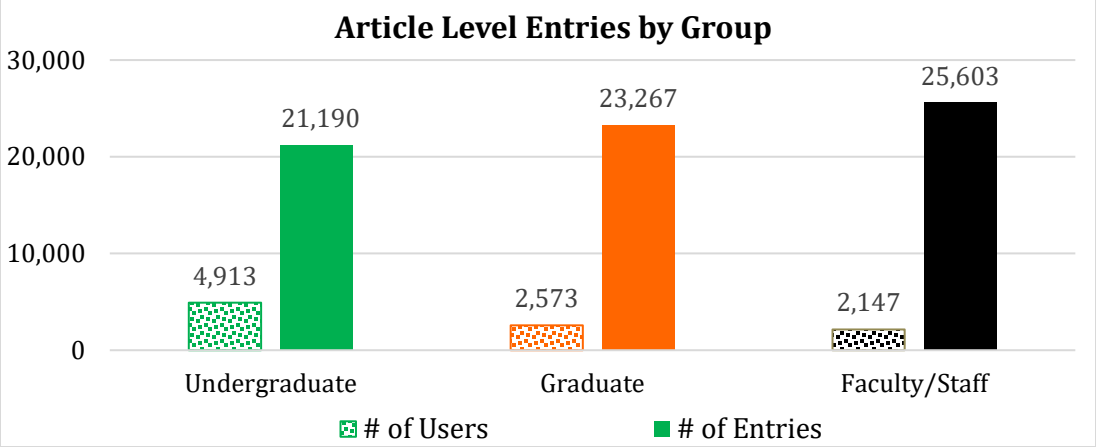
Data clearly shows that off-campus access at night far surpassed the on-campus Wi-Fi access for graduate students. Similarly undergraduate off-campus access to e-resources increased significantly in the evenings. Currently the library does not offer chat-reference. Data like this could be used to indicate the need for such support.

What E-Resources Did Users Want When Logging In?

The URL in the EZproxy log entry points identified what e-resources (i.e., journal articles, e-books, e-journals, or databases) users were attempting to access when logging in. More than half of the users (59.18%) accessed a database. The next highest category of e-resource was journal articles followed by e-journals and e-books. All three user groups tended to access mostly databases and articles, but differed when it came to e-journals and e-books. The students' initial e-resource tended to be more e-books than e-journals while faculty/staff accessed e-journals about 2.5 times more than e-books.

There were 70,060 article-level entries for 60,008 unique articles. These were found by searching "*doi* or *article* or *document*" within the URLs. 6,498 articles were accessed more than once ranging from two to 126 times by 4,388 users during the 12-month period. At first glance, having more than 20% of entries to be for specific journal articles was unexpected. Until an analysis of what web pages or websites users were coming from, we assume that users are selecting articles found by searching the library's discovery tool (One Search Mānoa), which does not require a login.

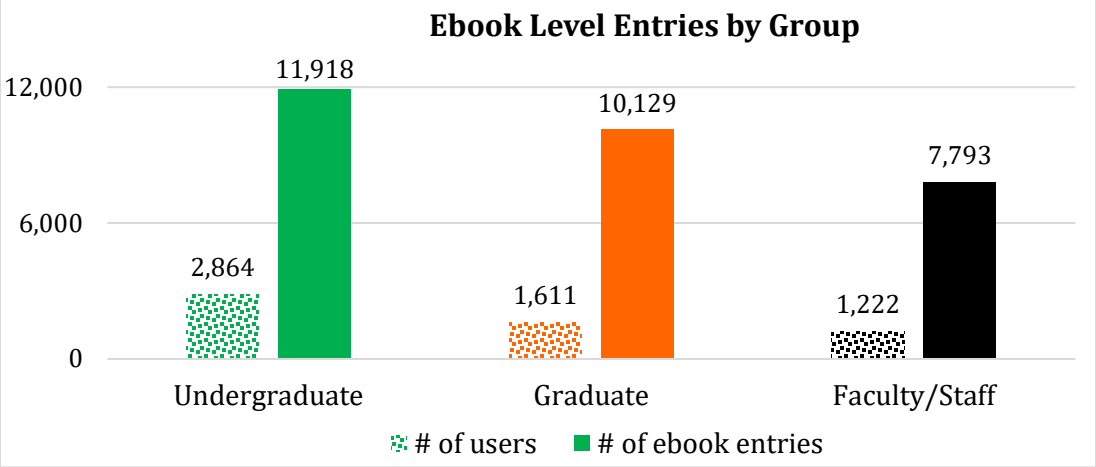
Figure 8. Journal article entries by user group



