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# Examining the Relationship Between Library Services Use and Fall-to-Fall Retention in Community College Libraries

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## Citation

Examining the Relationship Between Library Services Use and Fall-to-Fall Retention in
Community College Libraries


A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education in Adult and Lifelong Learning


by


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December 2021
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**Abstract**

Community college libraries exist to support institutional outcomes. One such outcome is student retention. This study's purpose was to fill the gap in the literature at the community college level, proposing that a model including all library service use types would explain variance in student retention beyond that explained by total library financial expenditure. Services included were numbers of physical materials circulated, digital books circulated, e-serials used, reference transactions, library presentations, attendees at presentations, gate counts, and interlibrary loan materials borrowed. Additionally, it was proposed that the relationship between gate counts of physical entry into the library and student retention would be moderated by ratios of nontraditional students attending colleges and Pell Grants awarded.

The study uses 2018-2019 fiscal year data obtained from the ACRL Annual survey and IPEDS. A multiple regression analysis found no relationships between the service use model and retention. No relationships were found between any independent variable in the study and student retention, nor was any moderation detected.

It was proposed that a feedback loop may exist at community colleges that divorces library activity from institution level student retention outcomes. Such a feedback loop has been untested in the literature, and further research is suggested.

**Table of Contents**

CHAPTER 1

**Overview**

In this chapter, I discuss the relationships between academic libraries' financial expenditure and student retention and discuss how library service use numbers have been used historically to evaluate libraries' relationships with student retention. In general, library services are those services provided by the library, and library service use refers to the number of uses of a service, annually, by customers, in this case primarily student use. In the course of this discussion, I propose how an alternative method of evaluating library activity in relation to student retention could first control for library expenditure. Library expenditure refers to the amount of money spent to provide all library services annually. Total annual library finance expenditure does not provide specific insights into how effective changes can be made to individual services to increase student retention. This is logically self-evident because total library expenditure does not separate out each individual library service type, such as database use, physical materials checkout, or use of the physical library space reflected by gate counts. Instead, total library expenditure is a total expression of all money paid, in a lump sum, to fund all services.

Additionally problematic, is that the service may cost the same, year-to-year, but if the products purchased or application of those products become obsolete or inadequate, then a decrease in the relationship between financial expenditure and retention may be registered, when in fact, a relationship between service use and retention continues. This hypothetical situation would represent a realistic and truthful negative downturn in the usefulness of specific library service provision, negatively impacting student retention. That understanding is much different

than assuming a divorce of the library/student retention relationship, which could be expressed in a financial expenditure-to-retention analysis of the same instance.

In cases where unused services become more expensive, their expression in total financial expenditure could mask their implications to the library's relationship with retention. Additionally, a library may be able to increase usage of an obsolete product by spending more money marketing it to students, faculty, and staff. This could increase the total library expenditure while pushing a product that does not benefit student retention. Controlling for total library expenditure before evaluating service use relationships with retention appears logically self-evident, but needs to be tested, which the current study proposes to do.

Financial analysis alone is not as effective in program evaluation if the purpose is to better individual service outcomes. Controlling for library expenditure prior to looking for relationships between library services and student retention should offset the impact of large changes in funding on service outcomes connected to student retention.

In other words, and by example, database costs increase between 3% and 5% annually. This activity increases either the total library expenditure annually, or the percentage of total library expenditure represented by database costs if the library cancels a non-database product to stabilize the budget and continue existing database subscriptions year-to-year. If databases that had price increases had no additional benefit on retention, then that would negatively impact the relationship between total library expenditure and retention, but library administration would not know, because they have not compared the difference between the controlled total library expenditure variable's relationship with retention and the retention relationship of the service use variable in question, that of database use. If, however, the databases that increased cost also increased in retention benefit in direct relation to their cost increase, through vendor

enhancement such as web platform redesign that proved more useful to students, then cost increase could mirror that of service usage increases and register accurately as a financial expenditure-to-retention benefit. You got a benefit increase that you paid for.

Alternatively, a service may cost less but be a larger contributor to the library-to-student retention relationship. If a library needs to cut a small amount of money to meet the budget, they could choose to cut this inexpensive service, incorrectly assuming minimal damage to retention based on the small amount of money being addressed.

External factors often force total financial expenditure changes in ways that cannot be controlled by library directors, and often in ways that do not take service outcomes into account. If the goal is to discover which library services are more likely to engage a student retention relationship and then use that knowledge to enhance such relationships, changes in total annual library expenditure may muddy the waters as we evaluate such relationships.

After introducing this argument, I present a gap in the literature related to library relationships to student retention studies at community colleges. I propose that existing studies of larger university libraries with higher levels of degree-granting and research focus to their missions may not generalize effectively to community colleges.

I then theoretically define concepts related to library services, as well as higher education concepts essential to this study, and describe the question guiding this study. I conclude this chapter with a discussion of the proposed study's scope and limitations.

## Background of Study

Library theorists such as Pritchard (1996) and Oakleaf (2011) have held that library financial expenditures and services should be tailored to and evaluated against their parent university's or parent college's mission and goals. Student retention is included in the goals of

most, if not all, institutions of higher education. Many librarians have thus studied the relationships between student retention and library financial and service activity (Crawford, 2014; Eng & Stadler, 2015; LeMaistre et al., 2018; Mezick, 2007; Murray et al., 2016; Soria, et al., 2013; Teske et al., 2013). Each of these studies have presented different library service variables, and/or financial and student retention variables. Many of these studies have also employed enrollment numbers as a means of normalizing variable expressions between institutions of differing size.

Full-time equivalency (FTE) is often used to standardize institution enrollment population sizes in studies that rely on institution-level analysis. It is a measure of student numbers that translates part-time and full-time student numbers into a more standardized hours-based expression and is often used in retention studies to allow for more meaningful analysis (Crawford, 2014; Eng et al., 2015; LeMaistre et al., 2018; Mezick, 2007; Murray et al., 2016; Soria et al., 2013; Teske et. al, 2013). A single FTE count is 30 credit hours per year for undergraduate studies (Association of College & Research Libraries, 2019). If headcounts were used instead of FTE, a part-time student earning 10 hours of credit for the year would count the same as a full-time student earning 30 credit hours in a year. Reliance on FTE corrects such headcount issues.

Total library expenditure is the total amount of money spent to run a library. It includes all spending on personnel, resources, and materials. Total library expenditure has been used as an independent variable in multiple library studies of student retention (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013).

Student retention is often expressed in different ways, depending on the length of time expressed in a study. In other words, the student retention range used would need to match the

duration time-period of the study, otherwise it would no longer be logically relevant to the study in question. If your student retention expression was for two years, but the time-period of data collection for your independent variables was only for one year, then you would be short a full year of variables expression needed to address two-year retention. A study analyzing a single semester may use fall-to-spring numbers, measuring students who were enrolled at the beginning of fall and were retained to the following spring semester. Some studies of the annual cycle of retention may use studies of fall-to-fall retention, which is a measure of students who were enrolled in one fall semester who are still enrolled in the fall semester in the following fall semester (Association of College & Research Libraries, 2019). Also included in calculations of fall-to-fall retention are students who have graduated prior to the following fall.

Mezick conducted some of the first work addressing relationships between library financial expenditure and student retention, with later researchers such as Crawford (2014), Eng et al. (2015), and Teske et al. (2013) supporting many of her findings. Mezick (2007) found a positive relationship between total library expenditure per FTE and fall-to-fall retention for baccalaureate colleges. Mezick (2007) also found a moderate relationship between total library expenditure per FTE and fall-to-fall retention for doctorate-granting institutions, and a weak relationship at master's degree-granting institutions. All degree-granting institutions combined showed a moderate relationship between total library expenditure and fall-to-fall retention.

A study conducted by Crawford (2014) indicates a highly significant relationship between library expense per FTE and retention, second only to instruction expense per FTE. Crawford further states that instruction expense explains 50% of variance for retention, while library expense explained 37% of variance for retention rate. Crawford's (2014) study population

combined bachelor's degree, master's degree, and doctorate degree granting institutions into a single group for his study, but excluded associate degree granting institutions.

Eng and Stadler (2015) conducted studies on two consecutive years of data for their sample, 2010 and 2011. They confirmed a moderate relationship between total library expenditure and student retention for bachelor's degree granting institutions for 2010 and 2011. They found a weak relationship of those same variables for doctoral degree granting institutions' 2010 and moderate for 2011 data. They also found that the relationship between total library expenditure and retention could not be made for master's degree granting institutions in either year, speculating that this was due to a shift from on-the-ground instruction to online instruction, limiting the effect of physical library space and resources.

In other words, prior to online instruction models, where schools provided classes for credit only in physical classes, the library was designed and engaged as a physical place, visited between or after classes for studying and researching. When colleges began teaching online, with online learning systems, many of the students were no longer coming to campus. They still had research and study needs, but these needs were no longer in physical proximity to the physical library and its collections. The study and research needs still existed proximate to the functions of the library, but often not proximate to the physical and traditional incarnations of those services. Libraries were in the process of changing their services to serve the research and study needs of online learners, while maintaining physical study space and physical resources for non-online learners. Eng et al. suggests that the service balance to meet the new learning paradigm was logically not immediate, and possibly resulted in the negative impact on retention between total library expenditure and retention.

Associate degree granting institutions were also addressed by Eng and Stadler (2015), and no relationships between total library expenditure and student retention was found. However, a similar disconnect could have resulted from a delay in shifts to online learning strategies, negatively impacting associate degree institutions as well as the proposed master's degree issues. It is possible that the lack of statistical relationship in that study was a commentary on service shifts related to online learning, and not a more overarching commentary suggesting no relationship between library activity and student retention. Hypothetically, there may be a relationship at the associate degree level, but it could not be identified in Eng and Stadler (2015) because it could have been overshadowed by the negative impact on that relationship produced as libraries worked to reorganize services to meet online learning needs.

Teske et al. (2013) confirmed Mezick's (2007) findings. Relationships between total library expenditure and student retention were moderate for doctorate and bachelor's degree granting institutions, weak for master's degree granting institutions, and moderate for all groups combined. Teske et al. (2013) also excluded associates degree granting institutions.

Other studies of relationships between student retention and library activity addressed library service use numbers instead of financial expenditure (Crawford, 2014; LeMaistre et al., 2018; Murray et al., 2016; Soria et al., 2013, Teske et al., 2013). Different studies included and presented library services differently, depending on what data collection measures were available to address the unit of analysis and scope of the population being studied. For example, studies that address the entire industry or a significant number of universities must rely on an institution level of analysis because student-specific library information is not reported as part of standardized data collection for the education industry.

Studies at the student level of analysis must often use unique data collection techniques that cannot be reproduced in studies external to the specific technological infrastructure of the library or libraries engaged by the study. For example, if a library or group of libraries being studied route all database access through a proxy server that requires individual student logins for each research session, then such studies can take advantage of that data collected and centrally housed in the proxy server's access records. If, however, another study includes libraries that do not conduct business in this manner, other means of data collection must be implemented. Such methods could include tools such as adding coding to links that collect needed information at the point of access, or reliance on cookies to collect such data. Naturally, resulting data from different methods of collection will mean different things in different studies, even when variables of the study are named similarly. Some variables may be included in a library service matrix in one study because collection methods were available, but excluded from another study's library services because no appropriate method of data collection existed within the infrastructures of libraries being studied. It is then important to understand that student level studies are not, nor can they be, standardized between studies.

In addition to library expenditure, Teske, et al. (2013) also studied library resources and library use variables. For all institution types combined, they found moderate relationships between the first-year student retention and the variables of volumes added to the collection, total collection size, circulation per FTE, reference transactions, number of presentations, and attendees at presentations. When reference transactions and attendees at presentations were standardized by dividing them by FTE, relationships with retention decreased to small relationships.

The Teske et al. (2013) study also separated results out by grouping institution types similar to Mezick's doctorate, master's, and bachelor's degree-granting institutions. In Teske et al. (2013) these groupings were doctorate degree-granting, master's degree-granting in 5 or more classification of institution program (CIP), and a third group that combined institutions granting 30+ master's degrees having no CIP designation with 100+ bachelor's degree granting institutions. This was done due to sample size issues. Associate degree granting institutions were once again left out of the study.

Haddow and Joseph (2010), in a study of Curtin University, found that single semester retention was significantly related to material loans, computer logins, and other resource logins. Soria et al. (2013; 2014) conducted library usage studies at the University of Michigan on 2011 data, revealing significant association with first semester to second semester retention ($\chi2(1)$ = 6.86, $p$ < .01). Murray et al. (2016) conducted a study at a regional public university in the Midwest, finding library use predicts spring-to-fall semester retention ($\chi2$ = 575.72, p < .001, Nagelkerke $R^2$ = .31). LeMaistre et al. (2018) found a relationship between online library resource use and one-term retention, when controlling for high school GPA, gender, first-generation college student status, and Pell Grant recipient status, at Nevada State College in Henderson, Wald $F(1)$ = 16.64, $p$ < 0.001.

The existence of a large number of studies of relationships between libraries and student retention found in the literature expresses an understanding by libraries of the importance to link library activity with their parent university's goals regarding positive student outcomes. The results of these studies support an understanding that there exists a broad relationship of both library financial expenditure and library services with student retention. The studies within the literature promote the logic that relationship findings change based on parent institution types,

designated through differing expressions of level of degree granting and research institution classification (Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013). Further research should identify and attempt to fill gaps in the literature related to underrepresented institution types to further a specific understanding of these relationships.

## Need and Purpose

The purpose of this study is to discover whether the services provided by community college libraries have a relationship with student retention after considering the impact of total library financial expenditure on that relationship. Prior research has shown relationships exist between library services and student retention (Crawford, 2014; LeMaistre et al., 2018; Murray, et al., 2016; Soria et al., 2013; Teske et al., 2013). Prior research has also shown relationships between library financial expenditure and student retention (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013). The literature does not contain information that considers the possible impact of financial expenditure on library service relationships with student retention.

A second purpose of this study is to discover if Pell Grant awarded or nontraditional student status moderate the relationship between use of the physical library and student retention. Pell Grant recipient status has been used as a control in studies of library services relationship to student retention by Soria et al. (2014) and LeMaistre et al. (2018). Controlling for this variable assumes a potential moderating effect, but that effect has not been tested at the community college level. LeMaistre et al. (2018) also found that Pell Grant recipients and nontraditional students are more likely to use the library, and that library users were more likely to be retained. The question of whether variables of Pell Grant recipient status and nontraditional student status

have a moderating effect on the relationship between library use and student retention has not been conducted at the community college level.

A third purpose of this study is to fill a gap in the literature regarding associate level degree-granting institutions, pertaining to the relationships of their financial expenditure and library service use on student retention. There exist only limited numbers of studies that evaluate library activity relationships to student retention at the associate degree level (Eng & Stadler, 2015). Most studies exclude associate degree granting institutions from studies of library activity relationships with student retention (Crawford, 2014; Mezick, 2007; Teske et al., 2013). Studies of higher education institutions support an understanding that such relationships differ in strength or existence based on the level of the degree granted by institutions being studied (Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013). Associate degree granting institutions find themselves in a situation of making library service and funding decisions based on the best possible academic literature available to them. That same literature does not sufficiently include their specific institution type and may not generalize to their situation as a result.

Accountability and performance funding requirements often reference student retention as a measure of institutional performance in student success (Crawford, 2014; Mezick, 2007; Murray et al., 2016; Oakleaf, 2011; Soria et al., 2014; Teske et al., 2013). Use of library total financial expenditure in relationship studies with student retention may provide an assessment of whether funding expenditures are effective overall, but they do not give information useful to deciding how library services should be modified in future years to enhance alleged relationships. If the decision proposed is whether libraries should be funded at all, with only two relevant answers, yes or no, then an analysis of total library expenditure would be useful.

Is it more useful to ask how we tailor library activities to enhance accountability and gain access to performance funding linked to student retention? That question cannot be addressed without a more meaningful analysis of the true nature of the relationship between library activity and student retention.

Students needs change in the manner and method of information service and delivery they find useful. Increases and decreases of frequency of use for specific library services and/or materials reflect such client need changes. In modern libraries, service methods, resource format, and technology needs will not be stationary indefinitely. Library services are in a constant state of flux.

An example of such flux on total expenditure to retention relationships is found in Eng and Stadler's (2015) understanding that there was no longer a relationship between library expenditure and student retention in master's degree granting institutions. Eng and Stadler (2015) pointed to university education shifts from face-to-face instruction to online instruction as a possible reason for these weakening relationships. The new online instruction model allegedly invalidated the library physical study space and physical books collections for meeting online student library needs. Such impacts of students' changing needs on relationships between total financial expenditure and retention are speculative, because Eng and Stadler (2015) did not include library usage information needed to test the assumption. No analysis of the relationship between physical study space use and retention rates was conducted. They also did not include an analysis of the relationship between physical book collection use and retention rates.

Eng and Stadler's (2015) study is an example of how studies of total library financial expenditure cannot answer questions more specific to identifying what changes are effective in modernizing library services to provide for current student needs. They speculate that the advent

of online learning created the divorce in the relationship between library expenditure and retention, but that speculation is based on a logical leap that is not addressed in their study. They are missing information about the relationship between retention and the services being provided through the monetary expenditures in their study. Such service relationship information could have further grounded their speculations about the reason for the finance/retention relationship divorce they identified.

Libraries may have since addressed the speculative disconnects in library services related to online class instruction through enhanced web-based services. During and just after the Eng and Stadler (2015) study, libraries were adding web-based library services to their existing library instruction and reference services (Bezet, Duncan, & Litvin, 2018; Meert-Williston & Sandieson, 2019; Ruppel & Vecchione, 2012; Smith & O'Hagan, 2014; Stieve & Wallace, 2018). Libraries also began providing eBook collections in addition to their physical collections (Acedo & Leverkus, 2014; Tucker, 2012). Such changes in library services may have positively impacted total library expenditure relationship to student retention, but it is impossible to tell because Eng and Stadler (2015) do not address library services being funded, only total library expenditure. Future studies would only be able to express whether total library expenditure relationship to retention had strengthened. They would not be able to designate what service changes are more related to the enhancement of the relationship between library activity and student retention.

Institution budgets are shrinking, and proof of a positive impact on students is often required for institution financial allocations (Oakleaf, 2011). Libraries are not normally seen as mission critical by the institutions they serve (Oakleaf, 2011). It is increasingly important to link library activity concretely to institution missions, while practicing fiscal responsibility. Library

administrators need to know the effect of services on student retention, not just effect of total funding for library services. Those same decision makers also need to have a way of discovering whether results of innovative new services warrant their costs. The ability to separate out impacts of services from impacts of financial expenditure is important to discovery and decision-making processes inherent to library management. New technologies are expensive, but also necessary to effectively engage evolving service community need. Directors will, in many cases, not be provided additional funds to support such modernization efforts, so they will likely need to discontinue some services to fund newer, more innovative services.

Community colleges are usually smaller than four-year institutions. For smaller libraries, the risk of introducing innovative new service models is high. Money and staff must be taken from other library service activities to support the new endeavor. These same libraries may not have the staff expertise or time to effectively analyze impact of the new service. They are thus more reliant than their larger counterparts on literature published in the library field to inform their decision making. Small institutions can review such literature findings, mitigating the risk of implementing changes. Community college specific studies are needed because studies applied to four-year, graduate level, or research facilities may not generalize to the two-year education environment.

Demographics is one of the major differences between university and community college students. In primary and secondary education systems where more impoverished communities do not have similar resources to produce student success, a higher proportion of impacted students do not meet university acceptance standards. Universities are thus accepting higher performing students, while community colleges accept all students who wish to be taught. Impact of poverty

is greater in the community college environment than it is in the university setting (Cohen et al., 2013).

Community colleges also provide training outside of the traditional liberal arts. Their missions include providing technical training in preparation for employment, continuing education, and local access to higher education in rural or other areas where universities do not operate (Cohen et al., 2013). The community college education opportunities may be advantageous to nontraditional students with other life responsibilities, including child-rearing, employment, and other familial responsibilities. Local family and community support systems may exist that would be missed if the student moved away to go to a university.

