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Usage of E-resources: Virtual Value of Demographics

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ABSTRACT

The focus of this study was to identify: 1) usage of library e-resources by faculty and staff affiliation and status to identify research and teaching needs; 2) usage of library e-resources by student major, status, gender, registered disability and registered veteran to establish best outreach practices and areas that need service improvement and collection development in support of student learning; and 3) the correlation between use of library e-resources and student attainment as defined by grade point average (GPA). Demographic data was collected for these users based on their university NetID logins. The findings in this study conclusively document that students and faculty use library e-resources to a statistically significant extent and that a statistical relationship exists between student GPA and their use of e-resources. This information confirms the value of library resources to institutional teaching and research needs and can be used to document library value to the institutional mission.

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INTRODUCTION

During recent decades, academic libraries have responded to the transformation of information resources from primarily that of hard copy to a dynamic interface of access to electronic resources (e-resources). As a result, services and collections have evolved to meet the needs of virtual users, and collection budgets further reflect this evolution. ARL statistics document that e-resources accounted for 13% of total expenditures in ARL member libraries in 2000 and had increased to 51% by 2008. Similarly, in 2013 at the University of Montana Mansfield Library, e-resources represent 69.1% of the collection budget.

Academic libraries also grapple with efforts to collect and analyze usage data of e-resources in order to refine their collection policies and to share this information with their institutions. More importantly, libraries want and need assessment information that documents the library's contribution to its institutional outcomes. The focus of this study was to identify: 1) usage of library e-resources by faculty and staff affiliation and status to identify research and teaching needs; 2) usage of library e-resources by student major, status, gender, registered disability and registered veteran to establish best outreach practices and areas that need service improvement and collection development in support of student learning; and 3) the correlation between use of library e-resources and student attainment as defined by grade point average (GPA). In combination with circulation statistics, data analysis of library users who access these resources can assist library liaisons in their practices of outreach and collection development in direct relation to faculty, staff, and student usage patterns.

LITERATURE REVIEW

While data regarding use of library e-resources proliferates, analysis of this use and its relationship to library users is complex. Most assessment of electronic resource usage is still based on the input–output model but continues to adopt standards and tools that consistently measure e-resource use along with established intercept survey methodologies (ARL, 2013; Grogg & Fleming-May, 2010).

Most relevant to this study are those analyses that seek to link library usage, specifically e-resource usage, to academic outcomes. Matthews (2012) suggests that library usage data should be part of a coordinated program of data analysis that is combined with both indirect measures of learning (student persistence, graduate rates) and direct measures of student learning that are part of national standardized test results. Some excellent examples of this approach are currently underway. The Library Impact Data Project (Stone & Ramsden, 2013) successfully demonstrated a statistically significant relationship between library resource use and level of degree result. Theirs was a 6-month project that measured e-resource usage, library borrowing, and library gate entries against final degree awarded for 33,074 undergraduate students across eight U.K. universities. They caution that their results do not establish a causal relationship between library usage and student attainment.

Another innovative approach is the “Library Cube,” the result of collaboration among the library, university administration, Performance Indicator Project Team, and information technology services (Cox & Jantti, 2012). The Library Cube consists of a multidimensional data warehouse that links student borrowing and use of e-resources to student grades and a system that allows users to create cross tabulated data views. Among other findings, they found a very strong nonlinear correlation between average usage of library resources and average

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student grades. These authors report that this is now an integral part of their university's performance reporting structure and have identified potential target audiences for library engagement strategies.

Two recent studies document correlations between library usage and student success. Soria, Fransen, and Nackerud (2014) focused on first-year undergraduates and identified four library use areas that were consistently and positively associated with student GPA. These use areas included database logins, book loans, electronic journal logins, and library workstation logins. Davidson, Rollins, and Cherry (2013) used authentication login data combined with associated demographics to analyze student users. Data shows a correlation between people who have higher GPAs and those who use library databases. Grouping the students by department allows for a focused outreach to those departments who are using the library at lower rates.