For e-books, there were 29,840 entries. Since eBrary and EBL were the primary vendors for the library's e-books at the time, these entries were found by searching the log data for "*ebrary*" or "*eblib*" within the URLs. Nine thousand, six hundred forty entries represented single access to an e-book. Three thousand fifty-four e-books were accessed more than once, ranging from two to 601 times, for a total of 20,200 entries. Among those 3,054 e-books, 2,249 of them were accessed more than once by a same user.

Because these statistics are for only entry points, we are not able within the context of this study to see the overall scope of repeated access to journal articles or e-books. While the number of articles (10.8%) and e-books (24.1%) with multiple entries are relatively small, it would be useful to get a better idea of the extent of repeated access. Previous studies have identified factors affecting how e-journal article usage are counted including e-journal interfaces, linking from search portals like Google Scholar, and double counting articles that are viewed and then printed or emailed.[16] Even with the limitation of using only entry point data, this study gives us a glimpse that the vendor provided usage statistics may be inflated if libraries wanted to give more weight to the unique views and downloads by unique users.

Figure 9. E-book entries by user group



While it was fairly straightforward to identify article-level and e-book-level entries, determining journal-level entries was challenging. One reason was that searching the URLs for journal-level entries proved difficult due to variations in the way vendor websites identified journals. Even a single vendor could identify a journal in more than one way. EBSCO, for example, could have *jn=* or *jnnpd* for journal-level URLs.

Another reason is that the string "*journal*" in a URL could be for article-level entries. In the example below, the URL for an article in an EBSCOhost database includes the word journal because that word is included in the journal title:

> ***openurl.ebscohost.com/linksvc/linking.aspx?sid=a9h&date=2003-04&issn=1472-5886&stitle=&issue=1&volume=2&spage=59&genre=article&title=Journal%20of%20modern%20Jewish%20studies&epage=78***

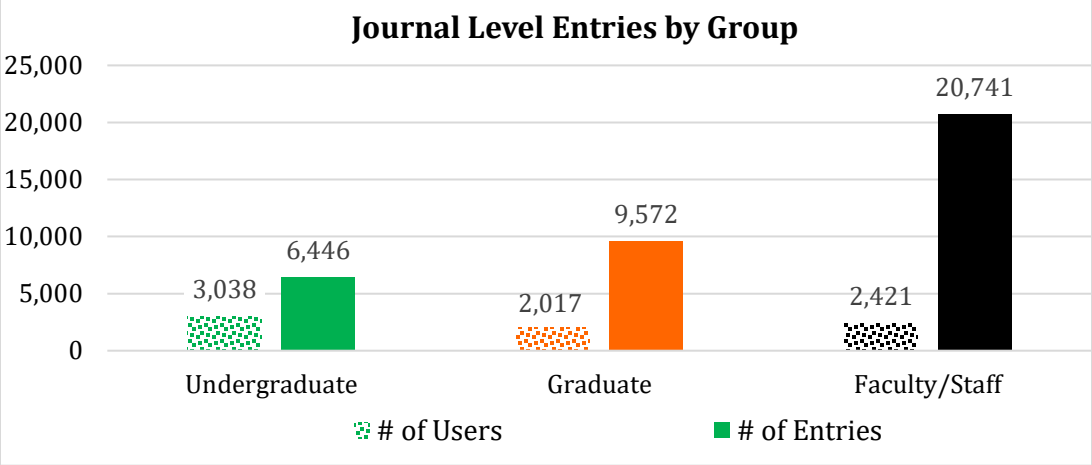
In the end, a complex Microsoft Access query was used to identify journal-level entries:

> ***[NOT (Like "*article*" or Like "*doi*") AND ((Like "*journal*" Or Like "*jn=*" Or Like "*jnnpd*" Or Like "*loi*" Or Like "*issn*")]***

This query yielded 37,987 entries. The number of unique journals that were accessed was 17,911.

