Diverse mobile users: The development of library experts

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Introduction

Diversity of thought, perspective, and organizational membership is a significant cornerstone of higher education (Gurin, et al., 2002). The importance and value of diversity has been shown in research underscoring the advantages of diverse group membership upon problem solving; noting that a diverse team outperforms homogenous groups of problem solvers (Page, 2007, p. 157). A classic work on the topic of innovation in organizations notes, "Innovating companies seem to deliberately create a 'marketplace of ideas,' recognizing that a multiplicity of points of view need to brought to bear on a problem", (Kanter, 1983, p. 167). Within education, greater intellectual growth and student achievement have been tied to the effect of a student body made up of diverse peers (Gurin et al., 2002).

This paper contends that access to library resources via mobile technology may yield new insights into diverse students' growth. The overarching consideration of this research is centered on describing the way in which diverse mobile app users develop to yield insights about learning over time, both away from a campus location and through ubiquitous technology. The scope and focus of this work is to interrogate the uses of mobile technology in general and several years of modular mobile library access in particular. As it pertains to methodological considerations, metrics used in this paper surface a unique statistical power law pertaining to library assessment and is understudied in the literature of student learning. This power law is uniquely different from classic assessment methodologies involving statistical significance.

Organizational science has criticized traditional metrics for their singular focus on finding statistical significance in features of datasets, arguing that, "Although normal (bell-shaped) distributions and related quantitative methods are still relevant for a significant portion of organizational research, the increasing discovery of power laws signifies that Pareto rank/frequency distributions, fractals, and underlying scale-free (SF) theories are pervasive and valid characterizations of nonlinear organizational dynamics. Where they validly apply, researchers ignoring Pareto distributions risk drawing false conclusions and promulgating useless advice to practitioners", (Andriani and McKelvey 2009, p. 1053). Pareto thinking underscores one particular power law distribution known well and referred to commonly as the "80/20 rule"—in which, for example, twenty percent of a population may account for eighty percent of an economy's wealth. Perhaps the library and information science (LIS) field would be most familiar with the power law Anderson (2006) described in his seminal book, *The Long Tail*, which explored the nature and preponderance of inventories within e-commerce that, because of their reach and scope, now can extend far into a long-tail niche of consumers sales. This niche necessarily reveals the need to attend to sales and commerce beyond blockbusters and best sellers. To frame this within the scope of our study, we found a range of experiences important to academic libraries' educational assessments, including minority voices that represent diversity.

There is a long tail of diverse users in libraries. Among other attributes, these users may represent a variety of socioeconomic backgrounds, and accordingly, the behaviors of diverse users were studied in the mobile server log analysis of this research. By identifying these users, their engagement with library data points can be analyzed for trends in growth according to unique economic demographics. Therefore, this paper implemented a multi-pronged investigation of users' diversity according to geographic location and economic level. By

analyzing the date and time of library interactions with mobile resources these data points were tracked over several years of library use in order to ascertain the level of continued engagement and use of mobile library resources. Geographic economic levels and diversity are closely intertwined as demographers and sociological observers have previously noted (Weiss, 2000; Bishop, 2009). The methodologies employed for understanding the aforementioned mobile engagement trends based on geography incorporate a variant of contemporary learning analytics.

Learning analytics are a set of computationally and data intensive assessment methodologies that are of growing importance in higher education in general and academic libraries specifically. These methodologies are possible in large part because of the fact that learning has generated massive amounts of data available for analysis. Learning analytics developed as well because of the contemporary reality that much of student learning today generates a digital footprint. Storage costs and computational costs also have become affordable utilities for many academic institutions, researchers, and data analysts. In a ten-year review of the development of learning analytics, researchers noted that "During the last decade, learning analytics has emerged as a significant area of research into technology-enhanced learning. A review of key reference points for the field shows that a combination of the availability of big datasets, the emergence of online learning on a large scale, and political concerns about educational standards has prompted the development of this field. Learning analytics are distinguished by their concern for providing value to learners, whether in formal, informal or blended settings. They are employed to understand and optimise both learning and the environments within which it takes place. Although this is a new area of research, it draws on extensive work in related areas, and has already developed a range of tools and methods that offer exciting potential," (Ferguson, 2012, p10-11). Several of the tools and methods

aforementioned are also in vogue now in the corporate technology sectors, as evidenced by the applications of instrumental data mining, machine learning, and deep learning; the combination of all of these techniques has led to a contemporary renaissance in artificial intelligence's promise to deliver new predictive insights into business, technology, and education.