Little information has been reported about linking library e-resource usage to the demographics of unique subsets of library users; e.g., gender, students with disabilities or student veterans. While Price and Fleming-May (2011) stress the need for libraries to demonstrate, quantitatively and qualitatively, the value of library resources and services and their return on investment in an academic environment, this is a complex narrative.

METHODOLOGY

The University of Montana is a graduate level research university. At the time of this study during fall semester 2012, 12,656 undergraduate and 2290 graduate students were enrolled and 840 faculty and 1560 staff served the campus. This population includes students registered with a disability as the largest minority and student veterans whose numbers place Montana second in the nation with number of veterans per capita. All library users who connect to the Library's e-resources from off-campus are required to authenticate as faculty, staff, or students of the University of Montana. This authentication data was collected between July 1 and December 31, 2012. To compare off-campus users with on-campus users who are not required to authenticate, 5 random days during each of the six months were set up to require on-campus authentication. Thus, 4 data sets were collected:

- all off-campus users of e-resources during the entire time period;
- on-campus users of e-resources for 30 random days;
- off-campus users of e-resources for 30 random days; and
- all random day users.

Demographic data was then collected for these users based on their university NetID. Authentication data was collected from the standard logs created by our proxy server, EzProxy. EzProxy logs the starting point uniform resource locator (url) access for each resource when a user clicks on a link from the library. Local users are logged without a username, just "local," along with the url to the resource they are accessing. When an off-campus user accesses a resource, their username is captured in the log as well. During our randomly selected days, we treated all users as remote, thus enforcing a log on and capturing a username for every resource accessed. The anonymized demographic data includes status of each user, department affiliation of faculty and staff, major area of study of students, gender, degree type, grade point average, ethnicity, disability, and veteran status.

All analyses were conducted using IBM SPSS Statistics 21 (Hines, 2013). Tested for normality using the Kolmogorov–Smirnov test in the four dependent variables based on frequency, the data was not normally distributed. The main dependent variable was determined to be the combined count of on-campus and off-campus access for users on randomly selected days. Thus, nonparametric statistical models that do not assume normality were used for analysis, and results presented are those of the all random day user group variable.

Two population tests, the binomial test and the chi-square goodness of fit test, were used to determine if the random data sample was

consistent with the sampled population and to test hypotheses about the population. The binomial test is a test of statistical significance of deviations from an expected distribution of observations when there are only two outcomes or categories. The chi-square goodness of fit tests whether the observed proportions for a categorical variable with more than two categories differ from expected proportions. For each test, a statistically significant result indicates that the null hypothesis, that observations in the sample are equal to the proportion in the population, is rejected. Outliers were identified as individuals who accessed more than 500 library resources—9 individuals across all four variables—and were excluded from the detailed analysis.

Statistical tests used in evaluations included nonparametric tests of the means and distributions of the samples based on different categories and a generalized linear model designed to predict the relative importance of different variables on the frequency of use. The Wilcoxon signed rank sum test is the nonparametric version of a paired samples t-test used to determine if the medians on two related observations differ from one another. The Friedman test is used to determine the distribution of observations in related samples. The Kruskal–Wallis test is the nonparametric version of ANOVA and is used when you have one independent variable with two or more levels and an ordinal dependent variable. The Wilcoxon–Mann–Whitney test or independent sample median test is used to determine if the median variables differ from one another among independent observations.

In all cases, evaluation tests were based on the data set of users in the all random selected variables since this data is a true sample of the population of users during the Fall 2012 semester. The dependent variable in all of these evaluations is the count or frequency at which a user accessed library e-resources. The Institutional Review Board exempted this project due to the anonymization of the data and its focus on improved library services and library collections.

ANALYSIS

To provide context, a total of 8105 unique NetID logins were documented during the data collection (Table 1). Authenticated usage by status of users identifies that the greatest use is by undergraduate students (71.1%), then graduate students (20.3%), faculty (06.3%), and staff (00.1%). The more interesting interpretation of this data, however, shows that 71.7% of all graduate students, 61.2% of all faculty, 45.5% of all undergraduate students, and 12.0% of all staff used e-resources during the timeframe of the study. Total electronic usage during the study represented 46.7% of all potential users.