As stated previously, faculty/staff were more likely to access e-journals (20,741 entries) than e-books (7,793 entries). They also had more journal-level entries than undergraduate and graduate students combined. This is an expected behavior since faculty/staff are familiar with the journals needed for their disciplines. We believe that journal-level entries come from the A–Z e-journal list on the library website. Until an analysis of what web pages or websites users were coming from can be done, this is only an assumption.

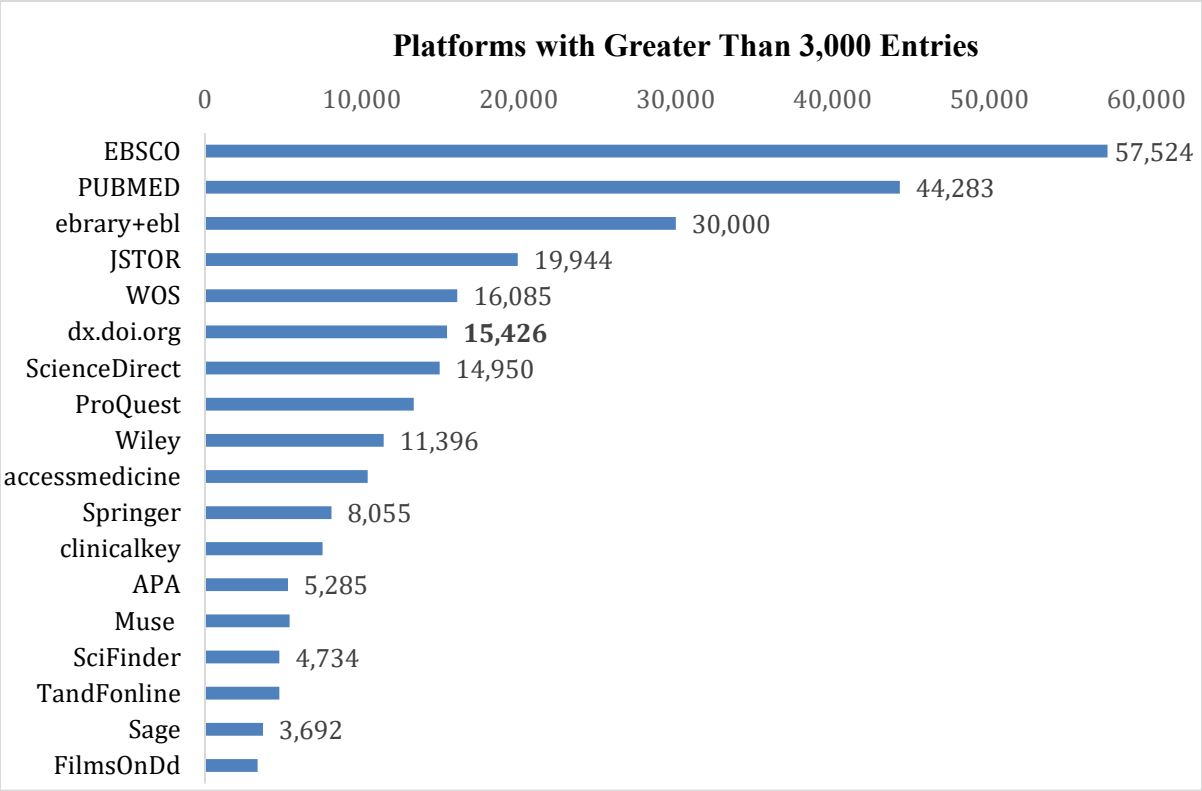
Figure 10. E-journal entries by user group



What Platforms Did Users Request the Most?

Databases were the resources that most users wanted when logging into the EZproxy server. One challenge in identifying the most requested databases is that some are available on multiple platforms, e.g., Medline and ERIC. Another factor in the analysis is that some vendors provided multiple databases on their platforms (e.g., EBSCO, Web of Science, and ProQuest). Rather than analyzing databases, the decision was made to analyze requests by vendor (i.e., hosts). The initial review was to count the number of host level entries. Figure 11 shows the platforms that had over 3,000 entries during the year.