A finding from the recent library research literature on student learning analytics (De Rosa, 2017; Long & Siemens, 2011) indicated that academic library features are correlated positively with student learning. One recent study stated that "Students' use of books (collection loans, e-books, and interlibrary loans) and web-based services (database, journal, and library website logins) had the most positive and significant relationships with academic outcomes" (Soria, Fransen, and Nackerud, 2017a, p. 8). A related study reported that students' library use is a "…significant predictor of semester GPA, one-term retention, and academic standing" (LeMaistre, Shi, and Thanki, 2018, p. 117). The influence of library instruction also is correlated positively with student GPA (Gaha, Hinnefeld, and Pellegrino, 2018). Student success measures were the focus of a study that analyzed GPA, student retention, and degree persistence (Massengale, Piotrowoski, and Savage 2016), and the study was exceedingly valuable in demonstrating academic libraries' positive influence on academic outcomes.

Summative and formative evaluations are standardized categories of formal evaluation of students in higher education. The trend in data-focused learning analytics in academic libraries focuses on summative outputs, such as first-semester GPA, and new undergraduate student persistence to their second semester or year (LeMaistre, Shi, and Thanki, 2018; Soria, Fransen, and Nackerud, 2013). Student success can be evaluated with summative measures. According to the *Encyclopedia of Terminology for Educational Communications and Technology*, "Summative evaluation is conducted at the end of a program or a process for determining short-

term results, immediate reactions or immediate competence" (Mosely, 2013, p. 70). Such metrics as one-term retention or a student's GPA during the preceding semester is, by the definition noted above, summative. However, the author contends that, because of their focus on such metrics as GPA and retention, summative measures of student learning in recent data-focused research in academic libraries are unable to measure student growth over time. Formative evaluation is defined as "…a judgment of the strengths and weaknesses of instruction in its developing stages, for purposes of revising the instruction to improve its effectiveness and appeal. The evaluation is conducted by collecting data about the instruction from a variety of sources, using a variety of data gathering methods and tools" (Tessmer, 1993, p. 11). Another researcher suggested that, "The findings from formative evaluations are fed into an improvement-focused process that further develops, refines, or revises the object being evaluated" (Russ-Eft and Preskill, 2009, p. 18). It is the author's contention that a formative evaluation of student growth over time would demonstrate library users' development as they interact with library services, notwithstanding the specifics of GPA or degree persistence, and serve as well to support the improvement of learner-centered services that academic libraries design in support of student's academic needs.

Formative and summative evaluation methodologies are sound and each has an important place in the learning analytics domain. This paper supposes a "yes, and" approach, and the underlying departure point for this research is that formative models may introduce descriptive data valuable to the learning analytics toolkit. The library research literature on learning analytics, and perhaps library service offerings that support learning, may gain additional value by attending to students' formative development as they interact with library resources. Because this is an exploratory idea, the author does not argue for one methodology over another, but

rather advocates an ensemble of approaches to understand growth over time. The author acknowledges there likely are limitations in formative evaluation, as on its own, it may be insufficient to demonstrate student success. This is perhaps a factor that contributes to the lack of studies of this type in the library literature.

The type of growth that this paper analyzes is the development of a library user from the beginning stages of use into one who is more experienced. For the purposes of this paper, we define library experts as experienced library users. These are users who have come back to the library over multiple sessions of learning, and branched out into multiple areas of library functionality and services. It also is important to note that a user can develop into an expert and at the same time not meet summative metrics that define student success. By necessity, formative evaluation requires more detailed metrics and data points than the end of a semester or year of study. In this study, the researchers used the time of day of a library interaction as a central metric throughout several years of engagement with a library-focused mobile app that was implemented by a statewide consortium. It may be the case that learning management systems (LMS) with strong library integration also hold data points that are valuable to formative assessments.

Library functions have been available via mobile platforms for several years. This study used historical server logs that record user transactions in a modular library mobile app to evaluate historical trends in their development. These trends revealed, in part, the nature of student growth over time. The Minrva consortium app, which has mobile modules for catalog and journal searches, as well as functionality to renew library materials, among others, includes user data for 2013 through 2017. A modular system allows component parts to be added or removed over time based on the app's development. The Minrva app repackages library services

and functionality for mobile access with iOS and Android applications. Version 2.0 of the core system was developed as a modular platform and its contemporary version was completed in 2013 (Hahn, 2015). Users' desire for contemporary information tools that match their expectations for content delivery, especially those related to their immediate interests and location, underscores the significance of the mobile app system. Server logs of the previous four years of student use allowed data mining research that can identify diverse users anonymously, which other library learning analytics studies have been unable to do (Nackerud, Fransen, Peterson, and Mastel, 2013). The app is implemented throughout an eighty-member academic consortium of libraries in Illinois.