FACULTY USERS

Using the hypothesis that faculty rank affects library use of e-resources, the chi-square test examined whether the observed population of tenure-track faculty matched the reported number of faculty in each rank during the fall semester of 2012. The results are statistically significant (Table 2) and do show that full, associate and assistant professors used electronic library resources at numbers higher than expected. Substantively, however, the test can only be interpreted to suggest that faculty with the rank of instructor are underutilizing the library given their numbers on campus.

Table 1

Total usage of e-resources by status for control group and total population where N = sample size; % = % of sample; Total N = total user group; and Total % = % of total user group.

Status	N	%	Total N	Total %
Faculty	514	06.3	840	61.2
Staff	187	00.1	1560	12.0
Undergraduate students	5761	71.1	12,656	45.5
Graduate students	1643	20.3	2290	71.7
Total	8105	100.0	17,347	46.7

Table 2
Faculty rank and library e-resource utilization.

Status	Observed N	Expected N	Residual	Chi-square	Asymp. Sig.
Instructor	15	39.3	–24.3		
Assistant Professor	74	68.3	5.7		
Associate Professor	89	83.0	6.0		
Full Professor	110	96.5	13.5		
Lecturer	5	5.9	–.9		
Total	293				
Tenure track only				17.947	.001

While faculty members with different ranks access e-resources disproportionately to their composition of total faculty, this difference is not reflected in their frequency of use. Their intensity of using library resources reflected in the number of times they used them was not statistically significant as identified by two independent samples tests (Table 3). Similarly, adjunct faculty and tenure-track faculty do not significantly differ in the number of times they access resources (Table 3).

Sixty unique departments were represented by faculty who used electronic library resources. Of these, 239 (46.5%) were from 10 departments, including English (34), Biological Sciences (32), College of Forestry & Conservation (31), Missoula College (28), Anthropology (24), Psychology (20), Modern & Classical Languages & Literatures (19), Mansfield Library (19), School of Law (16), and History (16). Faculty in the remaining departments who used the resources represented 13 or fewer individuals.

A final faculty analysis addressed whether significant differences exist between the number of times individual faculty, staff, and students used electronic library resources (Table 4). While there are differences in the mean number of times users in each category accessed resources, overall usage patterns are similar based on both a comparison of the median and distribution of access counts between faculty, staff, and students.

STUDENTS

Within the total group of unique users who accessed e-resources during the study period, the highest percentage of users were seniors (35.6%), followed by graduate students (22.2%), freshmen (16.3%), juniors (14.0%), and sophomores (11.9%) (Table 5). Descriptive data based on percentage of the total from each student status documented that 62.7% of all students used e-resources. Of these, the most frequent users were seniors (91.6%), followed by graduate students (71.7%), freshmen (49.6%), juniors (47.6%), and sophomores (43.0%).

To determine if the overall usage pattern of each student type (undergraduate, graduate, and professional) is significantly different, the median number of times databases were accessed and a comparison of the distribution of the access counts in each category of students were compared. In all cases, the null hypothesis was rejected; each type of student user accessed electronic library resources in a different pattern. Additionally, students at different stages in their education (first-year, sophomore, junior, senior, graduate, and professional) have

significantly different patterns of usage of electronic library resources. Again, in all cases, the null hypothesis was strongly rejected.

Gender of students as a variable identified that on-campus male and female students access library e-resources with the same intensity. Off-campus, female students increase their usage more than male students (Table 6). Using the mean number of accesses, a difference exists between these gender categories in off-campus use.

Using Spearman's Rho, the correlation between grade point average (GPA) and the intensity of student usage of electronic library resources was statistically significant (Table 7).

A generalized linear model, negative binomial regression analysis of frequency, used the combined data from the random access days to evaluate whether GPA predicted more or less frequent usage of electronic library resources. A comparison between three specifications—total GPA, term GPA, and both—suggests that total GPA is the better fit for the data. Using parameter estimates for total GPA, a statistically significant relationship is established between GPA and the number of times students use electronic library resources at each stage of their academic careers (Table 8).