Figure 11. Platforms with greater than 3,000 entries

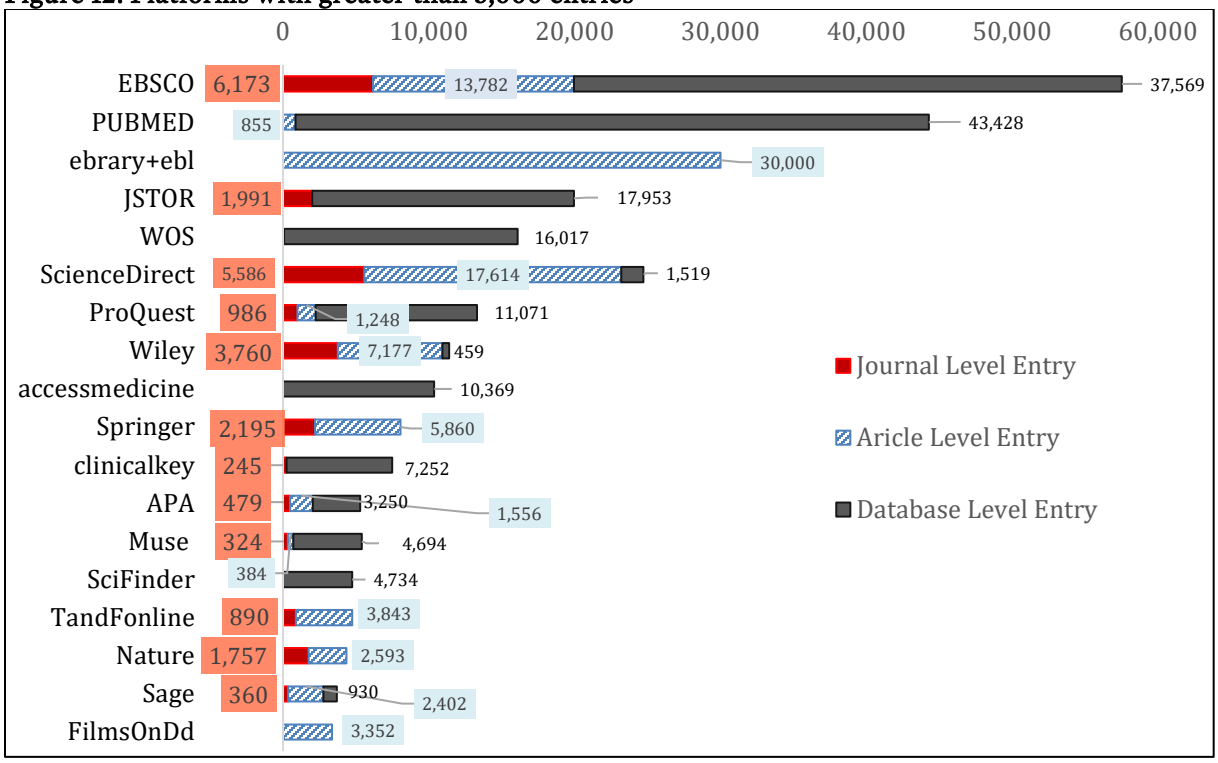


One odd URL that appeared on the list of those with over 3,000 entry points was dx.doi.org. That host level URL does not take users to a specific platform, but directs them to web sites for vendors. This necessitated a closer look at those URLs to identify what e-resources were being requested and which platforms hosted them. Below is one example of a dx.doi.org URL for a journal article: ***dx.doi.org/10.1088/0953-8984/25/2/025402?nosfx=y***

Article from Journal of Physics: Condensed Matter (IOP Science)

Once the actual platforms and type of e-resource were identified, the entry counts for the different platforms were re-calculated. This led to a slight change to the list of platforms with more than 3,000 entries. As seen in Figure 12, ScienceDirect jumped from seventh on the list to fourth. Nature, which was not initially listed, appeared with more entries than Sage and Films on Demand.

Figure 12. Platforms with greater than 3,000 entries



Further analysis of the 18 most used platforms revealed whether articles, journals, or databases were being requested and what user groups were accessing those platforms. EBSCO had the most entries with 57,524. Among those entries, 11% were journal-level entries, 22% were article-level entries, and the rest (67%) were directed to specific databases. PubMed came in second with 44,283 entries.