The data intensive tools that learning analytics provide are not without biases, as researchers are working now on techniques that can measure and mitigate bias in machine learning processes (Abbasi, et al., 2018; Dixon, et al., 2018). Diversity as a focus of data-intensive work can help expose and potentially ameliorate the systematic bias implicit in datasets used in data mining, machine learning, and artificial intelligence research (Shankar et al., 2017). Research in higher education suggests several areas for intervention that may improve academic success on the part of students of color (Carter, 2006). Research also has considered the cultural issues and needs that are preconditions of such students' success, noting in particular that "Race and racial identity affect one's socio-emotional and psychological health in significant ways" (Moore, Ford, and Milner, 2005, p. 172).

Literature Review

The literature review that follows situates the present research within mobile digital access and adoption in libraries, contemporary student success, scholarship on the assessment of diverse users, and attends to the historical continuities of consortia technology within academic libraries.

Mobile digital access, design, use and adoption in libraries

Mobile digital access has grown significantly over the past decade. According to the Pew Research Center's fact sheet on mobile technology, "The vast majority of Americans– 95%–now own a cellphone of some kind. The share of Americans that own smartphones is now 77%, up from just 35% in Pew Research Center's first survey of smartphone ownership conducted in 2011," (Pew Research Center, 2018, p. 1). Access to library resources have shown growth in recent years as well since "the share of Americans who say they read an e-book using a cellphone within the past year increased from 5% in 2011 to 13% in 2016," (Rainie and Perrin, 2017, p.1).

Smartphone dependence is an important consideration in designing services that target diverse, low-income populations, as "Reliance on smartphones for online access is especially common among younger adults, non-whites and lower-income Americans." (Pew Research Center, 2018, p. 5). These findings highlight mobile digital tools' importance to libraries for information access in general and the critical use of mobile access on the part of diverse users.

The literature on mobile design and use in libraries has matured since the release of Smartphones in the last decade. Mobile access was appreciated increasingly in library service when the iPhone was released, and especially after Apple Inc. founded the iTunes app store in 2008. Before the iPhone's release, mobile devices in libraries were used primarily in medical librarianship or by medical students, and often focused on personal digital assistants (Blummer and Kenton, 2016).

A 2016 research article on mobile adoption in university libraries found that, "A good proportion of the university libraries studied (88%) 44 are accessible through mobile devices (through an app of mobile web), showing a high level of mobile web adoption in libraries," (Torres-Pérez, Méndez-Rodríguez, and Orduna-Malea, 2016, p. 333). Library technologists examined the development of mobile websites first, while several libraries developed library or campus mobile apps. These efforts were evaluated in papers that inquired how mobile use suits students' needs, and directed attention to library features accessible via mobile technology (Bomhold, 2014). Popular features in mobile access include catalog access, hours, maps, Ask-A-Librarian, contact information, and access to databases and library accounts (Bomhold, 2014, p. 341). The development of responsive website design was identified as a growing trend in offering these popular services (Liu and Briggs, 2015). Recent scholarship on the nature of advanced users' needs in mobiles has reported trends in graduate student access (Markland, Rempel, and Bridges, 2017).

Technologies such as mobile apps also are believed to hold promise for use in library programs and services, including online app guides, loaning tablets with apps, author events, and app discussion groups, among others (Henning, 2014). Researchers interested in the digital literacy implications of mobile app use in libraries found in their recent study that app uses "…are personally driven and motivated rather than supported by clearly-planned, identified and integrated infrastructure across the institution" Hinze et. al, 2017, p. 182). Researchers also found that there are ties to online learning modules and research associated with demographics such as age and gender (Thill, Rosenzweig, and Wallis, 2016).

Student success

As stated above, most student success metrics focus on summative evaluation, and include those methodologies that focus on metrics such as GPA in the first semester (Soria, Fransen, and Nackerud, 2013, 2014) and retention from fall to spring semester. Additional summative examples were found in research studies on the part of the assessment team at the University of Minnesota Libraries that have been constructed and received well (Soria, Nackerud, and Peterson, 2015; Soria, Fransen, and Nackerud, 2017b). One of the more popular summative metrics related to learning analytics is the notion of student retention and persistence to degree as indicators of student success (Haddow, 2013; Mezick, 2015). Tinto (2000, 2006) has developed a respected research agenda and implementation frameworks cited often to improve student retention. The models Tinto advocated included those that focused on integrative aspects in campus settings.