There is an assumption in many research studies that socio-economic status and nontraditional student status may interact with the relationships between library activity and retention. Pell Grant recipient status is used as a control variable in both Soria et al. (2014) and LeMaistre et al. (2018). LeMaistre et al. (2018) found that Pell Grant recipients and nontraditional students 25 years old or older were more likely to use the library. LeMaistre et al. (2018) also found that library users, in general, were more likely to be retained as students the following semester. The question remains as to whether socio-economic status and nontraditional/adult learner status moderates the relationships between library activities or funding and student retention.

Modern libraries require innovation to remain relevant to their clients. The often-competing variables of limited finances and the necessity for successful innovation in library services produce distinct challenges for community college libraries in meeting their responsibilities to the colleges they serve. Community college libraries' students are often different from students in a university setting, with different barriers to their education, and with

different needs and backgrounds. Limited library literature that addresses the community college institution type complicate the role of the library and parent community college institution in effectively providing for the educational needs of their students. The current study is needed to provide such needed research.

## Definitions

The following terms will frequently occur in this study.

*Student full-time equivalency:* The fall 2018 FTE for students attending classes at the college the library serves, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). This is calculated by adding up the total number of for-credit hours taken by all students at an institution and dividing by 30 hours, which is the number of hours student must take in order to be considered full time.

*Total library expenditure:* The total annual expenditure for the library department, as reported on the ACRL Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). This number includes all money spent on personnel, materials, resources, and service contracts necessary for running the library for the fiscal year.

*Fall-to-fall retention rates:* The fall-to-fall retention of students at the educational institution as reported on Integrated Postsecondary Education Data System report for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). This is the number of students who attended in one fall semester who return in the following fall semester. Students who were enrolled in the previous fall semester and graduated prior to the following semester are also counted in the retention rates (National Center for Education Statistics, 2019b).

*Student use of library resources:* The combined effect of all library use variables included in this model.

*Physical material circulation:* The annual count of checked out physical materials owned by the library, including books and periodicals, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019).

*eBook circulation:* The annual count of eBook downloads, within the collection of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). At the conclusion of each fiscal year, the library pulls the number of full-text accesses from all eBook vendor platforms and adds them together to get a total, which is then reported.

*Full-text access to electronic journals:* The annual count of full-text accesses for electronic journal articles within the collection or within the subscriptions of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). At the conclusion of each fiscal year, the library pulls the number of full-text accesses from all electronic journal article vendor platforms and adds them together to get a total, which is then reported.

*Number of reference transactions:* Annual count of research/reference questions answered at all library service points, physical and electronic, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). A count of each reference interaction is made at the time of transaction and added together at the end of the fiscal year.

*Number of research consultations:* The annual count of referred research consultations, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). Each instance of scheduled research consultation is counted at the time of transaction and added together at the end of the fiscal year.

*Number of presentations:* The annual count of library presentations given by the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019. (Association of College & Research Libraries, 2019). Each presentation is counted at the time it is made and added up at the end of the fiscal year.

*Number of attendees at presentations:* The annual count of the number of attendees at presentations given by the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019. (Association of College & Research Libraries, 2019). Attendees at each presentation are counted by hand and added up at the end of the fiscal year.

*Number of gate counts for library entrance:* The annual count of library usage, as measured by either head count or entrance gate count, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019).

*Number of interlibrary loan returnable and nonreturnable borrowing:* The annual count of interlibrary loan returnable and nonreturnable borrowing from other libraries by patrons of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019).

*Carnegie Classification:* A classification system designed to address institutional diversity, including type and size, in U.S. higher education. The Classification is regulated and maintained by the Carnegie Commission on Higher Education (Indiana University Center for Postsecondary Research, 2018). The Carnegie classification is regularly used to provide a standardized expression of the type of institution by degree granting level and research type so that institution level of analysis studies can confine their studies to institutions of a similar type.

**Statement of the Research Problem**

In this study, I propose to use multiple regression analysis to identify relationships between library services usage and student retention after controlling for total library expenditure. I will also consider whether nontraditional student status or receipt of Pell Grant funding moderate the relationship between physical library space use, as described in gate counts, and retention.

Community college library services must operate within fixed budgets. Services are often evaluated using one of two measures, service output or total library expenditure, as they relate to an expected outcome, in most cases student retention. Service outputs are counts of library service use instances. Total library expenditure is the total amount of money, an input, which makes possible the library services responsible for those use outputs.

In evaluations of total library expenditure's relationship with retention, it is not possible to identify which specific services being funded are contributing to the relationship between total library expenditure and retention. Alternatively, analysis of only the relationship between library services and retention ignores the positive or negative impact that enhanced or diminished funding, expressed through total library expenditure, could be having on the library service use relationships with retention.

Librarians, then, do not have a clear picture of service output relationships to student retention, to plan for future library services within their existing budgets. Additionally, retention theories from higher education literature cannot be effectively engaged by libraries if the activities they are proposed to address are not first isolated from funding impacts on the relationships of the variables being studied. As such, a research question for this study is: at community colleges in the United States, does library service usage allow for greater prediction

of student retention than library expenditure? The library usage model includes output data from several library service types.

1) The number of physical material circulation.

2) The number of eBook circulation.

3) The number of full-text article access.

4) The number of reference transactions.

5) The number of research consultations.

6) The number of library presentations.

7) The number of attendees at library presentations.

8) The number of gate counts of students entering the physical library.

9) The number of interlibrary loans.

Second and third research questions are: does nontraditional student ratios or Pell Grant receipt averages moderate a relationship between physical library use, in the form of gate counts, and student retention?

## Scope and Limitations

This study will be confined to associate colleges, with associate degree as the highest degree level awarded, in the United States. Higher education institution types granting degrees greater than associate degree level, or providing a certificate or technical training but no associate degree level awards will be excluded from this study. Inclusion of additional institution types is not possible, due to compatibility issues between Carnegie Classification groups and resulting significant differences in service provision variables inherent to such institutions.

The results will be generalizable only to associate degree granting institutions within the United States. The study will be based on 2018-2019 fiscal year data, confining results specificity to that temporal context.

Accuracy of results will depend on the application of defined rules of reporting on the ACRL, Trends and Statistics Survey by reporting individuals at affected institutions. Likewise, the results will depend on the application of defined rules of reporting on the Integrated Postsecondary Education Data System by reporting individuals at affected institutions.

**Summary**

This chapter has introduced the background of research on relationships between total library expenditure and student retention. It has also introduced the background of research on effect and impact studies measuring library services usage relationships to student retention. I have introduced the financial implications of retention as an institutional success measure in legislatively mandated performance-based funding of higher education institutions.

I have informed on the importance of library service changes in response to the technological environment and service community expectations, and the mechanisms of balancing that need with a constricting financial reality. The need for a large, community college targeted study of the usage of library services while controlling for total library expenditure has been articulated. Research questions designed to address that need have been presented. The scope and limitations of this study have also been addressed.

Chapter 2

## Literature Review

This chapter will address the conceptual and historical foundations for the study of library usage as it relates to student retention. This discussion will include variable and concept definitions, as expressed in library reports used in prior research on the topic. The foundational history and logic of those library usage reports will also be addressed. Prior research will be presented. Theoretical foundations and impacts related to both library usage and retention will be introduced. The logical and conceptual linkage between library usage and retention will be presented, leading to an expression of the research questions and hypotheses that have emerged.

Studies of the link between libraries and retention have involved two types. Some study the relationship between specific library service usage by students and student retention. The second type of study looks at the relationship between library expenditure and student retention. Most studies have found relationships between library activity and student retention.

## Conceptual Frame

### The Role of Community Colleges

Community colleges, as institutions, are unique to the United States, with some exceptions in Canada. They do not exist in other developed countries. Developing external to the K-12 elementary and secondary systems, as well as external to traditional higher education, which housed baccalaureate, master's degree, and doctorate programs, these organizations grew primarily out of the U.S. culture that values individuality. They decreased barriers to progress regardless of age, background, or social status (Cohen et al., 2013).

The goals and missions of community colleges encompass an eclectic collection of social, community, and individual needs unique to the U.S. culture within which they exist.

These needs include adding education past the compulsory age, technical training, bridging the gap between post-secondary and university work, acting as feeder organizations for universities, minimizing lower-level freshman and sophomore education work for universities so faculty can focus on research and higher-level education functions, providing for local business and economic development through preparatory training of citizens, positively effecting dysfunctions present in society, providing cultural engagement in local communities through theatre and the arts, and providing remedial training for those unsuccessful in secondary education (Cohen et al., 2013).

Community colleges provide for additional education past the compulsory age of school attendance. This additional education's goal was two-fold, to provide vocational education to prepare students to succeed in non-academic life and provide for a bridge between secondary and baccalaureate education systems for those who did not perform well enough in secondary school to obtain placement in traditional universities. The underlying assumption of the two-path system was that people chose either a vocational training program or an academic program. That is no longer the case, as many students receive vocational training and eventually progress to an academic degree at a university. Likewise, many academically successful students return to community colleges for technology or other training that allows them future success as their jobs evolve or become extinct, or to fill other continuing education desires (Cohen et al., 2013).

From inception, community colleges were, and continue to be, advantageous to universities for several reasons. Community colleges are feeder institutions that prepare more people for later inclusion into the university level of academic engagement. Universities are availed of students they would not have access to, except for the academic progress that those students previously attain in the community college environment. Community college students

also benefit in self-efficacy by the practical experience of academic achievements produced through their effort at the community college level, which enhances their motivation to progress to a higher degree level post-associate degree (Cohen et al., 2013).

College access is further enhanced at the community college level through its diversity-based inclusion model. Individuals underrepresented in traditional higher education often get their academic start in community colleges. Gender-based inclusion was less prevalent at the university level early on. Minority inclusion in the university experience was also minimal. Such inequality of academic access was often a result of a secondary education system that failed to provide education equitably across demographics. Lack of access to appropriate college-preparatory education stifles progress in all but the traditionally targeted demographic of higher education, the affluent white male. Lack of equitable inclusion decreases successful application to university and, even when acceptance is granted, stifles success in academic coursework for members of demographics that have not been prepared appropriately in the secondary education system (Cohen et al., 2013).

Without a preparatory mechanism that offset the equity failures in the secondary system, the progress of civil rights in the form of equality of education and resulting employment opportunity could not be obtained. Community colleges filled this role (Cohen et al., 2013).

Lack of diversity inclusion was only one of many social ills that society became reliant on community colleges to help solve. Above the specific mission to educate, educational institutions in general, and community colleges specifically, have been expected to address social ills to include racial integration, unemployment, drug abuse, alcoholism, teen pregnancy, inequitable outcomes, and driver education meant to decrease automobile deaths. In fact, when faced with almost any societal problem, the knee-jerk reaction appears to be to engage education

as a solution. Community colleges have played and continue to play a large role in the development and implementation of local educational programs designed to address these societal problems (Cohen et al., 2013).

The local nature of community colleges also has significance. Access to education often depends greatly on proximity, especially for students with lifestyles, cultures, responsibilities, and other conditions that make remaining local necessary, appropriate, or desirable. Community colleges provide education in proximity to local students that university systems cannot produce (Cohen et al., 2013).

Additionally, the structures and missions of community colleges are inextricably linked to local governance, business needs, and community cultural engagement. A local board of trustees, answerable to the community, are responsible for the directional decisions of the organization. Community college curriculums must also be responsive to the needs of current or prospective businesses providing employment within the community. Fostering civil engagement and producing future leaders for the community are also products of community colleges. Local arts and theatre programs which enhance local community culture are also within the purview of community colleges (Cohen et al., 2013).

Community colleges fill a host of needs across a wide spectrum, often taking a practical understanding that their job is to fill any need that is represented broadly enough for a program to be created and responsibly funded to address it. Historically, the anecdotal expression of meeting these eclectic needs of the local community may have been enough to secure their ongoing funding and existence. This is no longer the case, as accreditation requirements, legislative funding mandates, and greater consistency with university partner institution curriculum become more prevalent and important to community college management. As a result

of these external forces, community colleges must focus their attention on outcome expectations such as persistence rates to graduation, retention, transfers, and post-degree or certificate job-getting. Community college programs and departments must consider these expectations to tailor services to community needs (Cohen et al., 2013).

## Student Use of Library Resources

Several studies have been conducted evaluating libraries' services as they impact or are related to student retention (Crawford, 2014; LeMaistre et al, 2018; Murray et al., 2016; Soria et al., 2013; Soria et al., 2014; Teske et al., 2013). The way that the library variables have been addressed within each study is different based on the availability of collection methods for the specific libraries being studied.

Variables being addressed are often dictated by several factors of the study. First, a decision must be made regarding the level of the unit of analysis for each study. There are strengths and weaknesses related to each unit type. An institution level of analysis treats each institution in the study as a research subject (Crawford, 2014; Teske et al., 2013). At the institution level of analysis, variable numbers are reported and standardized across all libraries reporting to an industry wide annual survey, such as ACRL Trends and Statistics annual survey, or the library section of the Integrated Postsecondary Education Data System (IPEDS) annual survey. Numbers reported on such surveys are not student specific but are specific to the total numbers for the institution. For example, full-text database access as reported on such reports is the total number of full-text accesses for the institution for that year, not delineated by student. Such institution level of analysis studies are useful for studying larger, industry wide trends, because more libraries can be included in studies of the existing dataset. Institution level units also provide greater standardization of definitions for each variable in the study because

reporting guidelines are very specific (Association of College & Research Libraries, 2019; National Center for Education Statistics, 2019b).

A weakness of institution level of analysis studies is that it minimizes local institution relevance. For instance, institutions cannot gain information on whether students who use library resources are more likely to be retained than students who do not use library services. Institution level of analysis can be used to support studies of the relationship between the libraries' usage numbers and overall institution retention numbers.

Student level units of analysis provide the ability to engage questions of whether students at a particular college or university are more successfully retained if they use library services (LeMastre et al, 2018; Murray et al., 2016; Soria et al, 2013; Soria et al., 2014). This information is much more useful to the local institution because the results are more targeted to that institution's individual successes or failures. Some weaknesses include the fact that standardization of data collection and variable definitions are less possible between the different studies employing the student level of analysis. As an example, one study may be unable to collect student level transaction information on database accesses occurring on-campus, because there is no electronic mechanism requiring students to sign in with individualized identifying information. Some studies of student level database access will solve this problem by excluding on-campus access data, relying on off-campus access information that does require individualized logins. A study that addresses all database access, both on and off-campus, would be operationally defining database access differently than a study excluding on-campus database uses out of necessity. As a result, student level unit of analysis studies talk about similar use variables, sometimes even calling them similar names, but, in most cases, different student level studies are not talking about exactly the same things.

Student level studies can contribute to the body of research found in the literature, but issues of standardization make generalizing and cross-comparing different studies less useful to identifying industry-wide truths about the effectiveness of library funding and services on student retention. This literature review addresses studies conducted at both the institution level of analysis studies and student level of analysis to provide a more nuanced and complete presentation of findings.

Another issue impacting comparisons between different studies of library services on student retention is that retention also takes on a different operational definition between studies. Depending on the length of time being studied, student retention could mean retention for a single semester, for a full year, or even persistence of retention through graduation. It is important to understand what each study is using as a definition of student retention. A student retained for a single semester may not be retained annually, and a student retained for a year may not be retained through graduation. Retention duration decisions impact library service definitions because library usage numbers would need to match the duration and time-period of the operationalized retention definition being used. A study of fall-to-fall semester retention, as an example, considers an entire annual cycle. This longer cycle includes the summer break, which fall-to-spring retention studies would not include. Excluding sections of an annual cycle such as summer break from the retention timeframe may impact results.

Library service usage numbers reported on standardized institutional reports are often annual totals, expressing a calendar timeframe from July 1st through June 30th (Association of College & Research Libraries, 2019; National Center for Education Statistics, 2019b). Retention reporting on these surveys often match that time-period. Institutional level unit of analysis studies are, by necessity, largely annual expressions. Student level unit of analysis studies are

often not compatible with that annual timeframe (LeMastre et al. 2018; Murray et al., 2016; Soria et al., 2013; Soria et al., 2014). Results stated and compared simply may refer to results less specifically as "retention" when, in fact, the context of duration of time of each study makes such comparisons less accurate.

***Defining Library Service Usage Variables***

For the current study, student use of library services is the composite variable of all the combined library usage variables in the usage model. Library usage is reported annually on the ACRL, Library Trends and Statistics: Annual Survey. The usage section of the report includes numbers of physical materials circulated, eBooks circulated, full-text articles accessed, reference transactions conducted, research consultations performed, library presentations, attendees at library presentations, gate counts for library entrance, and interlibrary loans for the fiscal year (Association of College & Research Libraries, 2019).

While institution level of analysis studies of library usage rely on standardized reports like ACRL Library Trends and Statistics: Annual Survey, some student level studies create their own similarly named variables using internal data collection methods. Such internal collection methods provide student identifying information, which annual institution level reports do not. Such identifying information driven methodology, however, has an impact on what variables can be studied and the specific definitions of those variables. The differing methods of collection, inclusion of only usage variables that offer student identifying information, and the differing time frames through which the variables are expressed make comparing results between studies, especially between student level and institution level studies, problematic.

The proceeding definitions section must do three things. First, it should present how definitions of these variables have necessarily differed between studies. Second, it must present

how and why variables have been included and excluded from studies, and what gaps are produced in the understandings of library service usage by those often-necessary exclusions. Third, a standardized expression needs to be set up for the purposes of focusing understanding of exactly how the variables in the current study are defined, so that the reader can understand the difference between the variables inherent to the current study and similarly named variables in other studies.

**Physical Materials Circulation.** Physical materials circulation is, in general, the number of books that are owned by the lending library and checked out by a library to students, staff, or other patrons. This does not include items interlibrary loaned to students who are not associated with the institution that is the primary service population of that library. Put another way, if another library requests a book from the lending library to be borrowed by a patron unassociated with the lending library, that use is counted as an interlibrary loan, rather than a circulation.

Circulation also does not include instances where the library interlibrary loans a book from a different library and lends that book to a student, staff member, or patron. That would also be considered an interlibrary loan, rather than a circulation.

Many studies have included physical materials circulation as a variable (Crawford, 2014; Murray et al., 2016; Soria et al., 2013, 2014; Teske et al., 2013). Crawford (2014), an institutional level unit of analysis study included circulation as described and expressed in the then American Library Survey (ALS), a survey which no longer exists and is replaced by the ACRL Annual Trends and Statistics survey. The number was then corrected by dividing it by each institution's FTE, which is similar to how the current study proposes to define the variable. However, Crawford (2014) then includes the circulation numbers into a mathematical expression that engages multiple other library use variables in a way that produces a single library use

index. At the point of creation of the library usage index, the circulation variable ceases to be its own specific variable and can no longer be considered for its individually specific relationship to student retention. Because the study employees ALS data, it is an expression of circulation activity for an entire annual cycle.

Teske et al. (2013) is an institution level unit of analysis study, and also applies circulation by FTE. Teske et al. (2013) does not include circulation as part of a larger library usage index, but instead, studies the relationship more specifically regarding circulation and student retention. Teske et al. (2013) uses Southern Regional Education Board (SREB) data instead of relying on ALS or ACRL data, and differences in reporting definitions may exist. The Teske et al. (2013) study limits the study to first-year student retention, which Crawford did not. While this does not change the definition of circulation, it changes the expression of the comparison between circulation and retention because students in their second, third, or fourth year are not considered in the equation expressing circulation relationships with student retention.

Circulation is also included by Soria et al. (2013, 2014) in a student level unit of analysis study, but is instead referred to as book loans. The number reflects interactions of check out occurring in the library resource management software commonly referred to as an integrated library system (ILS). In the case of Soria et al (2013, 2014) the ILS is a program called Ex Libris Aleph. Circulation is expressed as a single semester of use, rather than an annual expression as Crawford (2014) and Teske et al. (2013) describe it. Additionally, in their study of retention relationships, Soria et al. (2013, 2014) considers only a single initial use in their categorical expression of whether a student used library services, making no distinction between a student

that checked out a single book in a given semester and one that may have checked out 50 books in a given semester.

One of the Soria et al. (2014) regression models looked at the single unit increase of book check out, as a consideration for increased probability that a student will be retained. Unlike with the previous circulation expression, Soria et al. (2014) relied on a continuous expression of circulation for that measure.