Student users of e-resources identified by their major affiliations provide a more refined way for liaison librarians to identify success and gaps in their outreach. College or School affiliation is documented in Table 9 to document large groups of users. Individual liaisons can use this information to identify the total number of students within each department using e-resources and further refine their outreach initiatives.

Data from specific subsets of users including students with disabilities and student veterans provide important findings (Table 10). A binomial test examined if the proportion of students with a registered disability were using electronic library resources statistically different from the total population of students. Registered disabilities refer to students who have self-identified with the office of Disability Services for Students and have been documented with a disability of any kind. The test confirmed a statistically valid difference. Students with a disability are not using library resources at a level proportional to their composition of the student body.

The same binomial test examined if the proportion of student veterans was statistically different from the total population of students (Table 10). The test confirmed a statistically valid difference but not a substantive one.

DISCUSSION

The focus of this study was to identify: 1) usage of library e-resources by faculty and staff affiliation and status to identify research and teaching needs; 2) usage of library e-resources by student major, status, gender, registered disability and registered veteran to establish best outreach practices and areas that need service improvement and collection development in support of student learning; and 3) the correlation between use of library e-resources and student attainment as defined by grade point average (GPA). While this study includes unique elements—specific subsets of users and faculty and staff—the general findings regarding student use of library e-resources align with findings by Soria et al. (2014) and Davidson et al. (2013) that statistically correlate library use with higher GPA.

Table 3
Test summary of the intensity of use by faculty rank.

Null hypothesis	Test	Significance*	Decision
The medians of count are the same across faculty ranks	Independent samples median test	.299	Retain the null hypothesis
The distribution of count is the same across faculty ranks	Independent samples Kruskal–Wallis test	.351	Retain the null hypothesis
The medians of count are the same across adjunct faculty	Independent samples median test	.555	Retain the null hypothesis
The distribution of count is the same across adjunct faculty	Independent samples Kruskal–Wallis test	.865	Retain the null hypothesis

* The significance level is .05.

Table 4

Test summary of the differences in intensity of use by faculty, staff, and students.

Null hypothesis	Test	Significance*	Decision
The medians of count are the same across categories of faculty, staff, or student	Independent samples median test	.631	Retain the null hypothesis
The distribution of count is the same across categories of faculty, staff, or student	Independent samples Kruskal–Wallis test	.603	Retain the null hypothesis

* The significance level is .05.

FACULTY AND STAFF

Interestingly, full professors are using library e-resources at the highest rate among faculty. This suggests that tenured faculty who have attained their highest rank are active in their professions and continue to pursue activities that require information resources. With the exception of non-tenure track instructors and lecturers, tenure track faculty at all ranks are using library e-resources at statistically significant rates. This is an important finding that provides evidence of the value faculty place on accessing electronic library resources.

The demographic data further demonstrates faculty use by departmental affiliation. These findings are of particular value to liaison librarians who can use this information to both evaluate their outreach effectiveness and refine their future outreach to specific departments. Similarly, these findings can be used to address collection development in specific subject areas to determine areas of high and low use as they might relate to available resources.

It would be interesting to assess this usage data in combination with information regarding classes taught, publications, grants acquired, and promotions and merits to correlate the findings with traditional measures of academic success. Library usage data could also include interlibrary loan and circulation data to fully capture faculty use of library resources. This finding provides an interesting direction for additional analysis that could be used to address unique user outreach, collection development, and further documentation of the value of library resources to the Academy.

In contrast to students and faculty, staff are using resources at lower rates and have been targeted for outreach (Samson & Swanson, 2014). In terms of sheer numbers, classified staff and contract employees

outnumber faculty more than twofold. This is an important user group in any academic institution. Staff are often the first point-of-contact for students at the university and within an academic department. They welcome, advise, and mentor students. They support faculty across the disciplines as research assistants, laboratory monitors, and departmental aides. Not infrequently, faculty send staff to the library to acquire books and to use e-resources in support of their teaching and research. As with faculty, data that identifies departmental use can be used to evaluate successful outreach and refine future outreach.