Limitations

This study has some limitations related to the data that was used and the analysis that was done. First, the data only included information related the e-resources that users accessed when they first logged into the EZproxy server. The subsequent e-resources that users accessed after their initial entry point were not considered in this analysis because of the amount of data contained within the logs. This means that the data and analysis only considered a portion of what the patrons used during the 12-month period.

Second, all of the university's employees are assigned the same user group status in the library's ILS regardless of their role as a faculty or a staff member. This means that usage by faculty could not be distinguished from usage by employees who are support staff such as secretaries.

Third, the URLs for journal-level entries are structured differently between vendors (i.e., publishers and aggregators). A closer look at all entries revealed that a more complex query was needed to separate journal-level URLs from article-level ones. Even after the query was performed, it is possible that all variations would not be included.

Conclusion

This study revealed that most people affiliated with the University of Hawai'i at Mānoa are using the library's e-resources. Breaking down usage by user groups revealed differences in undergraduate students, graduate students and faculty/staff members accessed the e-resources, where they were at, and what they accessed. While this study was able to show distinctions between the user groups, reviewing the data raised other questions: Why did so many entry points (20.9%) go directly to journal articles? What webpages or web tools are directing users to the e-resources?

To answer these questions, the library needs to analyze data from other sources to see what resources and tools are used to link to e-resources: OpenURL link resolvers, database lists, discovery tools, and website analytics. In addition to looking at other data sources, a future study may also need to take consideration the library's transition from Voyager as its ILS and SFX as its Open URL link resolver to Alma.

Acknowledgements

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Endnotes

1. John Gallagher, Kathleen Bauer, and Daniel M. Dollar, "Evidence-Based Librarianship: Utilizing Data from All Available Sources to Make Judicious Print Cancellation Decisions," ***Library Collections, Acquisitions, and Technical Services*** 29, no. 2 (June 2005): 169–79, https://doi.org/10.1016/j.lcats.2005.04.004.
2. Wonsik Shim, and Charles R. McClure, "Data Needs and Use of Electronic Resources and Services at Academic Research Libraries," ***portal: Libraries and the Academy*** 2, no. 2 (2002): 217–36; Stephanie H. Wical and Hans F. Kishel, "Strategic Collection Management through Statistical Analysis," ***The Serials Librarian*** 64, no. 1–4 (2013): 171–87, https://doi.org/10.1080/0361526X.2013.760394.
3. Nancy Beals and Marcella Lesher, "Managing Electronic Resource Statistics," ***The Serials Librarian*** 58, no. 1–4 (2010): 219–23, https://doi.org/10.1080/03615261003625844; Linda Hulbert, Dani Roach, and Gail Julian, "Integrating Usage Statistics into Collection Development Decisions," ***Serials Librarian*** 60, no. 1–4 (2011): 158–63, https://doi.org/10.1080/0361526X.2011.556027; Ingrid Moisil, "Renew or Cancel? Applying a Model for Objective Journal Evaluation," ***Serials Review*** 41, no. 3 (2015): 160–64, https://doi.org/10.1080/00987913.2015.1065466; Wical and Kishel, "Strategic Collection Management," 174.
4. Joanna Duy and Liwen Vaughan, "Usage Data for Electronic Resources: A Comparison between Locally Collected and Vendor-Provided Statistics," ***Journal of Academic Librarianship*** 29, no. 1 (2003): 16–22; Stephen Asunka, Hui Soo Chae, Brian Hughes, and Gary Natriello, "Understanding Academic Information Seeking Habits through Analysis of Web Server Log Files: The Case of the Teachers College Library Website," ***Journal of Academic Librarianship*** 35, no. 1 (2009): 33–45.
5. Kelly Smith and Jens Arneson, "Determining Usage When Vendors Do Not Provide Data," ***Serials Review*** 43, no. 1 (2017): 46–50, https://doi.org/10.1080/00987913.2017.1281788; Sandra L. De Groote, Deborah D. Blecic, and Kristin Martin, "Measures of Health Sciences Journal Use: A Comparison of Vendor, Link-Resolver, and Local Citation Statistics," ***Journal of the Medical Library Association: JMLA*** 101, no. 2 (2013): 110–19, https://doi.org/10.3163/1536-5050.101.2.006.
6. David Nicholas, Paul Huntington, Hamid R. Jamali, and Carol Tenopir, "Finding Information in (Very Large) Digital Libraries: A Deep Log Approach to Determining Differences in Use According to Method of Access," ***Journal of Academic Librarianship*** 32, no. 2 (March 2006): 119–26, https://doi.org/10.1016/j.acalib.2005.12.005.
7. Lauren Ajamie, Glenn Bunton, Shannon Fox, and Monica Moore, "Ezproxy for Electronic Resource Librarians: Conference Report," ***Journal of Electronic Resources Librarianship*** 26, no. 3 (2014): 203–05, https://doi.org/10.1080/1941126X.2014.939038.
8. Deborah D. Blecic, Joan B. Fiscella, and Stephen E. Wiberley, "The Measurement of Use of Web-Based Information Resources: An Early Look at Vendor-Supplied Data," ***College & Research Libraries*** 62, no. 5 (2001): 434–53; Manorama Tripathi, Sunil Kumar, and V. K. J. Jeevan, "Understanding Utilization of E-Journals through Usage Reports from Aggregators in a Distance Education University," ***Journal of Electronic Resources Librarianship*** 24, no. 1 (2012): 22–42, https://doi.org/10.1080/1941126X.2012.657103.