Driscoll (2013) indicated the importance of defining learning when discussing attributes of change over time, noting that definitions of learning overwhelmingly include "…the fact that learners are in some way different after learning than they were before in what they know and can do" (p. 109). Driscoll continued to emphasize that learning ultimately "…refers to the processes that bring about the change in the learner." Observing this change through digital means requires using server logs with time of day and date of interaction.

Development and assessment of diverse users

Undergraduate and graduate students alike bring a diversity of experiences, backgrounds, and identities to campus. These can include gender, race, and economic diversity. Environmental factors are important to consider in student learning analytic studies, as Soria, Fransen, and Nackerud (2017a) suggested that "Researchers attempting to assess the impact of academic libraries on students' academic skills development are encouraged to consider the influence of

students' academic skills when they started on campus," because their results showed that, "Students' demographic characteristics often play a part in predicting their academic outcomes, although these demographic variables were not as meaningful to students' academic outcomes as their college experiences," (p. 20). Thus, both inputs to the college experience, as well as the college experience itself, are criteria for inquiry into student growth.

Consideration of other diverse attributes, such as low socioeconomic status, gender, and race's effects on academic achievement, are understudied in the literature on student learning analytics as well, because models have focused more on summative outputs (or effects) than on formative individual change over time. Higher education in the age of algorithms and learning analytics may hold the promise to improve student education, but human, social, and behavioral factors will need to be guiding, illustrative inputs to this research topic if the contemporary trend is to be truly meaningful for higher education in general, and for holistic student development, specifically. Recent case studies also have identified the way algorithms can serve to reinforce systematic biases, such as the adverse effects of poverty (Eubanks, 2018). Algorithms that reinforce systematic racism also have been prominent in contemporary Internet platforms (Noble, 2018). This is important to emphasize, as it pertains to computationally-derived evaluations of the type that are used in learning analytics; these systems are far from neutral, and may enforce systematically those biases and underlying beliefs that education must examine and address because they compromise educational wellbeing.

Consortia technology: Mobile implementation

The literature documents the history of collaboration via consortia in higher education (Bostick, 2001; Armstrong and Teper, 2017). Early consortia collaborations focused on reducing costs for member libraries, but typologies of collaboration extend from these "buying clubs" into

several features shared, such as shared ILS', shared discovery systems, digital repositories, and print archives (Machovec, 2013).

This paper was designed to investigate academic libraries and the development of mobile users within those institutions. A review of academic library consortia underscored "… the rapid change of technology and how it affects the services they currently or may potentially offer" (Guzzy, 2010, p. 181). The Minrva mobile app was implemented by a consortium and incorporates a shared, state-wide catalog and "my account" feature.

A recent study of a consortium-implemented mobile app examined new students' use of the platform in their first semester of study (Hahn, 2017). The study used server log analysis to understand better what parts of the app new students used. The study examined individual portions of the app in the first semester and found that, "The most popularly used parts of the Minrva mobile app during the first semester includes the Catalog Search module, Technology module, and the Display module," (Hahn, 2017, p. 478). This study used server log analysis over a longer period (2013–2017) to evaluate the uses of the consortium's app in user development, with the goal of understanding the nature of mobile user development.

Methods

This study entailed a quantitative a server log analysis using recorded API uses by the mobile app. The APIs that send data to the Minrva mobile app correspond to a mobile module. The analysis of server logs log is inspired in part by the library literature on transaction and search log research (Peters, 1993; Jansen, 2006; Mischo, et al., 2012). In this study, the following APIs were analyzed: catalog search, reserves, journal search, checked out, requests, citation, and favorites. The study was conducted from October 1, 2013 to September 30, 2017.

Server logs that record API access statistics include the metrics needed for formative evaluation of students—the server logs contain "the where and when" of library user development that then helps us understand the "how" of library user development. The logs contain date and time stamps and have been collected continuously since the app became available. The IP addresses, which tell researchers where users are located in general also were valuable to this study. Because the library hosts the mobile app API, the researchers were able to access it readily.

To track growth, diverse users needed to be identified. Splunk Enterprise (a server log analysis tool) and Tableau visualization were used to identify both the diverse users in the server logs, and the ways in which they employed various parts or modules in the mobile application platform over the four years of the study. These users may have been drawn from any of the more than eighty academic consortium's members in the state in which the study occurred. Certainly, not every user's growth could be tracked, as using the app once and never again provides no results about user development readily, although it may offer, in part, incomplete clues about barriers to student growth or development. IPs alone do not provide individual access statistics, but the IP does help approximate the device's location, and thus, with diverse, non-repeatable IPs, it was possible to identify a selection of, but not all, users. Such filtering necessarily excludes use in popularly occurring regions of the study. This excluded repeating common locations, so that identifying a geographically diverse user could be assured more readily, as the IP is not associated with a user directly, but more often than not represents a user location. In this study, 107 diverse users were identified by unique location.