STUDENTS

The findings in this study indicate that students are using library resources at a higher than expected rate. Based on demographic means, the most frequent student users were seniors (91.6%), followed by graduate students (71.7%), first-year (49.6%), juniors (47.6%), and sophomores (43.0%). While both seniors and graduate students might be expected to use e-resources more frequently, first-year access surpasses both juniors and sophomores. At the University of Montana Mansfield Library, information literacy outreach to first-year students is embedded into the curricula of required, research-intensive classes. First-year outreach accounts for nearly 50% of the instruction, and these findings document the success of this outreach.

While each category of students (undergraduate, graduate and professional) uses e-resources in a different pattern, the amount of education a student attains significantly changes how they utilize library e-resources. The null hypothesis was strongly rejected in this analysis and documents that as students progress in their academic careers their intensity of use, the number of times an individual accesses the resources, increases. The Mansfield Library rubric builds on a continuous learning cycle across the academic career of a student. It is designed to address the information literacy needs of students at each level. By

Table 5

Student usage of e-resources by student status for control group and total population where N = sample size; % = % of sample; Total N = total user group; and Total % = % of total user group.

Student status	N	%	Total N	Total %
Freshman	1206	16.3%	2419	49.6%
Sophomore	880	11.9%	2045	43.0%
Junior	1036	14.0%	2175	47.6%
Senior	2639	35.6%	2881	91.6%
Graduate	1643	22.2%	2290	71.7%
Totals	7404	100.0%	11,800	62.7%

Table 6

Count of the intensity of use by gender of students including all off-campus logins, random off-campus logins, all random logins, and random on-campus logins.

Gender		Count of all off-campus	Count of random off-campus	Count of all random	Count of random on-campus
F	Mean	22.06	7.92	8.61	6.12
	N	3715	1842	2479	1104
	Std. Deviation	59.369	36.533	32.603	11.430
M	Mean	19.17	6.98	7.83	5.96
	N	2463	1238	1769	874
	Std. Deviation	53.609	15.522	14.622	7.381
Total	Mean	20.91	7.54	8.28	6.05
	N	6178	3080	4248	1978
	Std. Deviation	57.156	29.917	26.634	9.847

Table 7

Correlation of GPA and the number of times students accessed electronic library resources.

			Count of all random	GPA
Spearman's rho	Count of all random	Correlation coefficient	1.000	.155
		Sig. (2-tailed)		.000
	GPA	N	4836	4218
		Correlation coefficient	.155	1.000
		Sig. (2-tailed)	.000	
		N	4218	6871

Table 8

Parameter estimates for total GPA (N = 3548).

Parameter	B	Std. Error	95% Wald confidence interval		Hypothesis test		
			Lower	Upper	Wald chi-square	df	Sig.
GPA	.132	.0295	.075	.190	20.203	1	.000
First-year	.352	.2011	-.042	.746	3.058	1	.080
Sophomore	.499	.2029	.101	.897	6.049	1	.014
Junior	.664	.2019	.268	1.059	10.806	1	.001
Senior	.781	.1976	.394	1.168	15.618	1	.000
Graduate (not Law)	1.186	.1993	.795	1.576	35.383	1	.000

Table 9

Student use of library e-resources based on major School or College affiliation where N = sample size; % = % of sample; Total N = total user group; and Total % = % of total user group.

Student college affiliation	N	%	Total N	Total %
College of Arts and Sciences	3149	40.4%	5784	54.4%
College of Education & Human Sciences	848	10.9%	1832	46.3%
Missoula College	807	10.4%	2237	36.1%
College of Health Prof & Biomedical Sciences	687	08.8%	1532	44.8%
Undeclared	650	08.3%	1495	43.5%
School of Business Administration	633	08.1%	1633	38.8%
College of Forestry & Conservation	580	07.4%	957	60.6%
College of Visual & Performing Arts	315	04.0%	1001	31.4%
School of Journalism	128	01.6%	376	34.0%
Totals	7797	100.0%	16,811	46.4%

combining the departmental demographics of electronic library users with the rubric, liaison librarians can construct an informed curriculum to meet the needs of these students as they proceed beyond their first-year instruction into their upper-division majors and into graduate programs.