Murray et al. (2016) also included circulation in their student level unit of analysis study, referring to them as checkouts. Murray et al. (2016), unlike Crawford (2014) and Teske et al. (2013), is a single semester study. This is similar to Soria et al. (2013, 2014), except that Murray et al. (2016) specifies fall-to-spring retention and does not specify first semester students as the population being evaluated. Student identifying information was collected through the ILS computer system, this time a program called Voyager.

LeMaistre et al. (2018) is also a student level unit of analysis study but excludes physical circulation from its study. This is because the library being studied only provides electronic resources and does not have a physical book collection.

When looking at the definitions of physical circulation used in previous studies, we gain an understanding of a lack of standardization. Differences may be slight, as is the case between the two institutional level units of analysis studies. They can also be viewed as quite different, as is the case when comparing Soria et al. (2013, 2014) with Crawford (2014). Still other studies of library use may exclude physical materials entirely, as is the case with LeMaistre (2018). The point is that similarly named variables, and, by extension, the statistical results attributed to them, may not be comparable across different studies.

For the purposes of the current study, the ACRL Trends and Statistics: Annual Report definition serves as a standardized expression of what is meant by physical materials circulation. Number of physical materials circulated is the total number of times physical materials are checked out from the library, not counting renewals. This amount does not include items lent to or borrowed from other institutions as a function of interlibrary loan, which are addressed elsewhere in the survey. These materials can be books, serials (journals and magazines), or media, but only those in a physical format. This number does not include electronic resource housed on computers (Association of College & Research Libraries, 2019).

**Digital/Electronic Circulation.** Digital/electronic circulation is generally understood as the circulation of eBooks, or streaming video and audio. E-periodicals, otherwise referred to as journal database or e-magazines are excluded from this variable, and usually counted elsewhere in a different variable.

The two institution level unit of analysis studies, Crawford (2014) and Teske et al. (2013), exclude digital circulation from their study. At the time of these studies, implementation of eBook and streaming media collections in libraries was still in its initial phases. While many libraries provide eBooks and streaming media, the practice was not as universal in 2010, which is the time-period expressed in the datasets used by Crawford (2014) and Teske et al. (2013). These two studies, again, express annual numbers, but used different reports to inform their studies (Crawford, 2014; Teske et al., 2013).

The student level unit of analysis studies treated digital/electronic circulation differently. Soria et al. (2013, 2014) made treated electronic book resources as a separate variable from other electronic resource types, like databases and journals. Murray et al. (2016) grouped all electronic resources together. LeMaistre et al. (2018) only counted proxy server access to databases and did

not distinguish between any electronic resource types. Soria et al. (2013, 2014), Murray et al. (2016), and LaMaistre et al. (2018) all present one semester counts of this variable.

Definition standardization between studies again becomes an issue. For clarity in the current study, we will use the definition as outlined in the ACRL Trends and Statistics: Annual Report. Number of digital/electronic circulation is the number of eBook and e-media, even if part of a database, and includes all views, downloads, or stream instances. This number does not include e-serials (journals or magazines in electronic format). It does not include circulated VHS, DVD, or other media formats housed physically. This item does not include titles used from Demand-Driven Acquisitions or Patron-Driven acquisition services where the item is not purchased by the reporting library (Association of College & Research Libraries, 2019).

**E-Serials Usage.** E-serials usage is generally understood as a count of instances of full-text views of any library owned electronic article. Neither of the institution level studies, Crawford (2014) or Teske et al. (2013) did not address this variable. Those studies concentrated on physical library services.

Soria et al. (2013, 2014) presents this variable as electronic journal use, but also presents a number regarding database logins. An electronic journal use is the full-text access of an electronic journal. Database login is a count of the number of times a student logs into databases (Soria et al., 2013, 2014). A student may log in to a database and then access several full-text articles in a single research session.

Murray et al. (2016) presents a larger, electronic resources variable to express an understanding similar to e-serials usage. Electronic resource access counts the instances of authenticated login through the proxy server to access any electronic resource (Murray et al,

2016). This is more similar to the Soria et al. (2013, 2014) database logins, a count of research sessions, rather than a full-text journal access count.

Likewise, LeMaistre et al. (2018) conducts a count of proxy server authentications for electronic resources. The count more closely parallels database logins or research sessions than instances of full-text access articles. They do not distinguish between journals, eBooks, or any other electronic resource.

Definition standardization is also a problem when comparing studies related to this variable. To limit confusion, the current study will use the ACRL Trends and Statistics: Annual Report definition. Number of e-serials used includes all e-serials, even those in databases. If possible, libraries should report article usage, specifically the JR1 counter report, which is a standardized format recommended to be used by database vendors but may not be. If the vendor does not provide such a standardized number, libraries may report usage by downloads, session views, transaction logs, or report zero. Viewing the item is countable when the full text of the item is downloaded. When possible, libraries should also report open access e-journal usage, provided that the item is accessible through the libraries catalog or discovery system (Association of College & Research Libraries, 2019).

**Reference Transactions.** Murray et al. (2016) and LeMaistre et al. (2018) do not address reference transaction numbers, because their collection methods could not gather student level identifying information on this variable. Soria et al. (2013, 2014) address chat reference but not face-to-face reference for the same reason, because of a lack of student identifying information. Chat refers to electronic chats occurring between online students and librarians.

The institution level unit of analysis does not have a need to have student level identification, because the numbers are at the institution level. Studies at this unit of analysis,

including Crawford (2014) and Teske et al. (2013), address reference transactions. Crawford (2014) does not analyze reference transactions as a stand-alone independent variable. Instead, Crawford (2014) transforms the ACRL Trends and Statistics annual survey reported reference transactions by dividing it by FTE, and then includes it mathematically into a library use index. At that point, relationship results are specific to the overall index, rather than specific to reference transactions. Teske et al. (2013) addressed reference transactions as reported in 2010 on an annual survey by the Southern Regional Education Board.

As a result of library usage studies not addressing reference transactions, not addressing it as a stand-alone variable outside of a usage index, or due to the age of the study, there are no current understandings of reference transactions as they relate to student retention. The current study proposes to address that issue.

For clarity and to standardize results, the current study will use the ACRL Trends and Statistics: Annual Report to define reference transactions. Number of reference transactions include all reference transactions in verbal or written, in person, by phone, or electronic through chat or email services. This item does not include directional questions, but only questions pertaining to the use of information services and resources provided by the library, or engaging library staff subject specialty and skills. Reference transactions do not include consultations by appointment, as those are reported elsewhere on the survey (Association of College & Research Libraries, 2019).

**Research Consultations.** Reference consultations are generally appointment with library reference professional staff who have specialized knowledge of how to do research. Student level units of analysis studies Murray et al. (2016) and LeMaistre et al. (2018) do not address research consultations. The data collection methods used by these two studies did not have a way of

collecting the student identifying information needed at the student level unit of analysis. Soria et al. (2013, 2014) addresses peer consultations which are consultations, but different from research consultations because they do not engage library staff professionals in research assistance. Instead, peer consultations are conducted by peer students, with less research knowledge than reference library professionals.

Neither Crawford (2014) or Teske et al. (2013), institution unit of analysis studies, do not address reference consultations as a variable.

Reference consultations are included as a reported standardized variable on the ACRL Trends and Statistics: Annual Report. Studies of library usage have ignored this variable, and there is no current information available addressing potential relationships with student retention.

The current study will define reference consultations as defined in the ACRL: Trends and Statistics: Annual Report. The number of research consultations includes one-on-one or small group scheduled consultations with library staff, external to the class. These consultations may be in person or electronic. They may be the result of a referral from another library staff member for specialized staff skills and knowledge engagement, or regarding questions too complex to answer at the reference desk (Association of College & Research Libraries, 2019).

**Presentations.** Presentations are generally defined as the number of presentations given by librarians in a year. Presentation numbers include library instruction classes presented to students as part of their education. Presentations are not student level variables, as they are counts of numbers of library presentations provide by an institution, rather than attendees. Attendees to presentations are addressed in a different variable.

Of the institution level studies, Crawford (2014) does not address presentation numbers, but does address attendee numbers at presentations. Teske et al. (2013) addresses presentations, using 2010 survey data collected by Southern Regional Education Board.

There are limited numbers of studies of library use relationships with retention. Only one study was identified that represents current studies, but that study addresses 2010 data, now over a decade old.

To provide a standardized and clear definition of presentations, this study will use the ACRL Trends and Statistics: Annual Report. Number of presentations includes all library presentations, which is include library classes taught, staff development sessions, and community presentations. Presentations are reported in two sections depending on whether they were in-person or web-based, but for the purposes of this study these will be added together to gain a total number of presentations, regardless of format. Hybrid presentations which are part in-person and part web-based are only counted once (Association of College & Research Libraries, 2019).

**Attendees at Presentations.** In general, attendees at presentations represent every person present at any library class, staff development sessions, and community presentations.

Of the institution level unit of analysis studies, Crawford (2014) and Teske et al. (2013) address attendees at presentations. Crawford again lumps this variable into an index, removing the ability to analyze potential relationships between retention specific to attendee numbers. Teske et al. (2013) presents two separate expressions of this variable. First, attendees at presentations are analyzed against student retention rates without any modification for institution size. Second, attendees at presentation numbers are divided by FTE, to account for institution size, then analyzed against student retention rates.

Soria et al. (2013, 2014) addresses presentations at the student unit level of analysis through a variable called attendees at workshops. They are study includes identifying information from enrollment roles for classes whose instructors have requested in-class library instruction sessions. Murray et al. (2016) similarly includes attendees at instruction sessions. LeMaistre et al. (2018) does not include this variable, as such data is not collected through the proxy server, the primary method of identifying student library use in that study.

For clear and standardized methods, the current study will use the ACRL Trends and Statistics: Annual Survey definition of this variable. Number of attendees at presentations is reported is a head count of attendees at presentations, both in-person and web-based. In the case of presentations with multiple sessions for the same course, if a single individual attends more than one session, that individual is to be counted for only one of the sessions.

**Gate Counts.** Gate counts are generally defined as the number of people who enter the library during a time-period. For annual studies, this would be all people entering the library for the year. For a semester study, this would be all students entering during a semester. This count is usually produced through an electronic count by security gate but can also be a periodic head count. Gate counts are expressions of the use of the physical space of the library.

Crawford (2014) includes gate counts as a variable defined by the ACRL Trends and Statistics: Annual Report. The variable is combined into an index, and not evaluated as an individual variable for a relationship with student retention. Teske (2013) does not include gate counts as a use variable.

There is no gate count variable for any of the student level unit of analysis studies (LeMaistre et al., 2018; Murray et al. 2016; Soria et al, 2013, 2014). Identifying information is not available for such a variable, so exclusion is logical. There is a variable expressing use of the

computer lab, collected by workstation logins for Murray et al. (2016) and Soria et al. (2013, 2014). The concern is that there are several self-regulated learning activities included in the physical library space, such as peer-to-peer collaboration, quiet study, and laptop use that would not be expressed through the computer lab use count. As a result, there is a gap in the literature regarding use of the physical library space and student retention.

For the purposes of clarity and standardization, the current study will use the ACRL Trends and Statistics: Annual report definition. Number of gate counts (annual) for library entrance is a count conducted electronically, using the library's security gate equipment, of every person who enters the library in a given year. If the library does head counts instead of gate counts, they may report it on this question, but must include a note stipulating such (Association of College & Research Libraries, 2019).

**Interlibrary Loans.** In general, interlibrary loans are books or physical journal articles, not owned by the library, borrowed from a different library to be provided to students, staff, or community members. Teske et al. (2013) does not study interlibrary loan services but does recommend such a variable inclusion in future studies. Crawford (2014) does include interlibrary lending as a variable, but only as part of an overall library use index. Crawford's expression of the variable comes from the ALS, later known as ACRL Trends and Statistics: Annual Report. There is no information on a specific relationship of this variable and student retention for the Crawford (2014) study.

Student level unit of analysis studies Soria et al. (2013, 2014) and Murray et al. (2016) include interlibrary loans as a variable in their study. Both use Ohio College Library Center (OCLC) ILLiad computer system. LeMaistre et al. (2018) does not include interlibrary loans as a library use variable. Interlibrary lending is a service provided by the library in the LeMaistre et

al. (2018) study, but it is not included in the proxy server access that was used as a data collection source for the study.

It should be noted that many libraries conduct additional interlibrary lending through consortium-based lending programs external to the OCLC computer system. Data collection of this variable for such libraries would need to be expanded beyond the OCLC data collection methods used in Soria et al. (2013, 2014) and Murray et al. (2016).

For clarity and standardization, the current study will use the ACRL Trends and Statistics: Annual Report definition of interlibrary loans. Number of interlibrary loan returnable and non-returnable includes materials borrowed from other libraries for lending to the institution's students, faculty, or patrons. Materials are counted in two separate questions on the survey, depending on whether they are materials that must be returned, or photocopies that are not returned (Association of College & Research Libraries, 2019). For the purposes of this study, the two numbers will be added together.

**Summing Up Library Usage as a Definition**. It becomes clear when reviewing the literature that there is confusion about what exactly a study of library usage is referring to. Different studies include different variables and exclude others. The term library usage becomes overgeneralized when comparing or compiling several different studies' results into a literature review. One cannot simply refer to the impact or nature of library usage generally without including within that generality significant inaccuracy.

There is an industry wide report which purposes to gather usage data on the totality of all library services provided by academic libraries, the ACRL Trends and Statistics: Annual Report. However, no study has been discovered that takes a holistic inclusion of all these library services

within the same study to gain a complete understanding of library service impacts on the service community, or relationships to student retention.

Even in institution level unit of analysis, the goal does not appear to be understanding impact of the whole of library services, while engaging the question of how much each of these variables contribute to the success or failure of that whole. Crawford (2014) comes the closest to this goal through inclusion of most individual library services in a library service index. Crawford's combining of these variables into the index in the way he does removes the ability to discover relationship understandings between the individual variables included in the index and the dependent variable of student retention. The Crawford (2014) study, in addition to being dated, also fails to include electronic resources as usage variables.

Teske et al. (2013) does not address the whole of library services as a model but does address many of the library service usage variables as independent variables. The Teske et al. (2013) study is also dated, and also lacks electronic services in its analysis.

Student level unit of analysis studies include more electronic variables but are limited in their inclusion of non-electronic services that do not offer student identifying information needed for this level of analysis. Inclusion of variables into studies appear to be based on the opportunity of collection.

An incomplete expression of library service usage, especially one produced out of collection opportunity rather than the strategic needs of the library to understand user needs, could produce poor decision making. Services having impact, which are not included in such studies could be limited or cut in order to provide funding and support for less functional services which happen to be more visible base on greater opportunity for convenient data collection.

Even when including similar variables in the library usage models in the literature, differences in the definitions of the variables themselves between studies introduce a degree of ambiguity to understandings. Much of this inexactness cannot be helped, within the overall construct of the literature. What would be useful, what is needed as we move forward in our attempt to understand the true relationships between library services and student retention, is a more robust study of library services that is conducted in a way that takes advantage of the intricacies of finding opportunities which exist in a multiple regression model strategy.

Such a study should employ industrially standardized definitions for variables. It should attempt to include as many library service types as possible. It should employ a mechanism to identify relationships between each individual services type and student retention, but it should also discover the relationship of the model, as a whole, to student retention. It should also identify what library service types have the greatest impact on the relationship of the library service usage model to student retention.

Discussion of the model in the definitions section of the literature view appears to be misplaced at first glance. The conversation is necessary at this stage, because any proposed model of analysis is only as good as the variable definitions inherent to that model. The literature, by necessity, presents multiple different definitions of both library services as a whole and the library services individually. The current study must have solid foundation to build on, and that foundation comes down to solid definitions. ACRL Library Trends and Statistics: Annual Report definitions employed in this study. Library usage will be defined through the inclusion of all usage variables reported in that report, unless decisions must be made to drop a variable because of collinearity or some other statistical issue.

*Historical and Conceptual Foundations*

While studies of library service use relationships with retention are relatively new, these studies can be viewed as part of the broader study category of student success variables as they relate to library service use. Student success can be expressed through many variables, including studies of persistence and course completion studies. Persistence and course completion studies are similar to modern retention studies in that they study the relationship between library activity and the student's ability to continue with studies towards the goal of achieving a learning outcome.

Kramer and Kramer (1968) conducted the earliest work in library use and student persistence. In general, persistence is considered shorthand for persistence to graduation, but to persist to graduation, students must first persist to the following semester. Kramer and Kramer (1968) addresses student persistence from Fall 1963 to the following year. Persistence, as expressed by the study, would be considered retention if conducted today.

The study was part of a larger response to the California legislature's concerns with student attrition at California State Polytechnic. The study addressed GPA and persistence as dependent variables, relating them to library physical materials checkout. Half of the freshman class of 1963, 742 students, was included in the study. The study included three subject categories, 251 engineering students, 83 agriculture students, and 316 students in the arts. Library data was collected during fall 1964, the semester at which library staff could confirm that all students had been issued identification necessary for book borrowing.

Students who borrowed at least one book during the semester had an average GPA of 2.2, in comparison to an average GPA of 2.0 by students who did not borrow a book. The information was more telling when evaluated by student subject of study. Engineering and

science student library use was non-significant for a relationship with GPA. Library users in the arts had an average GPA of 2.37, compared to 2.1 average GPA for nonlibrary users in the same majors. Agriculture library users had an average GPA of 2.17, compared to an average 1.7 GPA held by non-library using agriculture students. While the GPA findings suggest that the importance of library use may be different for different courses of study, the analysis related to different majors does not extend to student persistence. Results in this study for persistence are only expressed for the total sample, not delineated between majors.

Of all students enrolled, only 64 percent of the class returned to the college the following fall semester. In comparison, library users returned at a rate of 73.7 percent, while only 57 percent of nonlibrary users returned. Their work found a correlation, $\chi^2(1) = 4.22$, $p = .04$, between book borrowing and persistence for the total sample studied. While a strong statistically significant relationship was found between library use and persistence, many students did not appear to apply library use to their learning strategy.

In a practice that ran counter to the positive impact of borrowing books expressed in the study's findings, 65 percent of the students studied did not borrow library books (Kramer & Kramer, 1968). In reaction to that deviance, the authors recommended some form of library use orientation that promoted library use as positive for educational success (Kramer & Kramer, 1968).

Breivik (1977) addresses the implication of such a library orientation program on student's completion of course work. In a controlled study in 1972 at Brooklyn College, Breivik (1977) found that 77% of students who participated in weekly library instruction continued on to complete coursework in the following semester, compared to 71% doing so after one-time library tours and 68.75% of students who received no library instruction doing so.

Studies of library use are often conducted to align department activity with the expectations of constituents or governing authorities. This was true for Kramer & Kramer (1968) as the study was in response to concerns about student turnover brought up by the state legislature. Libraries are constantly attempting to align themselves with expectations of the larger system of which they are a part.

Pritchard (1996) argued that libraries must continually prove their worth to the overall education mission. She engaged ideas of total quality management in library service assessment. Library services need to provide for user needs while realizing operationally appropriate cost. Pritchard expressed the difference between providing good service, targeted to user and institutional needs, and merely providing more services that do not necessarily fit those local targets. Within this argument was a differentiation between outputs and impacts, the latter being significance in effect of user success and satisfaction. Purposeful changes in library services that provide for user needs enhance the value of libraries in the academic environment. A system of continual evaluation of library services is essential for continuation and enhancement of library value in meeting future user needs (Pritchard, 1996).

The journey to link library services with user needs continued. In December 2009, Oakleaf was tasked by the ACRL to produce a report on how to assess the value of academic libraries. The resulting Oakleaf (2011) report included the following steps for appropriately evaluating library value:

1. Define outcomes.

2. Develop appropriate assessment management.

3. Conduct studies to evaluate how and what libraries enable institution members to do.

4.  Produce systems to collect user data for library service enhancement studies, while maintaining client privacy.

5.  Provide greater student enrollment impact and record those activities.

6.  Engage library services to enhance retention and graduation rates.

7.  Positively impact successful student job experiences.

8.  Measure library influence on student scholastic achievements.

9.  Create and show library impact on student learning outcomes.

10.  Track library resource use related to student activities, as well as integration of library materials in courses by instructors. Identify relationships of such library resource inclusion on student learning.