For the purposes of this study, defining user development was predicated on using more than one module of the consortium library app. This concern with user development informs the framing of the first research question.

Research Question 1: How do diverse consortium mobile app users branch out into other mobile app modules?

Further goals of the formative evaluation include understanding how a user location via IP based geographic data in the server logs informs student demographics findings. To this end, the research attempted to map socioeconomic backgrounds to users. These concerns inform the second research question.

Research Question 2: Can the socioeconomic backgrounds of unique diverse users be identified?

Finally, as this research is concerned with understanding and then removing the barriers to becoming an expert user of the library, researchers analyzed the dates and times within the API logs attempting to answer the question of factors that may contribute to perceived developmental barriers. It is also asserted that removing barriers to development may pose an alternative to an interventionist approach – these concerns frame the third and final research question.

Research Question 3: How might developmental barriers to becoming a library expert be removed for the diverse users identified in this study?

After detailing API findings in the following Results section, this work will then return to how these research questions were attended to in the Discussion section, giving importance also in reporting implications for library practice.

Results

The diverse Minrva users in this study (n=107) accessed the range of modules in the Minrva app shown in Figure 1. The sum of the modules accessed is shown in Figure 2.

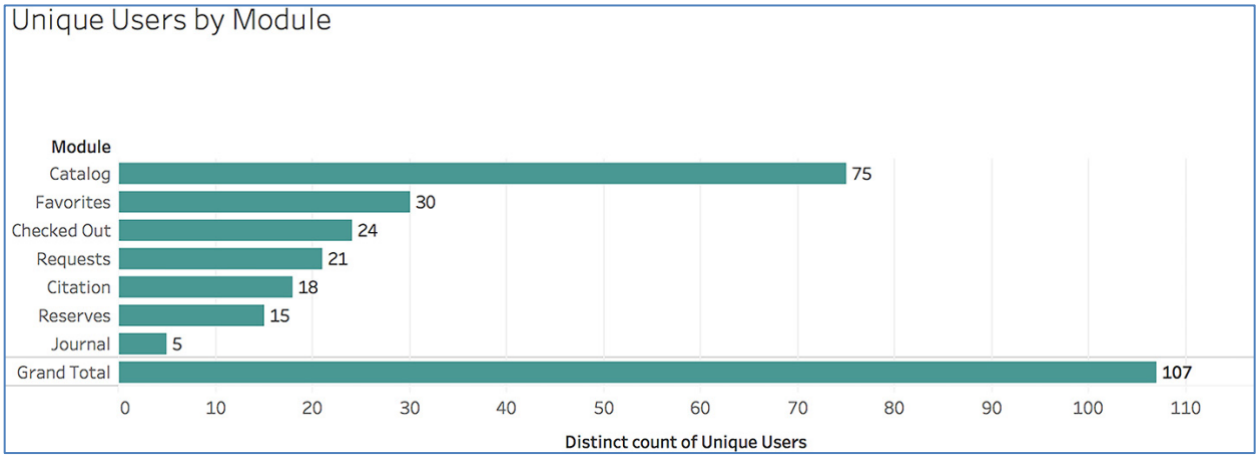

Figure 1.

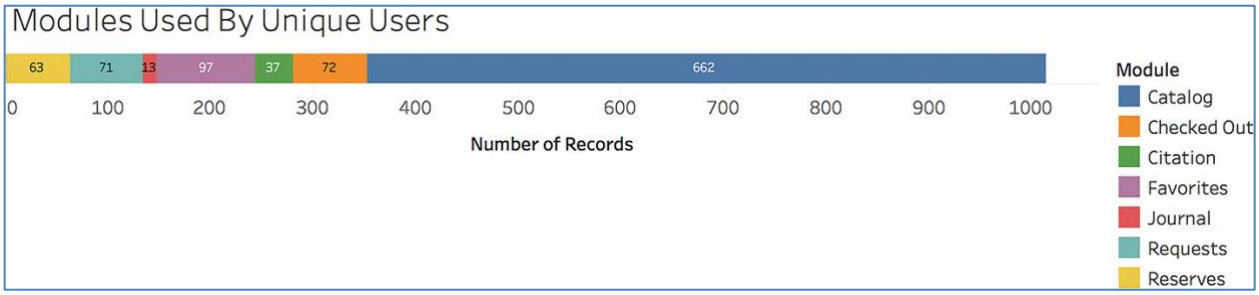

Figure 2.