9. Karen A. Coombs, "Lessons Learned from Analyzing Library Database Usage Data," ***Library Hi Tech*** 23, no. 4 (2005): 598–609, https://doi.org/10.1108/07378830510636373.
10. Shim and McClure, "Data Needs and Use," 225.
11. Albert Ball, Christine Davidian, Jonathan Jiras, Scott Vieira, and Peseng Yu, "Responding Proactively to the Problem of Compromised User Accounts," ***Serials Review*** 42, no. 3 (2016): 259–65, https://doi.org/10.1080/00987913.2016.1212315; Marshall Breeding, "Offering Remote Access to Restricted Resources," ***Information Today*** 18, no. 5 (May 2001): 52–53; Glenn A. Bunton, "Ezproxy: The Key to Remote Access," ***Serials Librarian*** 73, no. 2 (2017): 119–26, https://doi.org/10.1080/0361526X.2017.1338635; Alexander Jerabek and Minh-Quang Nguyen, "A Hybrid Solution for Improving Single Sign-on to a Proxy Service with Squid and Ezproxy through Shibboleth and Exlibris' Aleph X-Server," ***Code4Lib Journal***, no. 18 (2012): 1–7; Zou Qing, "A Novel Open Source Approach to Monitor Ezproxy Users' Activities," ***Code4Lib Journal***, no. 29 (2015): 1; Tim J. Ribaric, "Testing the Off-Site Experience, or, How Well Do You Proxy?," ***Computers in Libraries*** 29, no. 1 (2009): 18–21; Chris Zagar, "Unlocking Library Subscriptions," ***Library Journal*** 132 (2007): 6–9.
12. Coombs, "Lessons Learned," 598–601; Smith and Arneson, "Determining Usage," 48; H. Jamane Yeager, "Using Ezproxy and Google Analytics to Evaluate Electronic Serials Usage," ***Serials Review*** 43, no. 3/4 (2017): 208–15. https://doi.org/10.1080/00987913.2017.1350312.
13. Carol Tenopir and Eleanor Read, "Patterns of Database Use in Academic Libraries," ***College & Research Libraries*** 61, no. 3 (May 2000): 234–46, https://doi.org/10.5860/crl.61.3.234.
14. Blecic, Fiscella, and Wiberley, "Measurement of Use," 447–449.
15. Tripathi, Kumar, and Jeevan, "Understanding Utilization," 36–8.
16. Philip M. Davis and Jason S. Price, "Ejournal Interface Can Influence Usage Statistics: Implications for Libraries, Publishers, and Project Counter," ***Journal of the American Society for Information Science & Technology*** 57, no. 9 (2006): 1243–48, https://doi.org/doi:10.1002/asi.20405; Chan Li and Jacqueline Wilson, "Inflated Journal Value Rankings: Pitfalls You Should Know About Html and Pdf Usage" (PowerPoint presentation American Library Association Annual Conference, San Francisco, CA, 2015); Oliver Pesch, "Usage Statistics," ***The Serials Librarian*** 46, no. 1–2 (April 2004): 143–54, https://doi.org/10.1300/J123v46n01_15.