11.  Identify and document student engagement, experience, attitudes, and perceptions of the library.

12.  Contribute to faculty research projects and communicate how libraries have done so.

13.  Contribute to faculty grant proposals and funding enhancements and communicate how libraries have done so.

14.  Enhance support for faculty teaching and communicate how libraries have done so.

15.  Present how the library contributes to institution prestige.

16.  Assist in higher education assessment activities.

17.  Participate in higher education accreditation activities.

18.  Conduct liaison library activities in service of institutional leadership, as well as assessment and institutional research offices.

19.  Have a formal system of assessment and use it to plan future library activities.

20.  Engage in staff development.

21. Engage library administrators in activities related to Oakleaf's report, including communication with stakeholders, conducting evidence-based decision making, supporting library assessment initiatives, fostering a work environment that produces creativity, and including assessment initiatives in library planning.

22. Rely on library professional associations for support. This includes using association reports, services, collaborative learning, and networking with other members.

Nearly all these steps express the need to enhance analysis of library service usage, use those findings to enhance library services, and engage in reporting those applications to parent institutions, governing bodies, or interested colleagues.

The early work into library relationships to student success provided a foundation on top of which modern studies of library relationships have been built. The insights presented in Pritchard's (1996) work frame library activity in understandings of its usefulness in producing outcomes within reasonable budgetary constraints. Oakleaf's (2011) report provided a structure for future engagement in data-driven, outcome responsive library planning and decision making.

### *Institution Level of Analysis Studies of Library Service Usage*

Two studies address relationships between library service use and student retention at the institution level of analysis. While there are differences between the two studies, both found relationships between library service use and student retention. The studies also offer opportunities to enhance planning for future studies of the relationship between library service use and student retention.

Crawford (2014) conducted a multiple regression analysis to evaluate impact of institution variables, including total library financial expenditure and library service usage, on student retention. The regression model included financial expenditures internal and external to

the library. The study included doctorate, master's, and bachelor's degree granting institutions in Pennsylvania. The Crawford study excludes associate degree granting institutions.

Crawford (2014) computed a library usage index, calculated by adding total number of circulations, interlibrary loans, gate counts, attendance at instruction sessions, and reference transactions. The model used reported numbers from the ACRL Library Trends and Statistics survey, 2010 reported data. The library service index used by Crawford (2014) showed a moderate correlation with retention at $r=.39$, $p<.01$. Adding the total library service index variable to Crawford's multiple regression model, however, added no additional value to the model. It is important to note that total library financial expenditure, which showed a strong correlation with retention at $r=.608$, $p=.01$, also dropped out of the model. The rest of the variables included in Crawford's (2014) model were institution wide expressions, not specific to any one department's activities. See table A2 for library usage results for this study.

While library services show a relationship to retention, it may be that this connection is masked in regression models which include variables expressing similar service provision types provided external to the library. It may also be that library activity contributions do not hold enough weight in regression models that include much larger institution-wide variables and are overshadowed. For example, financial expenditure on instruction efforts in the larger parent organization have a similar process and service to library instruction, except that the internal library instruction is specific to library resource use and information literacy. Instruction services in the larger parent organization will be subject specific in relation to other departments' curriculum being funded.

Library instruction is often done in collaboration with, and physically within the other departments' in-class instruction, through a library one-shot in-class instruction where the

librarian is invited to the class to teach. The collaborative nature of library instruction within the instruction processes of other departments could muddy the waters between successes in retention related to parent organization instruction expenditure and library instruction services.

Another consideration would be that a single department's instruction data, in this case the library, when separated out as a standalone variable, while all other instruction on campus is combined into a single variable, may not have enough impact on retention on its own to make a difference when compared to the impact of the other, more inclusive campus-wide instruction variable.

Crawford's (2014) findings of moderate correlation between library services and student retention, while adding no value to the regression model, cannot be discounted or ignored. Library services may bring unique contributions, and still be mathematically overshadowed by the much larger impact of overall institutional activity.

Regardless of mathematical validity in an institution-wide model, it does library administrators no good, in relation to their decision-making responsibilities, to have their variables of concern drop out of college-level models entirely. In such a scenario, library administrators are left with no usable results with which to enhance future library services in support of the overall college mission. The takeaway is that library services are likely more effectively studied external to overall college service or expenditure regression models.

In a study of 200 four-year institutions associated with the Southern Regional Education Board (SREB), Teske et al. (2013) researched financial expenditures, library resources, and library use variables. The library resource and use variables included were book volumes added during the year, total collection size, circulation of physical books, reference transactions, reference transactions divided by FTE, presentations, attendees in presentations, and attendees at

presentation divided by FTE. Like Crawford (2014) the data set analyzed was from 2010 reports, but unlike Crawford (2014) the dataset was not retrieved from ACRL Trends and Statistics survey. Instead, Teske et al. (2013) used an SREB annual survey of its member institutions.

The Teske et al. (2013) study included doctoral, master's, and bachelor's degree granting institutions, and, like Crawford (2014) excluded associate degree granting institutions. They found, for all institution types combined, higher-moderate to strong correlations of library expenditures, professional salaries, book expenditures, acquisitions, and collection size with first year student retention, the largest correlation being collection size. These correlations weakened, however, when evaluation was confined to master's and bachelor's degree granting institutions. See table A2 for library usage results for this study.

Teske et al. (2013) also found, when addressing doctoral, master's and bachelor's degree granting institutions combined, lower correlations between first year student retention and library instruction, material circulation, and reference transactions. Library instruction and information services variables were low enough that the authors accepted the null hypothesis of no relationship with retention.

Two library service variables were modified by dividing them by FTE, then reintroduced them to the study. These variables were reference transactions and attendees per presentation. Transforming variables in such a way to offset the impact of differing institution sizes in a study is common (Teske et al., 2013). The dependent variable of first-year student retention does not appear to have been similarly modified to match the modified independent variables when addressing these relationships, but this variable is expressed as a rate rather than a total. The result is a decrease in strength of correlation for the modified variables with retention below

those between the prior unmodified variables and retention for all institution types and all institution types combined.

The data for the Crawford (2014) and Teske et al. (2013) studies was taken from different datasets but were similar in variables included in the study. All library service use variables were face-to-face or physical in nature. That is to say that electronic resource use such as eBooks, electronic journals, and online services were excluded from the study. These electronic library services are more modern service types that would tailor information service provision to the modernized, largely digitized expressions of student and faculty information seeking behavior.

There are several major differences between the Crawford (2014) and Teske et al. (2013) studies. First, they use different operationalized definitions of retention. Crawford (2014) uses first-time students as the dependent variable, which is defined as the student attempting a degree level that the student has never previously obtained. Teske et al. (2013) addresses the retention of only first-year students, which more specifically targets a different time-period related to the students' scholastic progression.

Crawford (2014) and Teske et al. (2013) also differ in how they codify and report library service results. Crawford (2014) identifies different library services and then combines them into an index which provides a single numerical expression. The resulting index score can be included into a larger regression analysis that includes library financial expenditure and other college financial expenditures external to the library. The Crawford (2014) method removes the possibility of identifying relationship strengths between each individual service type included in the index and student retention.

Teske et al. (2013), in contrast to Crawford (2014), reports relationship findings with retention for each of the library service types addressed. Teske et al. (2013) does not provide an

overall library service score for all library services combined, as they may or may not relate to student retention.

The populations being addressed by the sample are also dealt with differently by the two studies. Crawford (2014) confirms that samples are one of six different Carnegie classifications ranging from doctoral granting institutions with extensive research missions to general baccalaureate colleges, then lumps all these designated institutions into the same sample. Teske et al. (2013), on the other hand, identifies six different institution levels base on Southern Regional Education Board (SREB) classes. The SREB classes are organized from highest degree level granted to lowest degree level granted, and then further classified, within these degree levels, by number of classification of instructional programs (CIP). For sample size reasons these six groups are combined to make three groups that roughly match doctoral granting, master's degree granting, and bachelor's degree granting groups. The exception is the lowest level group, which contains master's degree granting institutions with no designated CIP and bachelor's degree granting groups with 5 or more CIP.

The result of the differences between Crawford (2014) and Teske et al. (2013) is that the methodologies overlap in a way that could be seen to complement one another if they studied the same geographic population. Crawford provides a service index that provides an overall statistical expression of whether the services included in the index, in total, have a relationship with student retention, but does not provide results specific to such a relationship between retention and the individual library services included in the index. Teske et al. (2013) provides information on whether the individual library services included in the model have a relationship with retention but does not provide information on whether the services combined provide an increasing effective predictive property related to retention.

Problematic for the understanding of the complimentary nature of the two studies' methodologies is that the populations being studied are not generalizable to one another. Crawford (2014) addresses Pennsylvania colleges, while Teske et al. (2013) addresses southern states associated with the Southern Regional Education Board. Any number of cultural, social, accreditation standards-based, or other differences between the two regions could invalidate or minimize any logical expression of comparative compatibility.

The two institution level studies led to some understandings of how the current study should be conducted. The associate level of degree granting institution was excluded in both studies, representing a gap in the literature that the current study needs to fill. Crawford's (2014) study showed that variables external to library activity should be excluded, so that information found will be more targeted to library decision making needs. Carnegie classification, or some other trusted standard of limiting the study by institution type should be used. Library service variables should include not only more traditional library services like physical materials use and face-to-face library services, but also more modern electronic and web-based library services. The study should be limited as much as possible to a particular geographic region, by accrediting body, governing body, or some other unifying mechanism. The study should include a method of identifying relationships between retention and each library service variable, but also allow for an understanding of relationships between student retention and the library services as a unified model and student retention. Student retention must be specifically operationally defined so that readers can tell what exactly is meant by the term retention. Dividing all variables by FTE should be considered to standardize the sample, offsetting the possibility that larger institutions may have greater impact on results than smaller institutions.

Finally, had either the library service usage index or total library expenditure fallen out of the model while the other library variable remained in Crawford's (2014) larger model, we may have gained some insight into how the two variables relate to one another. Because both fell out of the model, it becomes impossible to tell from Crawford's (2014) findings if library service correlations with retention are unique, or if they are byproduct of the stronger correlation between student retention and total library financial expenditure. The current study should address this question.

### *Student Level of Analysis Studies*

Four articles were identified that address relationships between student retention and library service usage at the student level of analysis. Each of these studies approach data collection and variable inclusion in different ways, largely based on the available opportunities for data retrieval available within their populations of study. Variables are similar enough to be compared with one another on a more cursory level, but technical limits on data collection restrictions specific to each study forces differences in the specific operational definitions of variables, even when they are named similarly. Time frame definitions also differed between studies, further complicating comparison of results. With those caveats in place, all the studies found statistically significant relationships between library service usage and student retention (LeMaistre et al., 2018; Murray et al., 2016; Soria et al., 2013, 2014).

Soria et al. (2014) conducted a study of 5,368 students, which was narrowed down to 5,162 students after factoring in drops prior to and during the Fall 2011 Semester. The study was conducted on 2011-2012 data at an unidentified university. Several regression models were used to study student library service usage relationships with student GPA and student retention.

Because the current study does not concern student GPA as a variable, the review of the Soria et al. (2014) study will focus on the student retention related findings.

Data collection was conducted in a variety of automated ways. Database logins were collected through click-through computer scripts when students accessed the database resources. Library website logins were captured using a content management software called Drupal. Book loans included count of initial checkouts and renewals that were identified through the integrated library computer catalog system called Ex Libris Aleph. Interlibrary loan data was collected through examination of the OCLC ILLiad computer system, which is a nation-wide interlibrary lending management tool. Reference transactions were confined to chat reference data compiled using a software called QuestionPoint. A computer management system called Cybrarian was used to capture computer lab workstation logins. Face-to-face presentation registrations were collected through Drupal. Peer consultations registrations were collected through review of the electronic appointment list (Soria et al., 2014).

While computer automation of services allows a decreased workload for data collection, the process of included several systems and processes to collect the data necessary for the study makes it more expensive and complex. Not all libraries have access to all the software used, and small colleges may not have financial assets needed to purchase such software.

Physical library service interactions where computer management or electronic interactions are not used are absent from the study (Soria et al., 2014). For instance, physical reference desk questions may be asked anonymously by a student participating in the study, with no means of including those questions in the study. Libraries have philosophical client privacy reasons for not tracking such interactions, but their exclusion produces an incomplete expression of library use by students.

The data collected was a combination of continuous and categorical variables. Examples of continuous variables were database access and electronic book requests. An example of a categorical variable included was in-class instruction and workshops, as students either participated or did not participate. Some regression models, studying retention as it relates to single library use or an increase of library use by one unit, transform continuous variables into categorical variables (Soria et al., 2014). Introducing categorical variables into a study or transforming continuous variables to categorical variables, while sometimes necessary, limits the amount of information that can be gained from the study.

Soria et al. (2014) controlled for demographic variables of sex, ethnicity, and international status. Pell Grant recipient status and first-generation student status were also controlled for. Pre-college activities were also controlled for, including ACT or SAT scores and high school advanced placement classes that transferred for college credits. Soria et al. (2014) also controlled for three variables that the literature shows has a positive impact on retention, including whether the student lives on campus or not, whether the student attended freshman seminar, and whether the student was a member of an advisory committee referred to as Access to Success. The study also controlled for whether the student was currently admitted to a college, or if their degree was undeclared.

For analysis of the relationship between library usage and student retention, the Soria et al. (2014) study relies on logistic regression analysis. The first regression tested prediction of first-year to second-year retention based on a single use of any library service during the first year. Predictors of single library service use were distinguishable between retained and non-retained students at $\chi2 = 207.13$, $p < .001$, $df = 19$. Students who used the library were more

likely to be retained, in comparison to their non-library using counterparts. The effect size was small, increasing probability of retention by 7 percent.

Another logistic regression analysis was conducted to see if first-year to second-year retention could be predicted by one or more uses of different types of library services. Retained and non-retained students were statistically distinguishable from one another at $\chi2 = 232.52$, $p< 001$, $df = 28$. The three types of use that were statistically significant for predicting student retention were one or more uses of a library database, an electronic journal, and a computer workstation. Like the previous logistic analysis, the effect size was, with probability of student retention to the following year increasing by between 2 and 3 percent (Soria et al., 2014).

A third logistical regression analysis was conducted to see if first-year to second-year student retention could be predicted by frequency of use of different types of library resources. Retained and non-retained students were statistically distinguishable from one another at $\chi2 = 244.49$, $p<.001$, $df = 28$. Likelihood of student retention to the following year increased significantly with a single unit increase in number of database uses at $p<.0001$, number of book checkouts at $p<.05$, or workstations used at $p<.001$. Effect was again small, with increases in probability of retention to the second-year increasing by less than one percent for single unit increases in these library use types (Soria et al., 2014).

Summing up the Soria et al. (2014) article, the study found statistically significant correlations between a single instance or more of library use and first-year to second-year retention. More specifically, statistically significant relationships were found between single instances of use or more of the services database use, electronic journal use, and computer workstation use with first-year to second-year retention. Additionally, a single unit increase in database usage, books checked out, or computer workstation use showed statistically significant

increased probability of retention. The study excluded physical library resource use that were not quantified electronically with identifying information, examples of such services would be reference desk services and physical study space use. Continuous variables were changed to categorical ones, limiting the study of relationships to single instance, minimizing the possibility of gaining more granulated understandings of relationships possible through the study of continuous variables. Relationships remained even after controlling for a significant number of demographic, scholastic, and other variables known to have a positive relationship to student retention.

In a second article by Soria et al. (2013) reported on a study at University of Minnesota, using similar data collection methods, variables, and controls. The study was conducted on 5,368 non-transfer, first-year students enrolling for the first time in fall of 2011. Similarities suggest this article to be the same study as presented in the other article by Soria et al. (2014). The study found significance between library usage and first-semester to second-semester retention at $\chi^2(1)$ = 6.86, $p< .01$ (Soria et al., 2013).

While Soria et al. (2013, 2014) found effect was small for library use as a predictor of first-year student retention, it should be considered that the university being studied has a high student retention rate for the entire student population (Soria et al., 2013). The generally high number of retained students could have limited the difference in retention between the two groups being studied, those who use library services and those who do not (Soria et al., 2013). Studying a college or university with a lower retention rate for the overall institution could present findings of greater predictability of library service usage on student retention.

Murray et al. (2016) evaluated library use relationships with one-term retention for 3,757 students at a regional public university in the Midwest. They used data incorporating checkouts,

electronic resources, computer lab usage, interlibrary loans, participation in library instruction, enrollment in credit bearing information literacy courses, use of the library managed writing center, and use of the library oral communication writing center. The study found that library use predicts spring-to-fall semester retention ($\chi^2$ = 575.72, $p$ < .001, Nagelkerke $R^2$ = .31). Freshmen who used the library were 9.54 times more likely to be retained to the following semester than students who did not use the library ($\beta$ = 2.26, $OR$ = 9.54, $p$ <.001). Sophomore library use predicted retention at $\chi^2$ = 84.03, $p$ < .001, Nagelkerke $R^2$ = .10. Students who used the library in the fall semester were 4.23 times more likely to enroll in the following spring semester ($\beta$ = 1.44, $OR$ = 4.23, $p$ < .001).

Murray et al. (2016) also found that, of the individual library services they evaluated, physical book checkout, electronic journals and database showed predictability for retention of both freshmen and sophomores. For freshmen, use of the computer lab, writing center, and communication center also showed predictability for retention. See table A2 for detailed findings.

The data describing student level use for different library services studied were collected using different computer systems on which they were housed, and then related back to student identifying information found in Banner, they student management computer system used by the institution (Murray et al., 2016). Physical materials circulation/checkouts were collected using the integrated library computer system, Voyager.

Use of electronic resources, such as electronic journals or databases, was collected through proxy server authentication designating student specific identifiers (Murray et al., 2016). Generally, there are two ways to authenticate and use an electronic resource through a proxy server. The first way recognizes the Internet Protocol (IP) address of the computer as one owned

by or existing physically at the university, which would require no student level identifying information to be given to authorize database use. The second way is through a student login using identifying information when the student is logging in from off-campus. Student access to databases were modified during the study so that students had to log in with identifying information to use the electronic resources, regardless of whether the students were on-campus or off-campus. If this step had not been taken, as does not appear to have been done in Soria et. al (2013, 2014), student on-campus access to electronic resources would not have identifying student information attached. Student level data on electronic resources would have been limited to off-campus usage only, but Murray et al. (2016) rectifies this issue.

Computer lab use was gained through analysis of the individualized logins by students onto workstations in the library computer lab. Interlibrary loans, like Soria et al. (2013, 2014) were addressed through OCLC ILLiad computer system (Murray et al, 2016). Participation in library instruction was gained from the electronic enrollment records of classes for which the teaching faculty requested library instruction and do not account for student absenteeism in the library instruction session (Murray et al., 2016). Enrollment in credit-bearing library courses was also gained from computer records of that enrollment (Murray et al., 2016). Uses of the library writing center and oral communication center were gained through student check-ins with identifying information (Murray et al., 2016).

Like Soria et al. (2013, 2014) the Murray et al. (2016) study is reliant on instances of library service use where student identifying information is available. In most of these instances, such identification opportunities are confined to electronic resource use, or instances in which such use is coordinated or authenticated through computer application (Murray et al., 2016; Soria et al., 2013, 2014).

Another similarity between Soria et al. (2013, 2014) and Murray et al. (2016) is that continuous variables are converted to categorical variables, which limits the analysis from one of incremental analysis of increasing numbers of library use instances and the relationship of those on retention, to one of any single initial instance of library use on the relationship with retention. Soria et al. (2013, 2014) does provide an evaluation of a single usage increase on student retention, which relies on a continuous expression of circulation. That continuous expression is not engaged in the baseline analysis of library use as it relates to student retention. Categorical variables limit the amount of knowledge that can be gained from a study, in comparison to an ordinal or numerical variable.

In summary, Murray et al. (2016) like Soria et al. (2013, 2014) engaged only library services managed or provided electronically, with individual identifying information automated in the service activity. This excludes several anonymous services, mostly engaged in the physical library environment, from the study. Data was gleaned through several computer systems specific to the institution being studied. Enrollment numbers were again used for participation in library instruction, not addressing student absenteeism to library instruction sessions. Retention was a single semester, from Spring-to-Fall in 2013. Statistically significant relationships between library use and student retention were found, with checkout, electronic journal access, and database access having predictive qualities to retention of both freshmen and sophomore students. Freshmen showed additional predictive qualities not shared with sophomores for computer lab use, communication center use, and writing center use. Results were limited to the single initial access of a library service in relation to retention because continuous variables were again translated to categorical variables.