Results of student use of library e-resources corroborate those of similar studies that correlated student GPA with use of electronic library resources. Using the total GPA variable, results suggest that the relationship between GPA and frequency of access of library e-resources are statistically significant. These findings support both the quality of the collections and the effectiveness of the library instruction program to meet the student research needs. Liaison librarians work with faculty to coordinate the acquisition of e-resources relevant to their subject areas and to integrate instruction into the curriculum. While causal connections are not the purview of this study, it does document that students who make the most use of the e-resources have a statistically significant higher GPA.

The demographic data further demonstrates student use by major. These findings are of particular value to liaison librarians who can use this information to both evaluate their outreach effectiveness and refine their future outreach to specific departments. Similarly, these findings can be used to address collection development in specific subject areas to determine areas of high and low use as they might relate to available resources. Liaison librarians were provided a detailed use by department as part of the study findings.

Considering subsets of student users, it is interesting to note that females are more likely to use library e-resources from off-campus. One can only surmise the reasons for this difference since additional personal data—employment, family obligations, location of residence, and age—were not gathered. This finding provides an interesting direction for additional analysis that could be used to address unique user outreach.

The finding that students who register with a disability are not using library resources at a level proportional to their composition of the student body becomes critical when considered along with the finding that students who use library e-resources have higher GPAs. Furthermore, at the University of Montana, students with a registered disability account

Table 10

Binomial test results for use of electronic library resources by students with disabilities and student veterans.

Population subset	Category		Observed Prop.		Exact Sig. (1-tailed)
			N	Test Prop.	
Registered disability	Group 1	Not disabled	4204	.995	.895
	Group 2	Disabled	20	.005	
	Total		4224	1.000	
Veteran	Group 1	Not a veteran	4051	.959044	.952164
	Group 2	Veteran	173	.040956	
	Total		4224	1.000000	

for the largest minority group on campus at 8.1% of the student body (Samson, 2011).

Accessibility of e-resources is an important component of an equitable academic library. Standards exist and are legally required by the federal government to meet the needs of students with disabilities; e.g. the Department of Justice ADA Standards for Accessible Design required as of March 15, 2012. The Digest of Education Statistics 2012 includes data for 2008 identifying undergraduate students with disabilities at 10.9% nationally (United States Dept. of Education & Institute of Education Sciences, 2013).

The proportion of student veterans was also statistically different from the total population of students. However, while the test confirmed a statistically valid difference, this difference was not substantive. It is important to note that the number of student veterans now taking advantage of the post-9/11 educational benefits will continue to increase their enrollment at academic institutions over the next decade (Pulley, 2013). Library services to student veterans need to address their unique experiences as they transition from military life to campus.

CONCLUSIONS

The findings in this study conclusively document that students and faculty use library e-resources to a statistically significant extent. This information confirms the value of library resources to institutional teaching and research needs and can be used as part of the library's story. In addition, the findings align with those studies that have sought to correlate library usage and student success.

Ample opportunities exist to use this data to support liaison librarian outreach. This data can serve as a base of information for strategic, data-driven outreach. The use of anonymized demographics can be used by faculty librarians to underscore their outreach as part of their individual performance records.

In addition to the findings that resulted from this study, additional research would augment these findings. During the same timeframe, comparisons could be made to circulation and interlibrary loan transactions to identify whether differences exist with the demographics of these populations from those of electronic library users. Using the same methodology, it would be valuable to repeat this same study to identify trends, especially if changes are made in e-resource access or collections. Focusing exclusively on students with a registered disability, what changes in services could and should be implemented to make a difference in their use of e-resources?

While causal absolutes are beyond the scope of this study, students and faculty are using library e-resources beyond their statistical expectation. This documentation supports the growth of this portion of the collection and underscores the value of library resources to the institutional mission.

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