Figure 3 shows the users' module access during 2013, 2014, and 2017. 2015 and 2016 were excluded, as they did not contain sufficiently diverse IPs that could identify users distinctly, (e.g., most of the use in 2015 and 2016 involved popular, non-diverse IPs).

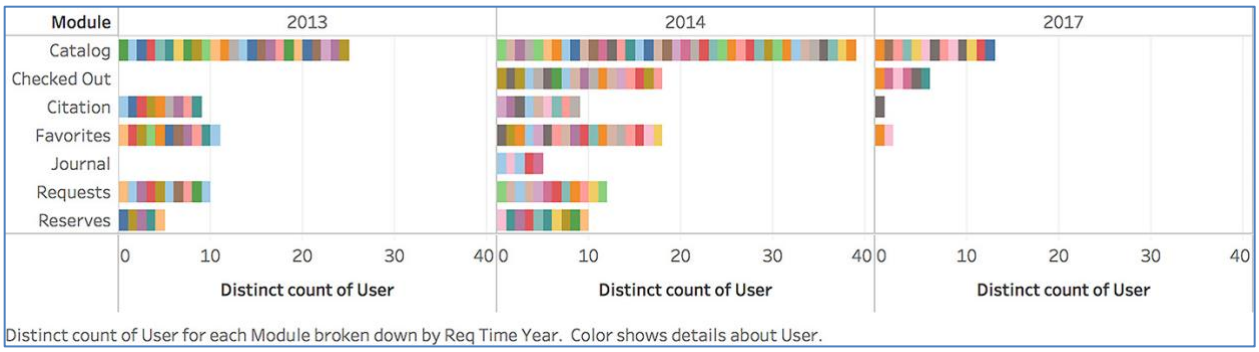

Figure 3.

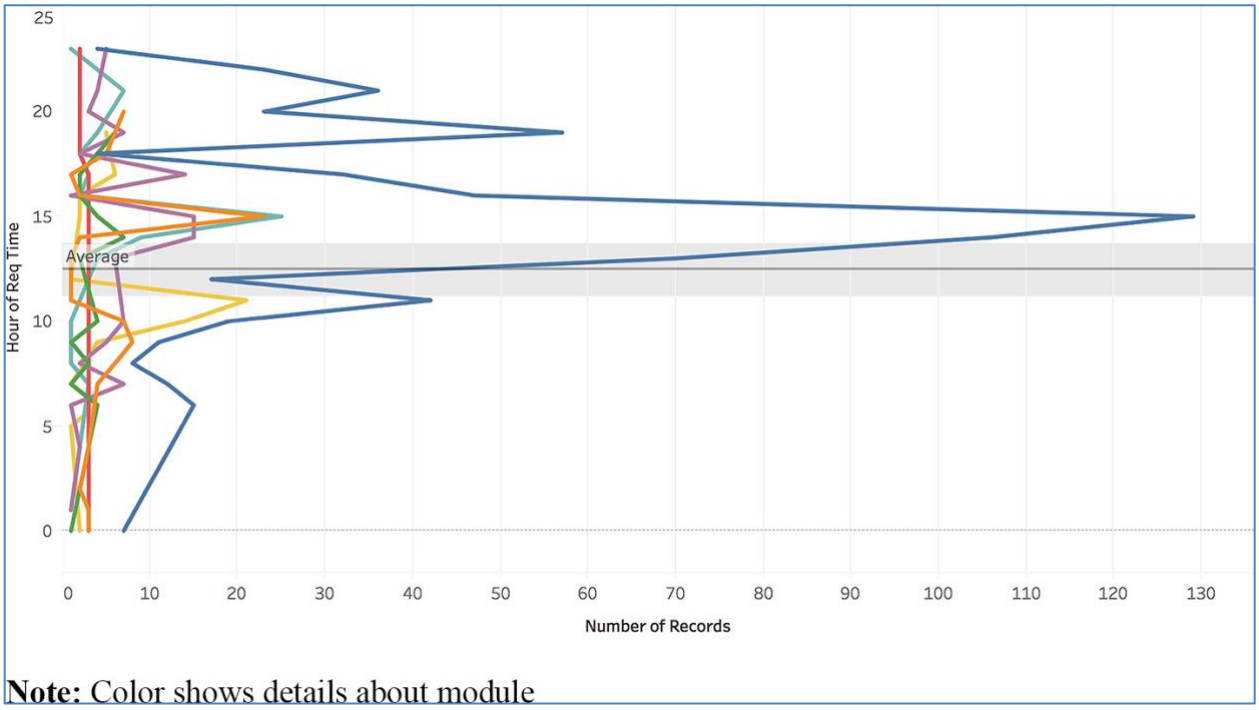

Figure 4.