LeMaistre et al. (2018) included student retention as a dependent variable in their study of student success relationships to library use. The study was conducted at Nevada State College Library in Henderson, a bachelor's degree granting institution. Using internal institutional data at the student level, LeMastre et al. (2018) found a relationship between online library resource use and one-term retention, when controlling for high school GPA, gender, first-generation college student status, and Pell Grant recipient status, at Nevada State College in Henderson, *Wald F*(1) = 16.64, *p* < 0.001.

The LeMaistre et al. (2018) study differed from the other student level unit articles in this review in two different ways. First, it was a study of a small bachelor's degree granting institution. The authors agreed with prior research that relationships between library use and student retention differ depending on the degree granting level of the institution being studied (LeMaistre et al., 2018). LeMaistre et al. (2018) chose to focus on the bachelor's degree granting level, rather than engage master's degree level granting institutions as the prior student level research had done.

Second, LeMaistre et al. (2018) collected data on the entire student population enrolled at the institution in fall 2015, 3,530 students, rather than relying on a sample. This model limited the possibility that the data used would not reflect the population being studied.

Soria et al. (2013, 2014) and Murray et al. (2016) focused primarily on electronic resource use, but did include physical services that had computer-based means of scheduling, organizing, and student level identifying information as part of collecting data for the services. LeMaistre et al. (2018) only includes electronic services as their independent variables. This made sense because the library collection is completely electronic at the Nevada State College Library. There is no physical collection. Authentication for resource use required student

identifying information regardless of whether the student was accessing library resource on-campus or off-campus. LeMaistre et al. (2018) also cites the small library staff size as logic for limiting the study to electronic resource use, presumably recognizing that such a data collection limitation would provide for needed economy of the task. As mentioned when addressing other studies, student level data collection with individualized identifying information is difficult if not impossible for many physical library service provisions, reference desk services being a glaring example of this.

Proxy server authentication and associated cookies were used to collect student level data on library use. The data was match to student information in student records using identifying student information. The data was then anonymized. Students could opt out of data collection, in which case data which had not previously been anonymized was not collected or used in the study.

LeMaistre et al. (2018) found that there was no statistically significant difference between users of library services and non-users base on gender, race, or first-generation status. They did find that no traditional students 25 years old or older, Pell Grant recipients, and individuals with higher GPAs were more likely to use library services, $p < .05$. 84.9% of library users were retained as students in the following term, compared to 66% of non-library users being retained as students in the following term, $\chi^2_{(1)} = 173.43$, $p < 0.01$, *phi ($\varphi$)* $= 0.222$. LeMaistre et. al. (2018) showed a relationship with one-term retention and library use at *Wald F*$(1) = 16.64$, $p < 0.001$, indicating that a one-unit increase in library sessions increased the likelihood of that student being retained to the following semester by 16.9%.

When comparing student level studies in the literature, we identify several study trends. First, the lack of associate degree granting institution studies enhances the understanding of a

need for research of that institution type. Second, studies have primarily concentrated on electronic resource use or those services managed electronically in a manner that readily provides identifying student information, leaving a gap in study of more anonymous physical library uses.

A third trend in the studies is either an assumed or a statistically significant expression of relationships between library use and other variables that have a positive impact on retention. Soria et al. (2014) found a relationship between student library use and GPA. Soria et al. (2014) also controls for demographic, scholastic and variables known to positively impact retention. Scholastic variables included Pell Grant recipient, first-generation student, pre-college AP credit transfers, and ACT/SAT scores. Soria et al. (2014) purposes to identify stand-alone impact of library services on retention and works to exclude other variable impacts on results.

In contrast, the methodology of LeMaistre et al. (2018) purposed to evaluate the relationship between library use and demographic or scholastic variables. The LeMaistre et al. (2018) findings that there was no difference in library use between gender, race, and first-generation status implies that there is no need to control for those variables in studies of library service use.

LeMaistre et al. (2018) findings that there is increased library use by nontraditional students, Pell Grant recipients, and those students with higher GPAs suggests that there may be some mechanism regarding how these students engage their education activities that makes them more successful, and includes increased likelihood of library usage. This idea is addressed more fully when discussing self-regulated learning theory in the theoretical frame section of this paper. Regardless, libraries have a mission to support all student clients, so controlling for different student types would decrease the usefulness of study results in planning future library services

tailored to all student types. However, it may be telling to engage variables of Pell Grant recipient status, nontraditional student status, and scholastic success indicators like GPA as potential moderators of relationships between library services usage and student retention at the associate degree level.

### *Summarizing Institution Level and Student Level Library Use and Retention Studies*

Summarizing the current literature on relationships between library services usage and retention into account, there are several major themes that inform the direction of the current study. First, there are statistically significant relationships between library use and student retention in all the studies located. Results differ between studies, based on level of degree granting of the institution, doctoral degree, master's degree, bachelor's degree granting, or associate degree granting institutions (Crawford, 2014; LeMaistre, et al., 2018; Murray, et al., 2016; Soria et al., 2013; Soria et al., 2014; Teske, et al., 2013). Teske et al. (2013) found different strengths of significant relationships between library use and student retention for some degree granting levels. The current study should be limited to one degree granting institution level.

Second, there is a limitation in the literature related to associate degree granting institutions, with none of the studies of library service usage applied to that level. The current study should attempt to fill the community college gap by focusing on that degree granting institution level.

Third, further attention is needed to the types of library services being studied. The institution level unit of analysis studies applied themselves to more traditional, non-digital library services (Crawford, 2014; Teske, et al., 2013). Student level unit of analysis studies have focused on services where identifying student information is available (LeMaistre et al., 2018;

Murray et al., 2016; Soria et al., 2013; Soria et al., 2014). This identifying information is more prevalent for electronic services. Because of the difference between what specifically is being studied in institution level unit and student level unit studies, overall institution numbers vs. individual student activities, comparisons between the two study type results can only go so far. The combination of these understandings leaves a gap in the literature regarding comparison of all library services usage variables, specifically and in totality, as they may or may not relate to student retention. A study is needed that includes both electronic resource use and non-digital face-to-face services use that offer more anonymity. In a world where mistaken logic is easily applied equating modern with better, a risk exists of removing or limiting more traditional non-digital services, such as reference desk interactions or gate counts, which are reflections of physical library space use, without considering whether such traditional services may, in some ways, be outperforming digital services in retention relationships.

A fourth concern is that library services usage is more effectively studied within the library, rather than attempting to include them in an overall institutional regression model. Crawford (2014) is an example of how library impacts can be overshadowed in a model where more robust variables are also introduced into the model. The study should include only library service independent variables, and not attempt to engage effectiveness of services existing external to the department.

Fifth, a model that engages continuous variables more fully would be advantageous to gaining additional information regarding the nature of relationships between the library services and retention. Those variables should be evaluated for their individual relationships to retention, as well as their combined predictive relationship to retention. Crawford (2014) used an index which removed the ability to test how each variable in that index impacts the predictive nature of

that index on retention. Teske et al. (2013) engaged a model that looked at the relationship of each library use type with retention, but did not combine them into an overall predictive model to discover which library services offer unique predictive impact to the model's relationship with retention. Of the student level studies conducted, all of them translated continuous variables to categorical variables as a function of their methodology, limiting their ability to more significantly engage the relationship's nature above that of a single initial instance of library use or a single unit use increase of the service above that initial use activity (LeMaistre et al., 2018; Murray et al., 2016; Soria et al., 2013; Soria et al., 2014).

Last, in a single study, Pell Grant recipient status, nontraditional student status, and GPA have all shown significant relationships with frequency of library use (LeMaistre et al., 2018). The LeMaistre et al. (2018) study was of a library that was primarily electronic in nature. While there was a physical library, housing computer access and study space services, the collection consisted of only electronic materials such as eBooks and journal databases. Access to these resources was counted through proxy server authentications which could have been initiated from computers either in the physical library, or from computers in dorm living spaces or off campus.

Studies of moderation by these variables on library use and retention relationships should consider their specific impact on the relationship between service use confined to the physical library space and student retention. Because Pell Grants are provided based on socio-economic status, recipients are more likely to have financial needs that impede residence-based computer access. That need may manifest through a lack of internet access or computer equipment sufficient to complete study activities. Less expensive residence accommodations are less likely

to include spaces specific to study activities, without which such students may be less likely to control distractions as part of self-regulated learning activity.

Nontraditional students may be less likely to have distraction free study spaces at their residences, based on competing responsibilities, such as parenting and other adult home life obligations. Nontraditional students may also be less likely to remain on campus outside of in-class instruction time, because of other adult obligations. As a result, they may be less likely to prioritize use of the physical library as part of their learning strategy. If it is the case that a relationship between physical library use and retention is moderated by nontraditional student status, knowing the direction and nature of that moderation would be useful in community college planning addressing that retention.

Use of the physical library study space and physical computer labs are reflected in the gate counts variable reported on the ACRL Annual Survey (Association of College and Research Libraries, 2019)  GPA average is not reported on any known institution level community college annual report. Nontraditional student ratios are also not reported institutionally, but measures of traditional student enrollment reflecting student enrollments within the first 12 months of high school graduation are reported (National Center for Education Statistics, 2019a). Pell Grant recipient numbers are reported on IPEDS (National Center for Education Statistics, 2019c).

**Total Library Expenditure**

*Definitions*

Total library expenditure has been used in studies to address the connection between financial input into library programs and outcomes desired through the institution's activities. One of the outcomes studied is student retention. Mezick (2007) conducted the initial work on the relationship between library funding and student retention. To cast a large, industry wide net

across all bachelor's, master's, and doctorate degree granting institutions, the use of two data sets was needed. Total library expenditure, which is the total amount of money spent to provide all library services for an institution of higher education, was reported on the Association of Research Libraries (ARL) annual survey, as well as ACRL Academic Library Trends and Statistics annual survey.

Institutions reported to one of these surveys depending on their library and parent institution type. Some institutions with research missions may have reported to the ARL survey and could have been excluded from the ACRL report. Likewise, some institutions that focus primarily on education and do not have significant research missions may have only reported to the ACRL. As a result, for Mezick (2007) to achieve a more comprehensive analysis of the academic library field, Mezick (2007) used data from both studies. At the time of the Mezick (2007) study, ACRL annual survey was using the ARL survey instrument. ARL was also providing access to ARL survey data for inclusion into the ACRL annual survey data. This activity provided a seamless definition of total library expenditure in reporting instructions.

In a study of institutions reporting to the Southern Regional Education Board, Teske et al. (2013) also studies student retention as it relates to total library expenditure. Teske et al. (2013) report to use a similar methodology to Mezick (2007). The definition of total library expenditure gained through the National Center for Education Statistics (NCES) matches ACRL annual reporting definitions.

Eng and Stadler (2015) also studied retention for relationships with total library expenditure. Total library expenditure data was collected from ACRL Metrics, which is the tool used to extract data from the ACRL annual report. Reporting methods similar to Mezick (2007),

Eng and Stadler's (2015) definition of total library expenditure also meets the confines of the ACRL reporting standards.

Crawford (2014), in a study of the relationship between retention and library finances, refers to the finance variable as "library expense." This variable comes from the Academic Library Survey (ALS), a report managed by the National Center of Education Statistics. The ALS was discontinued in 2012. ACRL Library Trends and Statistics Survey took up the role of providing data previously provided by ALS to academic library researchers (ACRL, 2020).

Total library expenditure is the total annual expenditure for the library department, as reported on the ACRL Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). This number includes all money spent on personnel, materials, resources, and service contracts necessary for running the library for the fiscal year.

Several studies have used Academic Library Trends and Statistics survey data to conduct studies of library expenditure (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007). Teske et al. (2013) used National Center for Educational statistics reported figures for total library expenditure, which mirrors that present in the Academic Library Trends and Statistics survey.

### Empirical Research

Library expenditure is important because it expresses a financial bottom-line impact understanding often taken by college administrators. This logic includes two variables, an expected institutional outcome and a financial bottom-line. Administrators search for a balance between impact and cost. In an effort to provide information in evaluating such a balance, library leaders engage return-on-investment (ROI) studies to evaluate and present library effectiveness. An example of such an ROI study is discovering the relationship between student retention, the return in the equation, and total library expenditure, the investment.

ROI is an attempt to quantify the effect of monetarily input, in this case total library expenditure, on one or more dependent variables, in this case student retention. Studies of relationships between total library expenditure and student retention are a type of ROI because they focus on an outcome as it relates to an expression of monetary investment in department activity.

Despite ROI's usefulness, it does have weaknesses, which are relevant to total library expenditure's placement as a control in the current study. The use is often defensive and reactionary to modern constrictions in the financial environment, as parent educational institutions within which libraries exist search for ways to produce cost savings within budget limitations (Town, 2011). As a result, some applications of ROI analysis may be seen as biased attempts at salvaging funding rather than legitimate attempts at identifying and engaging service planning.

Another weakness is that there is no standardized model, or even consensus on methodology to be used in the field of library sciences to produce consistent, appropriate, and effective ROI evaluation (Kaufman & Watstein, 2008; Town, 2011). ROI also ignores intangible knowledge assets in favor of evaluation of more easily measured assets of a financial nature. Easier or more accessible evaluation does not always imply more accurate or effective evaluation, and intangible assets such as service evaluation could provide enhanced value assessment (Town, 2011).

Alternative ROI measures have been suggested in the form of "multivariate statistical methods, productivity measures, social & behavioral models, social return-on-investment, contingent valuation, and regression analysis" (Kaufman & Watstein, 2008). The current study proposes to test that logic at least partially, by conducting multivariate regression analysis on the

relationship between library service usage and student retention after controlling for the effect of library expenditure on that same variable. In so doing, it is hoped that the study can identify the impact of less monetarily linked service benefits on student retention, which would not be discoverable in more traditional ROI analysis between total library expenditure and student retention.

Work on return-on-investment through evaluation of total library expenditure was conducted by Mezick (2007). In an industry-wide study using ACRL Annual Statistics data Mezick found correlation between total library expenditure and student retention, $r$=.453 for the total population, which including bachelor's, master's, and doctoral degree-granting institutions. The relationship relating to bachelor's degree-granting colleges was moderate at $r$=.505, weak related to master's degree granting institutions at $r$=.318, and weak but close to moderate for doctoral degree granting institutions at $r$=.476.

The methodology of Mezick's (2007) study was later reproduced in a similar study by Crawford (2014), indicating highly significant correlations between library expense and retention $r$=.608, second only to instruction expense $r$=.686. Crawford further stated that the instruction expense coefficient of determination explains 50% of the variance for retention, while library expense had a coefficient of determination of 37% for retention. As mentioned previously, Crawford's study also addressed the relationship between a library service index (including circulation, interlibrary loans, gate counts, instruction session attendance, and reference transactions), finding correlation at $r$=.390. Additionally, in the multiple regression model including instruction expense, research expense, public service expense, academic support, student service expense, institutional support expense, library expense and total library service index (all per FTE), the variables of library expense and total library service index were non-

significant, indicating that they add nothing to the predictive capability of the model, in predicting retention (Crawford, 2014).

It is possible, that library expenditure, similar to the previously addressed library service index in Crawford's (2014) study, dropped out of Crawford's total university predictive model due to the parallel nature of library services, in total, with service types associated with each of the other overarching institutional, college/university level expense types. Library expenditure and services are the only variables in the model that do not express an overarching institution wide service type, but rather expresses one department and/or a specific location that a service is being produced or addressed in. It is much like if one separated out the sociology department's budget and expressed its instruction expenditures separately from the instruction expenditures of the rest of the institution; you would likely see no statistically significant value added to the model with the inclusion of the sliver of sociology department data.

In other words, within the library service expenditures, the library is providing for library instruction services, library research services, library public services, academic library support, library student services, and library institutional support services. Because these library services, existing within the library department total budget, mirror the effect of the parallel overarching institutional services, the effect of total library expenditure budget is masked when considering Crawford's larger multiple regression model. It becomes necessary to evaluate library expenditure and resulting library services external to the overarching institutional model, to evaluate actual and specific library department impact on student retention.

Eng and Stadler (2015), while attempting to reproduce Mezick's work, concluded that library expenditure was no longer related to retention for all institution types studied. Their findings supported Mezick's regarding bachelor's degree-granting institutions, presenting a

moderate relationship between library expenditure and retention. They found that for master's degree-granting institutions, there was a negative correlation between total library expenditure and retention, however this finding was not statistically significant. Although the finding was not significant, Eng and Stadler concluded that because the non-significant findings represented a negative relationship, that Mezick's prior findings of a positive relationship were not supported. They speculated that this shift regarding master's degree granting institutions could be due to a recent shift from face-to-face on campus instruction to online learning, where physical library service impacts are limited due to lack of student physical presence on campus. The study had conflicting results for doctoral granting institutions, a negative relationship at $r=-.033$, in 2010, but positive relationship at $r=.5$ in 2011.

It should be noted that two of these three studies excluded community colleges and other institutions where the highest level of degree granted was two year or below (Mezick, 2007; Crawford, 2014). Eng and Stadler (2015) included institutions that granted no greater than an associate degree, finding that no relationship between library expenditure and retention could be gleaned from the results, $r=-.031$ for 2010 and $r=.007$ for 2011. That said, Eng et al. (2015) findings did not conform with Mezick or Crawford in other categories, representing an inconsistency in the literature in those shared categories. The combination of a near non-existent expression of community colleges in the literature combined with the inconsistency of Eng's overall results with other researchers expresses an understanding that further study is needed. See table A1 for total library expenditure results for the studies presented.

### *Conclusions*

Town's (2011) understandings are sound, that return-on-investment evaluation models' disregard intangible knowledge assets, such as service evaluation. To truly grasp the value of

libraries to their parent higher education organizations, we must address more than the bottom-line financial implications of that value. We must also evaluate the effect of student use of library service, and the effect of usage of each service type within library service, through an understanding of the impact on student success. Student success could include many different variables. In the case of this dissertation, this will be expressed similarly to most other library service and total library expenditure studies through the more specific measure of student retention.

One of the issues related to the discovery of such service effects is the prior research expressing a correlation between total library financial expenditure and student retention (Mezick, 2007; Crawford, 2014). How do we know that the correlations we see in library service use studies are specific to the actions of the service, and not expressions of library financial expenditure being reflected in the success of the services it funds? The answer lies in controlling for the effect of library financial expenditure, statistically, prior to conducting multiple regression analysis of the library service use relationship with student retention.

Studies by Mezick (2007), Crawford, (2014), and Eng and Stadler (2015) all support viewing level of degree granting (bachelor, master, doctorate) by institutions as a moderator. This is because the education mission, goals, and duration of student study activity are different for these different types of institutions, and relationships with retention have been consequentially different. Eng and Stadler's (2015) findings support adding a fourth group of associate degree granting institutions, to further understand that institution type. The limit in prior research specifically addressing community colleges makes focusing on this type of institution appropriate.

Eng and Stadler's (2015) speculation about the role of the shift from on-campus, face-to-face instruction to online instruction on their inability to reproduce prior work by Mezick (2007), is an example of the kind of usage shifts that Pritchard (1997) warned of. In her work on total quality management in library services, Pritchard (1997) presented an obligation to better understand shifting library service needs of users in order to target expenditures on innovation of services that were more relevant to the client community. Within the resulting literature framing, to meet Oakleaf's (2011) expectations of enhancement of library value, timely research engaging library usage while controlling for total library expenditure is needed. The expectation of continuous improvement of library services demands it.

Crawford's (2014) experience with his multiple regression analysis supports the idea of evaluating library activity separate from total parent institution regression studies on retention. Library leaders are responsible for library functionality in supporting parent institutional goals, and gain little in the way of insight for doing so through the engagement of parent institution level multiple regression models that appear to mask specificity of library service and expenditure impacts, while simultaneously expressing strong significant results of library services on those same parent institution goals.