The average hour at which all users accessed the app was12:44. Figure 4 shows the aggregate time of day (in 0-24 format) at which the study participants used all modules. The colored lines delineate modules and numbers of records accessed during this hour of the day by users who could be identified in server logs during 2013-2017. Users' median household income for the year 2018 is shown in Figure 5.

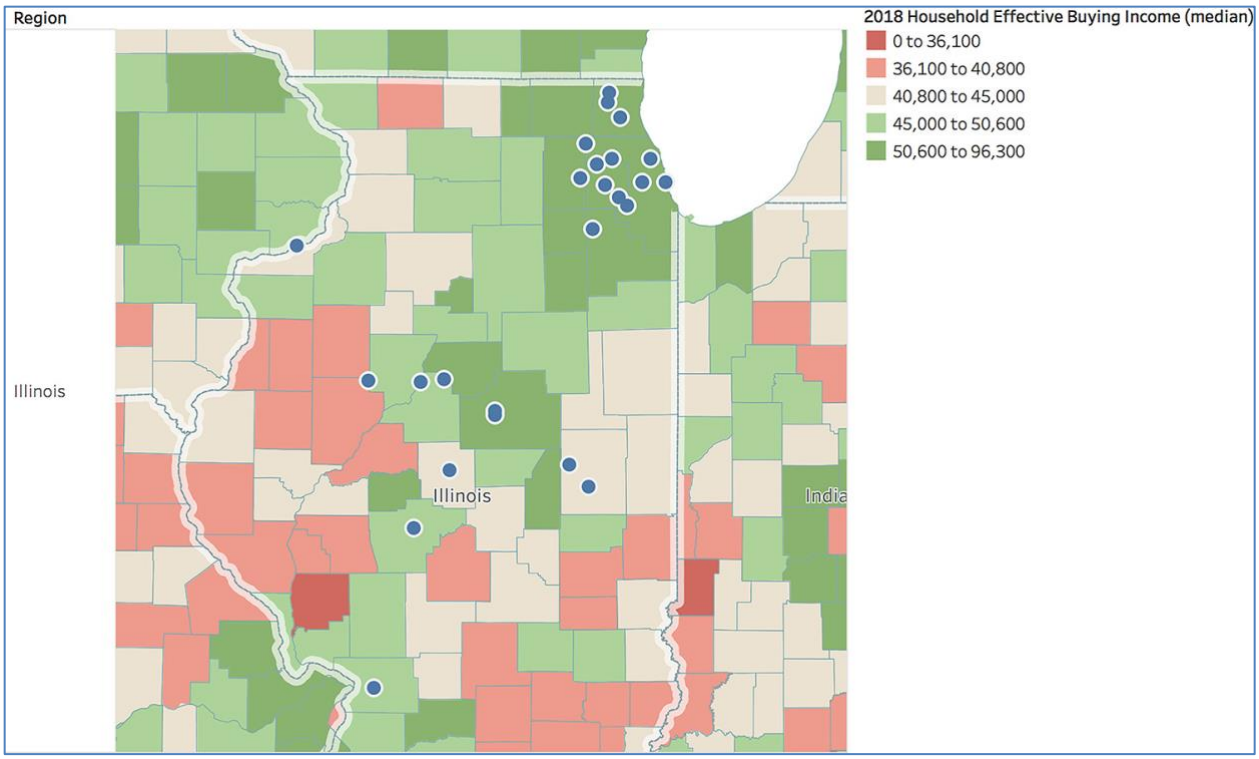

Figure 5.

Discussion

To address the first research question about the ways in which diverse consortium mobile app users branch out into other modules, we began by noting the popularity of several modules over the years of the study. Beginning in 2013, it is clear that the catalog search module and citation module were the most popular portions of the app (Figure 3). By 2014 and 2017, the catalog search module remained popular, but users began to branch out to the checked-out module, with the citations module as the third most popular. No users in any of the years of the study used all seven of the modules studied, and the maximum number of modules any user accessed was 5. The catalog search module was the most popular module available to students. The checked-out module was the portion of the mobile app platform used second most often, indicating that if users branched out into other parts of the app and library it may be because they were exploring and using collections associated with their course work. Library checkouts were correlated positively with student outcomes, in that "Students who borrowed books (including

traditional books, e-books, and interlibrary loans) were more likely than their peers who did not borrow books to be engaged in their academic work, to develop academic skills like critical thinking and reading/writing, and to engage in scholarly activities, including analyzing materials, using facts and examples to support claims, and incorporate ideas and topics across disciplines" (Soria, Fransen, and Nackerud, 2017a, p. 20).