**Relationships Between Library Expenditure, Library Service Use, and Retention**

*Empirical Research*

For us to truly understand the relationship between the three variables in this study, we must understand them as input, output, and outcome. Total library expenditure is the financial investment that makes library services possible, and as such should be considered an input. Library service usage, both in total and individually by specific type, should be understood as the output produced through library activities. These activities are impacted by library funding but

include the application of many additional nonfinancial inputs. These nonfinancial inputs could include enhanced staff knowledge, structural systems designed to provide services in more efficient ways, customer service behavior that ingratiate students causing them to continue using the library, and/or imaginative service provisions that target outcomes while producing cost savings. Outcome is the actualized impact of the output in achieving a particular expectation, in this case student retention.

Studies of total library expenditure as it relates to student retention are attempts to identify connections between input and outcome. Such studies include Mezick (2007), Teske et al. (2013), Crawford (2014), and Eng and Stadler (2015). As mentioned previously, all these studies have shown relationships between library expenditure and student retention, even as they differ in their more specific findings.

Eng and Stadler's (2015) findings of non-significant results in master's degree-level institutions and associate degree institutions, and their logic for why lends credence to two overarching assumptions. First, they give credence to Pritchard's (1996) understanding that service needs change over time, and it is the responsibility of library administrators to identify those changes in need and apply services in a targeted and fiscally appropriate manner that addresses them. Second, it lends credence to Town's (2011) assessment that ROI studies that solely address financial expenditure fail to address less tangible benefits of the resulting services provided. The point being that studies of relationships between total library expense and student retention cannot address the more granulated service activities being funded in a manner that accurately informs administrators of what services need changing in order to facilitate an enhancement of the relationship between financial input and student retention outcome.

Soria et al. (2013), Murray et al. (2016) and LeMaistre et al. (2018) all found significant relationships between library service use models and student retention. The library services included in each study's model are different from one another and based on the availability of identifying information for student level inclusion. They are also different based on the technology available for data collection within each study. Variable inclusion in the model is thus not a result of variable effectiveness or uniqueness in predicting the dependent variable.

Any measure of cost of the library services is not presented, so it is not possible to tell whether the benefit of the services exist above or unique from the cost of their provision. It becomes impossible to tell whether the service variables included are the most effective in the libraries service arsenal in meeting student retention outcomes, and it is equally not possible to rule out library service relationships as merely a passthrough of a larger relationship between the retention outcome and financial input.

Crawford (2014) and Teske et al. (2013) attempt to address both financial input and service output, as each relates to the outcome of student retention. These studies, however, do not take as holistic a view of the services being studied as is possible. The methodology of each study, while suited for their proposed tasks, do not allow for a complete picture of the input/output/outcome structure. Relationships are studied as either total library expenditure or library service use, as each relates to student retention. The relationships between library expenditure and the library services produced are never addressed, nor is there any analysis of the differences between the relationship finding with student retention, present between total library expenditure and library services.

To illustrate, Crawford (2014) found relationships between retention and total library expenditure at $r = .607$ $p = .01$. Crawford (2014) also found a relationship between student

retention and his library index at $r = .39$ $p =.01$. The two findings are presented separately without any understanding of why their strengths are different, and we are not informed as to whether, statistically, the smaller relationship of the library index is unique from the stronger relationship with total library expenditure.

Teske et al. (2013) have similar differences in strengths between total library expenditure and the individual library service types he includes, but, like Crawford (2014) does not address the uniqueness of the relationship of each service type to student retention, in relation to the total library expenditure findings.

### *Conclusion*

Several studies, as expressed in this section, have addressed the relationship between retention and total library expenditure. Other studies have addressed the relationship between retention and library use by students. Very few have addressed both, but even those have not addressed any potential relationship between the two. There are questions that remain unanswered by the literature. Are the relationships between library services and student retention unique from relationships between total library expenditure and student retention? Are the library service variables addressed in the literature the most impactful variables in the student retention relationship, or are they merely the most convenient to study? Can a study be designed that allows for more effective administrative decision making that tailors library service provision and targets funding expenditure to enhance student retention outcomes?

## Theoretical Framework

### Self-Regulated Learning

There is a largely consistent relationship between library service usage and student retention in the literature. What theoretical mechanisms is responsible for this connection? The

answer to this question must engage logical similarities between the processes or operations inherent to each of the included variables.

Consider what educational provisions each of the library service variables provide the learner. The use of books, which is expressed by circulation numbers of those books, represents the student's search for knowledgeable information expressed in greater detail than magazines or short web-based posts can convey. Electronic circulation is the electronic equivalent of book circulation and includes eBooks and streaming media usage by students. Physical and database inclusion of scholarly journals into libraries are also valued for the devotion to accuracy and in-depth consideration of subject matter inherent to the articles' included. All these material types engage editorial processes that promote quality and accuracy of the work, greater than a student would find if they used alternative resources with a lack of or limitation in such editorial activities. Such resources are additionally scrutinized for accuracy by librarians as part of collection development procedures. In essence, what is occurring when students choose to use the professionally vetted resources provided through the library, is that students are seeking out knowledgeable advice on a topic, given asynchronously through both physical and digital expression.

Research consultations, reference services, and library instructional services are ways of affording students access to or introduction in librarian specialized knowledge and skill. Such skills include professional level research techniques, citation assistance, and, at times, introduction of the student to new study or research techniques.

Use of the physical library space is measured by gate count of individuals entering the library. The physical space of the library is traditionally designed and engaged as a study environment. While the study space and study tools provided have been technologically

enhanced or otherwise changed to facilitate new paradigms in study techniques, the core purpose of providing an effective study space to students has not changed. Students may choose different types of learning methods based on their preferred learning styles or the nature the subject matter being addressed. An example may be learning in groups vs. learning individually. The student may actively choose a secluded space for study or purposely choose a table close to classmates when peer-to-peer learning is anticipated or wanted. Regardless of the individual choice, there is a choice being made, and one that is allowed by the physical layout of the library, purposely designed by library administrators to facilitate effective learning. The choice by students to use library study space, when other areas on the campus have not been selected, engages some type of logic which likely deduces the intended purpose of the library space.

The running themes of library services, and the voluntary use of those services by students, align closely with self-regulated learning theory (SRL). Albert Bandura conducted the seminal work in this theory, which was then grown, enhanced, and expounded on by later researchers (Benbenutty, 2011b). SRL addresses the psychological and behavioral self-control of the learner in their scholarly efforts (Benbenutty 2011b). Within this psychological and behavioral frame are studies of motivation, self-efficacy, and regulatory processes used by learners to continue and complete learning projects when faced with deterring factors (Benbenutty, 2011b). Self-regulation skills acquisition and use enhance the likelihood of persistence in short-term and long-term learning goals, and enhance the quality of student coursework (Lichtinger & Kaplan, 2011).

Weinstein et al. (2011) professes a link between learner acquisition of self-regulated learning strategies and enhancement of student success, persistence, and student retention. Zusho

and Edwards (2011) also states that students who lack self-regulation skills may be more likely to not be retained.

Motivation in SRL is anchored in achievement goal theory (AGT), which addresses the underlying reasons for student motivation in learning (Anderman and Maehr, 1994; Kaplan and Maehr, 2007). AGT is concerned more with the why of goals rather than what the goal is (Anderman and Maehr, 1994). For instance, in a community college, the student's what goal in coursework may be to get a degree, which will then lead to a good job. Within that goal, an additional what goal may be to get a good GPA, which will enhance the likelihood of getting a good job after graduation.

A why goal is concerned with why the student engaged in learning and is a more granulated expression (Anderman & Maehr, 1994). Examples of why goals may be to learn a new topic, to enhance one's experience level in a previously learned topic, to develop more fully to a state of self-actualization, to become more skilled in a particular activity, to compete with other students, to prove intelligence, or not to appear stupid. All of these why goals, if accomplished, will likely lead to completion of the what goals as a byproduct, but the point of the motivating why goal is more localized to the activity of learning, rather than a proposed future outcome that is less grounded in the current context of the student's existence. Why goals are more directly related to the tasks being conducted within the currently existing learning environment.

Within the why goal, there are two different types of motivations (Ames, 1992). One of these is the mastery motivation, within which the why goal is focused on enhancement of knowledge or skill for the sole purpose of enhancement of one's knowledge or skill (Ames, 1992). In other words, this is learning for the sake of learning. There is also the performance

motivation, which is more focused on external impacts within the why goal (Ames, 1992). Examples of performance motivation could be not appearing stupid, outperforming peers, and appearing intelligent.

Mastery and performance motivations both articulate with avoidance and approach frames, that inform on whether the student is either attempting to acquire something or prevent something (Elliot, 1999; Elliot & McGregor, 2001). As an example, a mastery approach frame would be a student learning the Spanish language because that student wants to become a better Spanish speaker, whereas a mastery avoidance frame would be if the student got a job in Mexico and was learning Spanish because he did not want the future experience of not being able to communicate properly when he got there. Both frames deal with an internal desire to learn to speak Spanish, but one is approach oriented in a way that engages personal growth as the motivator, while the avoidance motivator is more interested in avoiding the inability to communicate.

In a performance approach frame, the student may want to learn Spanish out of a desire to show others how intelligent he is because he is bilingual. If the student was performance avoidance, the student may be motivated to learn Spanish out of a desire not to look stupid to locals during his trip. Note that both the performance approach and performance avoidance are concerned with what other people think, rather than what the student thinks or feels internally unrelated to external observers (Elliot & McGregor, 2001).

Note the difference between mastery avoidance and performance avoidance examples. The mastery avoidance frame is concerned with the internal feelings of the learner, not connected to the opinions of other people. The performance avoidance frame is concerned with what other people think, or, in other words, the display of ignorance (Elliot & McGregor, 2001).

A performance avoidance frame offers the potential for a student to meet the goal by only communicating in instances where limited vocabulary would not present a deficit to others. A mastery avoidance frame goal is not satisfied through such action, because the student still feels less functional even if he has fooled others into believing he is not.

Of the four frames, the mastery approach has been shown to be more positively related to student self-regulated learning (Lichtinger & Kaplin, 2011). Sommet and Elliot (2017) engage a more modern understanding of these concepts in a study addressing interactions between mastery and performance, approach and avoidance, and two self-determination theory (SDT) reasons for learning, autonomous and controlled reasons.

SDT addresses the needs of competence, relatedness, and autonomy as they relate to what goals an individual pursues and why. Within SDT, the degree of internalization of regulations exists on a spectrum from least internalized, controlled, to most internalized, autonomy (Deci & Ryan, 2000). For instance, if an algebra student believes that there is no future moment in which he will apply algebra, then that student will likely find himself closer to the controlled end of the spectrum when taking an algebra class. Alternatively, if that student recognizes the value of algebra in a future or current activity, that student would likely find themselves closer to the autonomy side of the spectrum.

Sommet and Elliot (2017) engage motivations in the earlier framework of articulation between mastery vs. performance and approach vs. avoidance, adding autonomy vs. controlled concepts from SDL to the study of motivation. Four studies were conducted, three of which were conducted on Amazon Mechanical Turk users. The fourth was conducted on a medium-sized U.S. university using SONA Psychological Research Participation System. Sommet and Elliot (2017) found that, when evaluated separately mastery goals and autonomous reasoning similarly

enhanced self-regulated learning outcomes, including deep learning, interpersonal help-seeking, challenging tasks, and persistence. They then considered the simultaneous impact of mastery orientation and autonomous reasons on the pursuit of the goal, and found that mastery orientation and autonomy explain independent variance in comparison to one another. The independent variance implied that the two motivational constructs expressed distinctly different processes that influence motivation in a similar way. However, when either mastery or autonomy were evaluated when controlling for the other, both showed a decreased predictive strength for the self-regulation variables explained. There appeared to be an overlap occurring between mastery and autonomy expression. Motivation in SRL theory is then impacted in a more complex way by the mechanisms of AGT and SDT.

If we engage library services use as an application of SRL, then we can reasonably apply the known implications of AGT and SDT to student motivation to use the library. Specifically, students high in mastery approach motivation, coupled with a more autonomous reasoning should be more likely to use library services than those who are performance avoidance motivated, coupled with controlled reasoning. If that is the case, then we should expect increased library use fueled by the mastery approach, autonomous motivational frame to produce more positive SRL outcomes in persistence in short-term and long-term learning. When we discuss student retention, we are essentially discussing persistence in educational activity to a fixed point, e.g. single semester retention, fall-to-fall retention, or retention to graduation.

SRL models presented by multiple authors all share three similar phases, the forethought phase, the enactment phase, and the management phase. The forethought phase includes activities of preparation for learning, such as defining tasks that need to be performed and planning. The enactment phase includes all activities conducted once the learning process has

started, including monitoring, controlling, and evaluating learning while engaged in learning

tasks. The management phase includes post learning activities, such as reactions to and

reflections on the learning process and activity after completion (Pintrich, 2000; Zimmerman,

2000; Zusho & Edwards, 2011).

The three phases of SRL can be applied to library use. As a base level decision-making

function, a trip to the library is a forethought phase decision. Students, especially students who

successfully and consistently use library services, likely engage some form of forethought

planning related to the activity. As an example, the cognitive decision to go to the library to

research for a particular paper is an example of forethought in a learning task, if we consider the

research for and production of a paper to be a learning process.

Once in the library, decisions must be made regarding what resources to use and how to

use them. If the student is familiar with library research processes, he may act on his own. If the

student is less familiar with research processes, he may seek out help from the librarian through

reference or consultation services. That is an example of an enactment phase application.

Finally, if the student's engagement of library research methods does not produce a

successful learning outcome, the student will likely write a research paper that is insufficient, and

receive poor marks as a result. The student then engages the management phase opportunity to

discover why efforts produced a less than sufficient outcome and will apply the knowledge

gained to produce a more success educational outcome in future library service uses. The logic of

this example can also be applied to non-research library services, such as peer-to-peer learning,

individual study, or other learning applications in library study spaces.

Self-regulated learning includes a toolbox of skills that together produce a higher

likelihood of persistence and learning success. These skills include controlling the environment

within which learning will occur, seeking appropriate help when the need arises, seeking out and engaging self-regulation opportunities, metacognition in the development of study practices, acquisition of effective cognitive learning strategies, and delayed gratification (Benbenutty, 2011a).

The study environment should be controlled in a way that physically enhances the use of self-regulation (Lichtinger & Kaplan, 2011). Environment should also be considered to avoiding distractions (Bembenutty & Karabenick, 2004; Bembenutty, 2011a). Students enhance their likelihood of success by controlling their study time and environment to facilitate task focus, effective use of time, and regulate effort. They manage and plan study schedules, and monitor their activities to ensure that they complete assignments and readings on time (Bembenutty, 2011a).

Seeking appropriate help is an important SRL activity. It implies not merely seeking help when needed but seeking help from a knowledgeable individual in the content and education task. Self-regulated learners ask for help to enhance their success and do so strategically. Such help seeking would logically be more prevalent in learners with a mastery approach motivation frame, because such students are more interested in mastering the content than feeling or looking stupid, or appearing as though they understand content that they in fact do not (Karabenick & Dembo, 2011). There is also an understanding that in peer-to-peer assistance, the knowledge level of the peer who is assisting the less knowledgeable student is also enhanced by the action of helping (Lichtinger & Kaplan, 2011).

While SRL skills applications can exist in areas outside of the library, such activities occur significantly in library use. Students recognize the library space as one of limited distraction, with a scholarly purpose, where study practices are engaged and learning strategies

are employed. Research and study tasks inherent to effective library use are not prone to immediate gratification. For example, students who put in limited time and energy on research tasks will likely produce less successful research products. Additionally, students who put in minimal time and energy in their study endeavors will likely have disappointing learning outcomes.

Self-regulation opportunities are often limited by well-meaning individuals. For instance, Zucho and Edwards (2011) present the understanding that many modern college students are often still significantly connected to their parents regarding the regulation of behavior. There sometimes exists a tether between students and their parents whereby the parents assist with coursework, edit projects, contact professors in problematic instances of learning, and remind students to turn in coursework on time. All these parental engagements appear appropriate on face value but limit the experiences necessary to engage behavior of SRL in the student. The importance of SRL to educational persistence and student success requires students to seek out instances of SRL to practice and acquire the behavioral characteristic engaged within SRL (Zucho & Edwards, 2011). Library users purposely and voluntarily place themselves in an environment that offers SRL opportunities. Students who use the library are assisted by librarians when the students ask, but, absent that request, are completely in control of their own learning methodology as they tackle learning tasks.

Metacognition is the ability to understand your own thought processes. Understanding your cognitive learning processes is a necessary step in recognizing thought patterns and learning practices that positively or negatively impact your learning (Weinstein et al., 2011; Flavell, 1979). If faculty are purposeful in planning not only their expectations for content learning, but also the SRL processes and activities that they expect students to do in completing that learning

task, communicating those expectations to the student, students can be more successful in self-monitoring their learning processes (Weinstein et al., 2011). In addition to these forethought and enactment phase activities, reflective engagement of how the student arrived at incorrect answers on tests and projects applies the management phase of SRL to enhance student learning (Karabenick & Dembo, 2011).

Students often use library services in response to a faculty assigning a research or study project. In many of these cases, expectations are present in the syllabus, assignment instructions, or associated rubric. When asked, these three documents are often relied on by librarians when they assist students in library related learning processes. The actions performed by the librarian in assisting with learning processes that engage these assignments are counted as reference transactions or research consultations.

In SRL, knowledge of learning strategies is important, but such knowledge must include more than just an understanding of the strategies. To be skilled and successful, self-regulated learners must know themselves, develop a repertoire of learning techniques, and be able to recognize a successful match between a technique in that repertoire and the current learning task and content. The learners must know their own strengths and weaknesses, as well as how they prefer to learn, so that they can apply that knowledge specifically to their own learning challenge. As they engage a new content type, discipline, or learning task, they identify how that learning context engages their strengths, weaknesses, and preferences. Once all the dynamics of the learning scenario and the individual involved have been addressed, the student must then choose an appropriate learning strategy with which to address the learning task (Weinstein et al., 2011).

Examples of learning strategies are rehearsal, elaboration, and organization strategies. Lower level rehearsal strategies, such as passive repetition where words are repeated without higher cognitive engagement does not enhance learning, but active rehearsal methods that engage higher order cognition in repetition do have positive learning outcomes. Examples of such active rehearsal are the use of flash cards addressing word definitions, identifying derivative terms or sources addressing the learning content, repetitively using the content correctly in conversation, or applying the concepts in problems (Weinstein et al., 2011).

Elaboration methods are those that enhance or modify the content in a way that fosters learning. Activities such as summarizing content, forming analogies, comparing or contrasting terms, applying the content in creation of a new product, or explaining it or teaching it to another student are all examples of elaboration methods (Weinstein et al, 2011).

While all these learning strategies can be employed in the library, some stick out as particularly relevant. Elaboration methods such as summarizing content, forming analogies, and comparing and contrasting terms can all be seen as relevant to the library research process. Identifying derivational or alternative information sources that address course content is integral to the library's role in providing supplemental materials on course topics. The creation of a new product that includes learned materials is the very essence of a research paper or other research assignment. Each of these applications within the library setting is likely to produce library service usage counts in book circulation or database use.

Organization methods are those that display or engage the structure of a concept. These include concept maps, outlines, cause-effect diagrams, and diagrams that address relationships within the concepts being learned. The effectiveness of different organization methods in enhancement of learning is reliant on whether higher or lower order cognition is engaged. Simple

outlines, for instance, engage a much lower level of cognition than does a concept map or relationship diagram (Weinstein et al., 2011). Such methods can be employed while studying for exams, or when planning the organizational structure of a research paper.

Students who have delay of gratification skills tend to be more academically successful than those students who do not. Such students can set aside potential immediate rewards for higher quality rewards that come with time and effort. Students who practice delayed gratification have also been shown to have higher levels of task, self-efficacy, motivation, and use of effective cognitive learning strategies (Bembenutty, 2011a). Bembenutty and Karabenick (1998) found relationships between academic delayed gratification and self-efficacy, and academic delayed gratification and motivation in two studies of undergraduate students at a Midwestern university. Bembenutty and Karabenick (2004) review the consistent history of findings of relationships between successful self-regulation activities and academic delay of gratification.

As mentioned previously, delay of gratification is practiced in library research activities and enforced through grading outcomes in the resulting quality research products. Poor research products often result from limited time and effort on the part of the student. Students who have not yet acquired delayed gratification skills are likely more prone to accepting poorer quality research outcomes, if it means a more expedient route to paper completion.

While SRL has a much broader context than merely library service applications, it lends itself well as a theoretical underpinning in this study. Similarities between library service implications and the SRL theoretical frame abound. While SRL is likely not the only theoretical construct that engages library services, its mechanisms are evident in many aspects of learning related to student library service use.

### *Library Services Use as Self-Regulated Learning*

Beatty (2016) conducted a qualitative study, interviewing 21 students, 11 female and the rest male, at the University of Calgary in Canada, to discover connections between student preferences in physical library space and self-regulated learning engagement. Students' reports confirmed that students were purposefully visiting the library to engage SRL activities, and more specifically selecting particular areas of the library as a match for their personal study preferences and understandings of their learning strategies. While choices differed between desires of student study environment selection, the metacognition activities of the students showed considerations between study area selections within the library, as well as a function of modifying those space strategies based on learning task variables such as time constraints.

Students expressed specific explanations of their favorite study areas and were able to articulate exactly why they liked that space. Some students expressed ideals of limiting distractions, while others presented ideas of access to other students for peer-to-peer assistance or mini-breaks. Some expressed the desire for an open space with higher ceilings, while others preferred cubicles. Students preferred access to outlets for laptops or for computer access when laptops were not present. Table space large enough to lay one's things out on were also mentioned. Some students expressed a desire for quiet, while others wanted a small amount of ambient noise, and still, others wanted a louder environment. Some students did not express a concern for sound issues, reporting that they regularly listened to music on headphones while studying in the library. Most students expressed a desire to study alone, or within an area of other students individually studying. Most students expressed a dislike for group work, stating that they usually only do that when forced to by the learning task assigned (Beatty, 2016).

Students also expressed an understanding of changing preference of the environment, based on time and task management. Students who perceived that the task at hand had a limited time for completion or when greater concentration was needed moved from their normally preferred space to areas of the library with fewer distractions. Different learning strategies, such as reading, paraphrasing, diagramming, cue card, or self-testing work were considered when considering a library study space (Beatty, 2016).

Arp et al. (2007) present parallels between modern reference instruction practices and self-regulated learning activities. They present the idea that ACRL Information Literacy Competency Standards that librarians use to engage reference and instruction services engage SRL ideology through research planning, monitoring progress, controlling research activity, and persistence to project completion.

The idea of utilizing reference desk transactions as an opportunity to teach research strategies and skills, as opposed to just answering questions, is now common practice in reference services. When we do not engage how research questions are answered, or why particular research strategies were conducted, we remove ownership of the question and process from the student and enforce an inappropriate dependency on reference librarians in relation to learner information seeking. Research ownership by learners engage planning processes, scheduling of research activity, assessment of the quality of resources found, knowledge gap identification, revising knowledge acquisition strategies based on success or failure of the previous strategies used, and learning by doing (Arp et al., 2007).

There are concerns regarding novice student researchers' tendency of rely on insufficient articles and information found early in the research process, rather than searching more in-depth to gain more appropriate information (Arp et al., 2007). This is like academic delay of

gratification concerns. Such academic delay of gratification presents the idea that student success in learning is connected to the student's ability to decline immediate opportunities so that they can persist to a more beneficial future outcome (Bembenutty, 2011a).

Arp et al. (2007) state that students often do not have sufficient metacognition skills to monitor their own research strategies. Reference librarians can assist the student through prompts to elaborate or summarize search processes, and engage other tutorial techniques. These applications are indicative of the cognitive aspects of SRL.

The activities used by librarians to assist students in the library use engage SRL to enhance student success in research and other study activities within the library. Students who use library resources use processes and techniques presented in SRL literature. As a result of these links between student library use and SRL mechanisms, this study presents library service usage analysis as a proxy for the SRL mechanisms used therein.

## Research Question and Hypotheses

Uses of library services are byproducts of SRL application by students. As such, library use should positively impact student persistence in learning tasks. A relationship between library service and student retention should, therefore, be expressed statistically. As library service techniques modernize and change, they create a new model of library services with which to provide for the SRL needs of the student. If successful, the new model should remain appropriately related to student retention. Evaluation of the impact of each library service variable on that relationship informs on that variable's appropriateness for inclusion in a library service model that promotes student retention as a goal.

Such new models of library service include modernized services, such as chat reference, database, and eBook access, as well as more traditional services, such as reference desk services,

face-to-face instruction, physical study space provision, and physical book access. Expense of providing library services has increased in an environment where library budgets have not. Library service provisions are confined to financial realities, and library service quality in meeting SRL needs could be suffering as a result. If libraries are truly doing more with less, from an SRL frame, then library service relationships to student retention should outperform the total library expenditure relationship with student retention.

The variables of Pell Grant recipient ratios and percentages of nontraditional student enrolled at institutions have shown relationships with both library service usage and retention. These variables should be evaluated to discover if they have a moderating effect on the relationship between library service use and total library expenditure.

**Research Question for the Model**

**Research Question 1:** At community colleges in the United States, does library service usage account for additional variance in student retention beyond total library expenditure?

**Research Hypothesis 1:** Library service usage accounts for additional variance in student retention beyond total library expenditure.

**Research Question 2:** Does the number of physical materials circulated contribute to the predictive utility of the library services usage model?

**Research Hypothesis 2:** As part of the library service usage model, number of physical materials circulated accounts for unique variance in student retention.

**Research Question 3:** Does the number of eBooks accessed contribute to the predictive utility of the library services usage model?

**Research Hypothesis 3:** As part of the library service usage model, number of eBooks accessed accounts for unique variance in student retention.

**Research Question 4:** Does the number of full-text articles accessed contribute to the predictive utility of the library services usage model?

**Research Hypothesis 4:** As part of the library service usage model, number of full-text articles accessed accounts for unique variance in student retention.

**Research Question 5:** Does the number of reference transactions contribute to the predictive utility of the library services usage model?

**Research Hypothesis 5:** As part of the library service usage model, number reference transactions accounts for unique variance in student retention.

**Research Question 6:** Does the number of research consultations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 6:** As part of the library service usage model, number of research consultations accounts for unique variance in student retention.

**Research Question 7:** Does the number of presentations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 7:** As part of the library service usage model, number of presentations accounts for unique variance in student retention.

**Research Question 8:** Does the number of attendees at library presentations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 8:** As part of the library service usage model, number of library attendees at presentations accounts for unique variance in student retention.

**Research Question 9:** Does the number of gate counts contribute to the predictive utility of the library services usage model?

**Research Hypothesis 9:** As part of the library service usage model, number gate counts accounts for unique variance in student retention.

**Research Question 10:** Does the number of interlibrary loans contribute to the predictive utility of the library services usage model?

**Research Hypothesis 10:** As part of the library service usage model, interlibrary loans accounts for unique variance in student retention.

**Research Question 11:** Does the average of Pell-grant receipt at an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure?

**Research Hypothesis 11:** The average Pell Grant receipt by students attending a community college moderates the relationship between gate counts and student retention.

**Research Question 12:** Does the percentage of nontraditional students attending a community college moderate the relationship between gate counts and student retention?

**Research Hypothesis 12:** The percentage of nontraditional students attending a community college moderates the relationship between gate counts and student retention.

**Summary**

Within this chapter, definitions associated with the study of library use, library expenditure, and student retention evaluation were communicated. Information was presented on the nature of each of the library usage variables expressed in the ACRL Trends and Statistics survey, and the appropriateness of this data's use in this study. Historical framing of the early work on library usage as it related to student success was conducted, as well as the expressions of how that early work has transitioned into the current industry expectations for library service value attainment in higher education. The changing nature of library service needs in the face of

user expectations was expressed. Current research was presented, addressing the nature of the relationship between library expenditure and retention, as well as library usage and retention.

The progression of the research leads us to the understanding that there is a need for a study establishing library usage relationships with retention, after controlling for the relationship between library expenditure and retention, in order to truly evaluate library services. This study must be conducted in a manner that standardizes for institution size. The study should address associate degree granting institutions more specifically than has been done in past research, filling a gap in the literature where they are concerned. Such a study of library usage and retention needs to be at the institution unit level of analysis to facilitate greater standardization of variable definitions and methods of data collection. The study should evaluate potential relationships external to any matrix that includes other non-library, institutional service models that may run parallel to specific library services. Inclusion of such extra-library parallel service types can mathematically mask the library specific service impacts on retention, limiting access to information necessary for library administration decision-making in the furtherance of parent institution retention goals.

Chapter 3

## Introduction

This chapter explains the methodology for this study. The study will address whether library services use offers greater prediction with student retention above that of total library expenditure. Included will be descriptions of the specific population and geography being addressed, the needed sample size as expressed by power analysis, the research questions, hypothesis, variable definitions, measurements used, data collection methodology, and data analysis methodology. Threats to internal and external validity will also be addressed.

## Research Questions and Hypotheses

**Research Question 1:** At community colleges in the United States, does library service usage account for additional variance in student retention beyond total library expenditure?

**Research Hypothesis 1:** Library service usage accounts for additional variance in student retention beyond total library expenditure.

Null hypothesis: $R^2$ (library service usage + total library expenditure) $= R^2$ (total library expenditure)

Alternative hypothesis: $R^2$ (library service usage + total library expenditure) $> R^2$ (total library expenditure)

Library usage, as a model, includes:

1) Physical material circulation

2) Digital/electronic circulation

3) Number of e-serials use

4) Number of reference transactions

5) Number of research consultations

6) Number of library presentations

7) Number of attendees at library presentations

8) Number of gate counts

9) Number of interlibrary loans

All variables will be divided by the institutions' respective student FTE to offset effect of differing institutional sizes and standardize scores.

The study will address the following research questions and hypotheses.

**Research Question 2:** Does the number of physical materials circulated contribute to the predictive utility of the library services usage model?

**Research Hypothesis 2:** As part of the library service usage model, number of physical materials circulated accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of physical materials}} = 0$

Alternative hypothesis: $\beta_{\text{number of physical materials}} > 0$

**Research Question 3:** Does the number of eBooks accessed contribute to the predictive utility of the library services usage model?

**Research Hypothesis 3:** As part of the library service usage model, number of eBooks accessed accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{Number of eBooks circulated}} = 0$

Alternative hypothesis: $\beta_{\text{number of eBooks circulated}} > 0$

**Research Question 4:** Does the number of full-text articles accessed contribute to the predictive utility of the library services usage model?

**Research Hypothesis 4:** As part of the library service usage model, number of full-text articles accessed accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of full-text articles accessed}} = 0$

Alternative hypothesis: $\beta_{\text{number of full-text articles accessed}} > 0$

**Research Question 5:** Does the number of reference transactions contribute to the predictive utility of the library services usage model?

**Research Hypothesis 5:** As part of the library service usage model, number reference transactions accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of reference transactions}} = 0$

Alternative hypothesis: $\beta_{\text{number of reference transactions}} > 0$

**Research Question 6:** Does the number of research consultations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 6:** As part of the library service usage model, number of research consultations accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of research consultations}} = 0$

Alternative hypothesis: $\beta_{\text{number of research consultations}} > 0$

**Research Question 7:** Does the number of presentations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 7:** As part of the library service usage model, number of presentations accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of library presentations}} = 0$

Alternative hypothesis: $\beta_{\text{number of library presentations}} > 0$

**Research Question 8:** Does the number of attendees at library presentations contribute to the predictive utility of the library services usage model?

**Research Hypothesis 8:** As part of the library service usage model, number of library attendees at presentations accounts for unique variance in student retention.

Null hypothesis: $\beta_{\text{number of attendees at library presentations}} = 0$

Alternative hypothesis: $\beta$ ~number of attendees at library presentations~ $> 0$

**Research Question 9:** Does the number of gate counts contribute to the predictive utility of the library services usage model?

**Research Hypothesis 9:** As part of the library service usage model, number gate counts accounts for unique variance in student retention.

Null hypothesis: $\beta$ ~number of gate counts~ $= 0$

Alternative hypothesis: $\beta$ ~number of gate counts~ $> 0$

**Research Question 10:** Does the number of interlibrary loans contribute to the predictive utility of the library services usage model?

**Research Hypothesis 10:** As part of the library service usage model, interlibrary loans accounts for unique variance in student retention.

Null hypothesis: $\beta$ ~number of received interlibrary loans~ $= 0$

Alternative hypothesis: $\beta$ ~number of received interlibrary loans~ $> 0$

**Research Question 11:** Does the average of Pell-grant receipt at an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure?

**Research Hypothesis 11:** The average Pell Grant receipt by students attending a community college moderates the relationship between gate counts and student retention.

Null hypothesis: $\beta$ ~(Pell Grant x gate counts)~ $= 0$

Alternative hypothesis: $\beta$ ~(Pell Grant x gate counts)~ $> 0$

**Research Question 12:** Does the percent of nontraditional students attending an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure?

**Research Hypothesis 12:** The percent of nontraditional students attending an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure.

Null hypothesis: $\beta$ (nontraditional students x gate counts) $= 0$

Alternative hypothesis: $\beta$ (nontraditional students x gate counts) $> 0$

## Methods

### Study Design

This study is a non-experimental design, with an institutional unit level of analysis. It is a cross-sectional study. Non-experimental design was selected to gain a real-world perspective of the library and educational activity being addressed. Libraries are living and breathing departments, existing in connection with continually changing institutional, cultural, and social ecosystems. An experimental design would largely separate the library system from that ecosystem, minimizing the realistic expression of library service usage impacts within that ecosystem.

The institutional unit level of analysis was selected because industry wide standardized methods of data collection and reporting exist in both datasets being used to address that level of analysis. Student level of analysis studies, as expressed in the literature, lack an inclusion of all library service types into library service models. Such exclusion occurs because of a lack of access to identifying student information, or because of decreased technological opportunity for data collection of some library usage variables at the student level.

This lack of inclusion minimizes understanding of results and comparative opportunity between studies through an over-generalization of the term library use that excludes some library service types from some studies and includes them in others. Variables expressed as library

services in one study are different from variables expressed in other studies, minimizing industry wide standardized definitions of the term library services, as expressed through the student level of analysis literature.

A cross-sectional study was selected to gain an understanding of relationships across a single point in time. It is expected that usage impacts will change across time as student needs change and technology advances. A study that considers those changes more fully may be useful, but this is not that study.

This study considers the current state of library services, both electronic and physical, within the confines of the current technology and funding available. Modernization and technological enhancement of library services have progressed at a fast pace over the last several years, and that changing dynamic makes year-to-year comparisons difficult. A more stationary time frame of study is needed to gain more accurate understandings of the library service model as it currently exists.

As an example, eBook collections were significantly smaller in most libraries just a few years ago, so their impact would obviously be less in past years than in the current year. A study that includes such variables longitudinally would need to address the change in the nature of those services across all years, as well as the limitations of electronic collections and services in prior years. This would overly complicate variables while attempting to gain an understanding of the relationship of those services with retention. It would become difficult, if not impossible, to hold the service model definitions constant enough to gain a clear picture of their relationship with retention. We should either address changes in the service model over time, or the impact of an existing service model at a certain point in time. To try to do both in the same study overcomplicates the scenario, making it harder to grasp the true nature of findings. Longitudinal

studies would muddy the waters, and risk confusing relationship results. The current study proposes to engage relationship understandings at a single point in time.

All variables in this study will be from one of two secondary data sets, ACRL Trends and Statistics or IPEDS annual survey. The dependent variable of student retention from fall semester to the following fall semester will be obtained from IPEDS annual survey results. The moderator variables of Pell Grant recipient ratios and nontraditional students will also come from IPEDS. The independent variables inherent to the library service usage model, including material circulation, eBook circulation, number of full-text article access, number of reference transactions, number of research consultations, number of library presentations, number of attendees at library presentations, number of gate counts, number of interlibrary loans will be obtained from Association of College Libraries (ACRL) Trends and Statistics Survey. FTE, which will be used to standardize all variable results to offset institution size effects, will be obtained from the ACRL Trends and Statistics Survey. The control variable data of total library expenditure for each school in the sample will also be obtained from the ACRL Trends and Statistics Survey. All the variables included in this study are continuous.

A list of all community colleges in the United States appearing in both data sets will be developed. A random sample will then be selected that meets the power requirements of this study.

**Study Setting**

This study will be conducted from two prior existing data sets, both expressing 2018-2019 fiscal year information, representing July 1, 2018-June 30, 2019. ACRL annual survey is reported annually by academic library directors, specific to the instructions expressed in Chapter 2 of this study for each question. The report is an annual snapshot of each library's services and

finances expressed for that year. IPEDS are collected annually by organization research officers at each educational institution, of which the libraries in question are members, specific to the instructions expressed in Chapter 2 of this study. The fiscal year in question is reported, in the case of both surveys, between February and April of the year following the fiscal year in question. For instance, 2018-2019 fiscal year was reported between February and April of 2020, and was then published in summer of 2020.

**Participants and Placement**

Sample schools will be selected at random from a group of schools that meet prior determined parameters. First, each school must be represented in both surveys. Second, the selected school must be a community college providing a minimum of an associate level degree, but no degree provision greater than that level. Third, schools will only be included if they include information for all variables being studied, all other schools will be removed as a function of listwise deletion. Fourth, variables will be removed from the study altogether when the number of schools missing data for that variable limits the sample size to a point where the variable's inclusion would make power needs impossible to attain.

While a regional level study would have been preferable to a national study, there were not enough schools reporting all variables to both datasets to meet power analysis requirements. For this reason, the population will be all states in the United States, excluding any U.S. territories not currently of statehood status external to the continental United States. All 50 states and the District of Columbia would thus be included in the study population.

Institutions that match the criteria of the study will be identified. Each institution will be assigned a number, and a random number generator will be used to randomly select institutions for inclusion in the study. Once selected, data addressing each of the sample institutions will be

included from the ACRL and IPEDS databases and included in an IBM SPSS file for later evaluation.

GPower software was used to do a power analysis to identify sample size needed to discover a medium effect, $f^2 = .15$, under the following criteria: $\alpha = .05$, $\beta = .20$, power $= .8$. The study is concerned with the increase of $R^2$ of the model, library service use, after accounting for $R^2$ of the total library expenditure in relationships with student retention. In this case, there are 12 total predictors, including the control, two moderators, and nine tested predictors. It was determined that 127 institutions were needed to meet the power needs of this study.

**Materials**

Stat Trek random number generator will be used to randomly select the samples. ACRL and IPEDS databases will be used to gain access to needed data on the sample institutions. IBM SPSS 25 will be used to construct all models, as well as test for linearity, outliers, homogeneity of variance, independence of variables, and multicollinearity.

**Measures**

***Fall-to-Fall Retention***

The dependent variable of fall-to-fall retention rates is conceptually defined as this rate at the educational institution as reported on Integrated Postsecondary Education Data System report for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationalized by the institution in question's score, reported on the IPEDS annual survey for fall-to-fall retention rates, which is then divided by the respective school's FTE, to standardize scores by correcting for institution population size differences.

This number is addressed in section "E" of the reporting directions section of the Fall Enrollment Full Instructions for Integrated Post-Secondary Education Data System survey.

Specifically, the section refers to first-time cohort retention rates. It counts students as anyone enrolled in the fall semester of the years in question. Students addressed are only those who are attempting a first-degree or first-certification. The rate is calculated based on the number of students still enrolled in the current reporting period's fall semester, in relation to the students who were enrolled in the previous year's fall semester, plus any students who were enrolled in the previous fall semester who completed their program prior to the fall semester. Excluded from the evaluation are students who have died, left to serve in the armed forces, left to serve in a foreign aid service for the federal government, and those students who left to serve on an official church mission (National Center for Education Statistics, 2019b).

It is further operationalized by its use in the literature. Several researchers have used fall-to-fall retention rates in their studies (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007). Other studies have used variations on retention. Fall-to-spring Semester has been used (LeMaistre et al., 2018). Spring-to-fall semester has been used (Haddow & Joseph, 2010; Murray et al., 2016). Retention has also been studied as a fall-to-fall semester measure specific to first-year students' persistence to second-year enrollment (Soria et al., 2014). Teske et al. (2013) used first-year retention rates as reported on IPEDS. For the current study, fall-to-fall retention will be used because the measure reflects the same time-period expressed by both ACRL trend and statistics and IPEDS.