Demographic findings for unique users

Figure 5 shows the results of mapping IPs to counties and these counties' buying income that we used to address Research Question 2: "Can the socioeconomic backgrounds of unique diverse users be identified?" Although IP mapping is imperfect, several trends related to 2018 Household Effective Buying Income did emerge from this data analysis approach, as Figure 5 shows. It did not appear that users from the IP addresses identified were associated with areas with low median buying income. There were several areas with middle buying income, ($40,800 to $45,0000). The median buying income among most mobile app users appeared to be among the higher ranges for the state, from $50,600 to 96,3000. This apparent absence of lower income app users is a trend that deserves further inquiry. The gap is consistent with other research into the demographics of smartphone ownership and use. The Pew Research Center's "Mobile Fact Sheet," indicated that 25% of those respondents who earn less than $30,000 a year, own a cell phone, but not a Smartphone (Pew Research Center, 2018). The implications for digital access to online resources are profound, because, as a related Pew Research report notes, "reliance on smartphones to go online varies greatly by income. One-in-five adults whose annual household income falls below $30,000 are smartphone-only internet users, compared with only 4% of those living in households earning $100,000 or more," (Rainie & Perrin, 2017, p. 3). This also is

indicative also of a parallel digital divide occurring in new technology adoption (Anderson, 2017).

Observed user development

Continuing the investigation of research question 1, we noted that 61% of users in this study used only one module in the app, such that 39% of all users used more than one module. The next stage of development observed, those who used two modules overall, represented 18% of the users and was the second largest developmental characteristic identified. Twelve percent of the users in this study accessed three modules in the app, while 9% of users accessed four or more modules. Twenty-one percent of users used a majority of the modules. The data analysis seemed to fit a pareto distribution of expert users, where 79% of distance users do not become experts, while 21% of the users identified accessed 3-4 modules over the course of their library use.

The aggregate access of the module by time of day for all users (Figure 4) demonstrated a trend, in that the majority of module use occurred from 8am – 8pm. However, there was a slight trend of higher than average module use after 8pm, and high catalog searches into the evening hours, but fewer modules overall were used after 8pm. Previous studies have shown a relation between GPA and sleep (Kelly, Kelly, and Clanton, R. 2001) and recent scholarship has served to verify the relationship among undergraduate sleep habits and student success (Hartmann and Prichard. 2018). We can see in Figure 4 that, in the aggregate, modules are explored more often before 8pm–12pm, with particular spikes in catalog searches in the afternoon. This is consistent with studies that have addressed the nature of sleep, stress, and their effects on performance and sleep quality (Sano et al., 2015). The mean hour of mobile access on the part of all users was approximately 1pm (Figure 4). Library use is more likely to have an influence on students during

hours that are amenable to adequate sleep, as the results of the logs from all years of the study showed. In addressing research question 3, the time of day analysis helped the researchers begin to understand potential barriers to student development over time. However, log analysis may not be sufficiently qualitative to truly understand barriers of student growth over time.

Conclusion

This paper incorporated an API log analysis to evaluate first, the location of users in non-traditional areas, e.g., outside of the classic paradigm of educational settings. To study the nature of diverse user development, users from unique locations were identified and tracked over several years. Using a modular approach, it was possible to ascertain this unique cohort's module use over time. Modular use was only one indicator, but findings that focused on modular use over time seemed to suggest that while over half of these users used only one module, 39% percent accessed more than one module, and thus showed some development as a library user over time. This formative approach to assessing student library engagement suggests additional assessment methodologies, such as evaluating development of library users over time for outreach and distance learning through mobile module access. It may be fruitful in future work to investigate why the unique student users identified here do not become frequent mobile module users by using qualitative interviews, focus groups, or survey data, particularly to reveal the barriers to developing into an expert library user with data available. The research presented here describes the way digital interactions manifest within a global exploration of digital touch points that support student learning. Future studies can continue formative evaluation by including learning management systems touch points that have data that correspond to library related learning, such as information literacy instruction (Klomsri and Tedre, 2016) and formative

learning that takes place within reference services online (Avery and Ward, 2010; Ward, 2011; Lenkart, Krogman, and Ward, 2017; Krieb, 2018).

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