### Library Resource Use

The library resources use model is conceptually defined as the combination of all library use independent variables included in this model, as they are included in the ACRL annual survey. It is operationalized as a multiple regression model including all other independent variables in this study. Each instance of the nine independent variable scores relative to the

sample community colleges included will be divided by that school's FTE, which corrects for institution population size differences. The scores will then be included into the multiple regression analysis.

Library usage is reported annually on the ACRL, Library Trends and Statistics survey. The usage section of the report includes numbers of physical materials circulated, eBooks circulated, full-text articles accessed, reference transactions conducted, research consultations performed, library presentation, attendees at library presentations, gate counts for library entrance, and interlibrary loans for the fiscal year (Association of College & Research Libraries, 2019).

ACRL Trends and Statistics annual survey service variable use in the study is further operationalized by its use in the literature. Gregory Crawford (2014) computed a library usage index, calculated by adding total number of circulations, interlibrary loans, gate counts, attendance at instruction sessions, and reference transactions. The model used reported numbers from the ACRL Library Trends and Statistics survey.

The reported numbers on the ACRL, Library Trends and Statistics survey assumes an institutional level unit of analysis, rather than a student level one. In studies where student level of unit analysis is used, similar usage variables have been gleaned from intra-institutional processes. The inclusion of similar service types in such studies lend credence to the use of these service types as engaging an expression of library use.

The Murray et al. (2016) used a similar model, evaluating library use, but used internal institutional data, incorporating checkouts, electronic resources, computer lab usage, interlibrary loans, participation in library instruction, enrollment in credit bearing information literacy

courses, use of the library managed writing center, and use of the library oral communication writing center.

In a study by Soria et al. (2014), library use was defined through three different regression models. The first regression model included student use related to ten variables: database logins, electronic books use, book loans, electronic journal s use, inter-library loans, peer consultations, reference chats, website logins, workshops attended, and workstations used. A second regression model including at least one use by a student through database login, electronic journal use, and use of a library computer workstation. A third library use regression model was used including one-unit increase in database use, number of books checked out or renewed, and workstations used.

### *Physical Material Circulation*

The independent variable of physical material circulation is conceptually defined as the annual count of checked out physical materials owned by the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for physical material circulation represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 60, column "A" of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. It is the total number of times physical materials are checked out from the library, not counting renewals. This amount does not include items lent to or borrowed from other institutions as a function of interlibrary loan. These materials can be books, serials, or media, but only those in a physical

format. This number does not include electronic resource housed on computers (Association of College & Research Libraries, 2019).

It is further operationalized by its use in the literature. While institution level unit studies that allow for use of the ACRL standardized representation use in studies are rare, similar student level studies addressing this variable are abundant, including Haddow and Joseph (2010), Murray et al. (2016), and Soria et al. (2014).

### *Number of Digital/Electronic Circulation*

The independent variable of digital/electronic circulation is conceptually defined as the annual count of digital/electronic downloads, within the collection of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for eBook circulation represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 60, column "B" of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This number includes eBook and e-media, even if part of a database, and includes all views, downloads, or stream instances. This number does not include e-serials. It does not include circulated VHS, DVD, or other media formats housed physically. This item does not include titles used from Demand-Driven Acquisitions or Patron-Driven acquisition services where the item is not purchased by the reporting library.

While institution unit level studies are rare, similar variables of expression have been used in student unit level studies. Some studies with student level units have similarly applied

digital/electronic circulation through user authentication instances represented in proxy servers, such as OCLC EZproxy software (LeMaistre et al., 2018; Murray et al.,2016). Such numbers were, in other cases, gleaned using "click through" scripts (Soria et al., 2014). Other logins have also been used including catalogue, database, metasearch tools, and eReserves (Haddow & Joseph, 2010).

### Number of E-Serials Used

The independent variable of e-serials used is conceptually defined as the annual count of full-text accesses for electronic journal articles within the collection or within the subscriptions of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for full-text access to electronic journals represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 63 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This item includes all e-serials, even those in databases. If possible, libraries should report article usage, specifically the JR1 counter report. If the vendor does not provide such a standardized number, libraries may report usage by downloads, session views, transaction logs, or report zero. Viewing the item is countable when the full text of the item is downloaded. When possible, libraries should also report open access e-journal usage, provided that that item is accessible through the libraries catalog or discovery system.

Like the digital and electronic circulation variable, institution level studies, that would match ACRL survey output use are rare. When studies have applied student level units to

studies, they have applied EZproxy authentication information, "pass through" script, or other login methods related to electronic resource access by the user (Haddow & Joseph, 2010; LeMaistre et al., 2018; Murray et al., 2016; Soria et al., 2014).

### *Number of Reference Transactions*

The independent variable of number of reference transactions is conceptually defined as the annual count of research/reference questions answered at all library service points, physical and electronic, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for number of reference transactions represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 64 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. These include all reference transactions in verbal or written, in person, by phone, or electronic through chat or email services. This item does not include directional questions, but only questions pertaining to the use of information services and resources provided by the library, or engaging library staff subject specialty and skills. Reference transactions do not include consultations by appointment, as those are reported elsewhere on the survey (Association of College & Research Libraries, 2019).

When studies apply student level unit analysis, collection of individual specific reference transaction information becomes more difficult, as there are, in most cases, no standardized recording practices that can produce such individual specific data at all access points. Soria et al., (2014), thus only used reference question counts that went through live internet reference chat

services, a product called QuestionPoint, as that service retains identifying information related to use.

### Number of Research Consultations

The independent variable of number of research consultations is conceptually defined as the annual count of referred research consultations, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for number of research consultations represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 65 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This item includes one-on-one or small group scheduled consultation with library staff, external to class. These consultations may be in person or electronic. They may be the result of a referral from another library staff member for specialized staff skills and knowledge engagement, or regarding questions too complex to answer at the reference desk (Association of College & Research Libraries, 2019).

In a study applying the student unit level, Soria et al. (2014) applied specially trained students to assist their peers in narrowing topics, developing searches, evaluating resources, and other research skills.

### Number of Presentations

The independent variable of number of presentations is conceptually defined as the annual count of library presentations given by the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019. (Association of College & Research Libraries,

2019). It is operationally defined as the score for number of presentations represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 70 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. In-person presentations are reported in column "A," while web-based presentations are reported in column "B." Hybrid presentations reported one presentation, either as web-based or in-person (Association of College & Research Libraries, 2019).

Because presentation numbers are a separate variable from attendees at presentations, this variable becomes impossible to evaluate at the student unit level of analysis. Institution unit level studies of library service use are rare and have not included presentation numbers. The variable's exclusion from previous models has not been explained. It is possible that there is a covariance issue with the variable attendees at presentations, but no such logic is presented. The variable will be continued in this study until such a time as a covariance or some other issue arises, which presents a logical statistical reason for its exclusion.

### *Number of Attendees at Presentations*

The independent variable of number of attendees at presentations is conceptually defined as the annual count of the number of attendees at presentations given by the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019. (Association of College & Research Libraries, 2019). It is operationally defined as the score for number of attendees at presentations represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for library service use.

This number is reported on line 71 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This is a head count of attendees at presentations. In the case of presentations with multiple sessions, if a single individual attends more than one session, that individual is to be counted for only one of the sessions, not for both.

Institution unit level studies are limited for this variable. In a study related to the student unit level of analysis, Soria et al. (2014) evaluated only free, voluntary, workshop attendance numbers. This presentation type is exclusive of other library presentation types. Access to individualized participation data for all library presentations is likely insufficient for student unit level analysis of number of presentations, as a larger, whole variable, inclusive of data from all presentation types.

Murray et al. (2016) evaluated instructional participation, another subcategory of presentation attendance, through recording section numbers of library instruction requests, and then gaining a list of student id numbers enrolled in that section. This does not mean that all the students attended the library instruction session, and it also excludes presentation types outside those requested by a faculty member, in support of a particular course.

Crawford (2014) included attendance at instruction session, as well, rather than the larger category of presentation attendance.

### Number of Gate Counts

The independent variable of number of gate counts for library entrance is conceptually defined as the annual count of library usage, as measured by either head count or entrance gate count, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for

number of gate counts for library entrance represented on the ACRL survey report for each respective institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for Library service use.

This number is reported on line 73 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. If the library does head counts instead of gate counts, they may report it on this question, but must include a note stipulating such (Association of College & Research Libraries, 2019).

While there is a stipulation in reporting that expresses deviation from gate counts to head counts, the accepted alteration of method of data collection will produce an inconsistency reporting across the sample.

Because entrance into the library is not recorded with individually identifying information, but as an overall student count gained by electronic traffic counter device at the entrance of the library, the variable is not conducive to analysis at the student unit level, only at the institution level unit of analysis. Institution level studies of library use are rare, and do not include gate counts.

### *Interlibrary Loan Returnable and Nonreturnable Borrowing*

The independent variable of number of interlibrary loan returnable and nonreturnable borrowing is conceptually defined by the annual count of interlibrary loan returnable and nonreturnable borrowing from other libraries by patrons of the library, as reported on the ACRL, Trends and Statistics Survey, for fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationally defined as the score for number of interlibrary loan returnable and nonreturnable borrowing represented on the ACRL survey report for each respective

institution. The score is then divided by the FTE of the school in question and included into the multiple regression model for Library service use.

This number is reported on line 82 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This item includes materials borrowed from other libraries for lending to the institution's students, faculty, or patrons. Materials that can be returned to the lending library are reported on 82a. Materials that are photocopies and are not returnable are reported on 82b. Materials received through non-library commercial services are reported on 82c. 82a through 82c are added and reported on 82d (Association of College & Research Libraries, 2019).

Some student level unit studies used internal institutional information located in the interlibrary loan system to identify students with interlibrary lending activity (Murray et al., 2016; Soria et al., 2014). Institution unit level studies that would allow for employment of ACRL annual statistics application are rare and have not included interlibrary borrowing.

### *Total Library Expenditure*

The control variable of total library expenditure is conceptually defined as the total annual expenditure for the library department, as reported on the ACRL Trends and Statistics Survey, for the fiscal year 2018-2019 (Association of College & Research Libraries, 2019). It is operationalized as the score reported on the ACRL annual survey for the institution in question, which is then divided by that school's FTE to correct for population size of the institution.

This amount is reported on line 26 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries as all operations and maintenance expense for the library (Association of College & Research Libraries, 2019).

Several studies have used Academic Library Trends and Statistics survey data to conduct studies of library expenditure (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007). Boris Teske et al. (2013) used IPEDS reported figures for total library expenditure, which mirrors that present in the Academic Library Trends and Statistics survey.

### *FTE Used to Standardize Variables*

While not a variable in the study, per se, FTE is used to standardize each variable in the study, so it must be operationally defined. This number is reported on line 90 of the Association of College & Research Academic Library Trends and Statistics: Annual Survey by academic libraries. This FTE is the number calculated from credit hours on the IPEDS 12-month enrollment survey component, based on the institutions' calendar system. For institutions using a semester system, one FTE is the equivalent of 30 undergraduate credit hours or 24 graduate level credit hours (Association of College & Research Libraries, 2019).

Several studies conducted at the institution level of analysis have used FTE as a way of standardizing results across institutions of varying size (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013).

### *Average Pell Grant Received*

The moderating variable of average Pell Grant received is conceptually defined as its reported definition in IPEDS. That definition is the average amount of Pell Grant awards received by first-time, full-time and part-time students who have received Pell Grant funding. These are students who are students working on the first degree, at the first institution they have enrolled in (National Center for Education Statistics, 2019e). It is operationalized as the average Pell Grant awarded to first-time students attending institutions, as reported on the IPEDS annual survey for the institution in question (National Center for Education Statistics, 2019c).

*Nontraditional Students*

The moderating variable of nontraditional student is not reported at the institutional level on any known survey. The ratio of first-time degree/certificate seeking students who attend college within their first 12 months after graduating high school, relative to the total student body are reported on IPEDS (National Center for Education Statistics, 2019a). For the purposes of this study, absent any other usable representation of nontraditional students, this ratio of students attending within 12 months of high school will be reversed to get the ratio of students attending college for the first-time later than 12 months after graduating high school.

Nontraditional students, within the confines of this study, will then be conceptualized as the ratio of students attending participant institution who first attended college later than 12 months after graduating high school. It is operationalized as the opposite of the ratio of first-time students attending college within the first 12 months after graduating high school, in relation to total first-time students attending, as reported on IPEDS for the 2018-2019 academic year, regarding 2-year degree-granting schools.

**Data Collection**

Data used for this study is collected annually as a part of the ACRL Trends and Statistics annual survey and IPEDS annual survey. The survey instructions are specific to how and when the information included in each survey should be collected and what specific information should be expressed. This study is reliant on the standardized methodologies associated with the collection of data by ACRL, responsible for ACRL Trends and Statistics data collection, and the NCES, responsible for the collection of IPEDS annual survey. As this is a cross-sectional study, data collection will consist of collecting the relevant data needed for this study from the database

of previously collected data archived by each of these two institutions. The information will be entered into SPSS for analysis.

**Data Analysis**

Multiple linear regression will be used for the study for several reasons. The study includes nine independent variables, a control variable, two moderating variables, and one dependent variable. All of these variables are continuous variables. The current study requires a statistical method that can consider the relationship between the total library service usage model and student retention, after controlling for the relationship between total library expenditure and student retention. The statistical method must also be able to consider the relationship of each variable included in the library service use model with student retention. Finally, the statistical method must allow for consideration of moderators on the relationship between gate counts and student retention. Multiple linear regression meets all these requirements (Field, 2018).

All variables' scores will first be centered by subtracting the mean scores from the institution scores for the variable in question. This is done to make the y-intercept zero. Such centering allows the data to make more sense, especially when the models testing moderation are conducted.

To address potential bias, models will be tested for parametric assumptions and outliers. These assumptions include the normal distribution of errors, linearity, homogeneity of variance, and noncollinearity of variables. Scatterplots between all variables will be created to assess linearity. The distribution of raw values will first be assessed through analysis of skewness and kurtosis of all predictors. This will also help in identifying potential outliers. Then error distributions will be assessed through histograms of errors in each model. Zpred vs. zres plots will also be used to evaluate for potential heteroscedasticity.

If outliers arise, consideration of each case will be made, as to why such outliers exist. If an outlier is believed to be a data entry error, it may be considered for deletion. If, however, outliers are believed to be an accurate representation, bootstrapping may be used to limit their impact on the overall study results. Winsorizing may alternatively be employed, in cases where multiple outliers are represented.

Collinearity between variables will be evaluated using pairwise Pearson correlation analysis between all independent variables in the model, as well as the control variable. If correlations between predictor or moderator variables are found at .8, an issue with multicollinearity will be understood as existing, resulting in one of the two variables being removed from the model.

If assumptions are not met, then the specific nature of the cause will be evaluated, and an appropriate method of bias reduction will be employed. Such methods could include trimming data, winsorizing, bootstrapping, or transforming the data in a way that appropriately addresses the specific bias issue. Care will be given to rectify statistical bias issues in a way that maximizes the protection of the data and minimizes impacts on the integrity of the study results.

After assumptions have been met or appropriate bias reduction have been applied, SPSS will be used to calculate the coefficient of determination, $R^2$, between total library expenditure and student retention. Using this as a baseline, a second model will be constructed that includes all the library use predictors, from which a second coefficient of determination will be calculated. All non-significant predictors will be removed from the model to determine if they are necessary for the library use model. The most parsimonious library use model will be constructed and used to determine if the coefficient of determination changes from the baseline control model.

Within the final most parsimonious library use model, the coefficient of determination, $R^2$ will be evaluated to determine relationships between the model and student retention. Each individual variable in the model will be evaluated for its contribution to the model, and t tests will be used to identify individual variable relationships with student retention.

To test for the moderation effect of Pell Grant recipient ratios on the relationship between gate counts and student retention, an interaction variable will be created. Pell Grant scores and Gate count scores for each institution will be multiplied together to create an interaction variable.

To test the moderation effect of nontraditional student ratios on the relationship between gate counts and student retention, an interaction variable will be created. To create the interaction variable, nontraditional student scores and gate count scores will be multiplied together.

All these calculations will be done electronically using the SPSS process tool. This tool will provide t test results representing any moderation existing for Pell Grant recipient ratios or nontraditional student ratios within the relationship between gate counts and student retention. The SPSS process application will also provide effect results at high, mean, and low levels of Pell Grant ratios and nontraditional student ratios. Johnson-Neyman method will also be used to further discover the specific moderating effect of the interaction variables on the relationship between gate counts and student retention.

**Internal and External Validity**

For the evaluation of the library use model on fall-to-fall student retention, the known impact of library expenditure is controlled for. This limits the understanding that expenditure is in some way effecting the impact of the service on the dependent variable.

There is an uncontrollable internal validity threat that could not be addressed within the model. That is that library service types parallel types of services provided by other departments

on campus, while providing a different type of application of such services. For example, library instruction provides instruction specific to the subject specialty of librarians, but is similar in nature to in-class instruction provided in for-credit instruction by other departments, related to other subject specialties. Likewise, reference services occur at a service desk that provides library specific assistance and is like other service desks external to the library that provide assistance related to other non-library services. Because of the similarity of such service types, it is possible that correlations between expenditure and retention, or correlations between library usage variables and retention, are indicative to the overall institutional service type, rather than specific to that service type as expressed within the library specific application.

Crawford's (2014) results of high correlation between his library services index and his library expenditures to retention, while showing no added benefit to including library numbers into the overall model that included extra-library institution service expenditure variables is likely indicative of the existence of this internal validity issue. We also cannot control for this internal validity issue because the control variable and the independent variables in the library use model would likely be too highly correlated and introduce collinearity issues into the model. The best we can do is to recognize that the issue likely exists, and frame results within that recognition. This does limit the usefulness of the study for validation of library existence within the parent institutions, but that is not the point of this study.

The study is useful to library administrators because it addresses the library specific services that are related to retention, one overall institutional goal for enhancement. Library directors have no control over instances of parallel service models external to the library and the library subject specialty, much like a department head in the Sociology Department would not have control over instruction methodology and impacts unrelated to his/her department. The

multiple regression study does provide information to library administrators to allow them an additional scientific tool with which to make educated decisions about applications of service models within the library.

Another potential issue with internal validity is the issue of methodology related differences between expressions of library services in different institutions. We know, as an example, that action-based instruction is more effective than lecture-based instruction. Libraries that include more effective methodology in their instruction are then more likely to have a greater instructional impact on their students, and this may positively impact retention correlation with library instruction scores. An institution with the same score that uses a lecture-based model would likely have less of an impact on their students, and as a result the correlation between library instruction scores and retention could be diminished. There is currently no reporting mechanism that would allow for the inclusion of methodology in this cross-sectional study.

A similar issue with other independent variables in the model includes the degree of student-centered methodology used in reference interviews at reference desks or in consultations. Another example could be the inclusion of link resolvers, proxy servers, and modern, user-centered databased access functions that make such accesses more user friendly.

Yet another example could be the methodology and technological expression in the library physical environment in the form of resources and layout that enhances collaborative learning, as this would impact the success of the student represented in a gate count access of the physical library. If the library does not follow a provision of equipment, furniture layout, and infrastructure in the form of appropriate access to power outlets and WIFI, the diminished effectiveness of the physical study space provided could decrease the correlation between gate

counts and student retention. These are variables that cannot be controlled for in our cross-sectional study because this data is not currently reported.

Another internal validity issue could arise from geographic regional expressions. Concentration of the study to a particular region could not occur, due to of sample size needs of the study. The smallest region that could provide for the power needs of this study was the national level. If there are differences in the relationship between library service use, total library expenditure and student retention, or if there is a cultural difference in student populations in different regions regarding impacts to their retention, this study could not address those.

The study's specificity of studying only community colleges means that there is likely an external validity issue across higher education institution types. Institutions that provide bachelor level, master level, or doctorate level degrees would have different library service needs than those who only provide associate degree. It is likely that access to more complex research articles would be needed in institutions that provide upper level degrees, and reference services would likely be more impactful, as examples. Institutions that have a larger faculty research component could, additionally, have less correlation between student retention and library service use because library resource provision is not as tightly focused on the student experience, and must take into account faculty needs for research external to student learning and retention. This study specifies on associate degree granting institutions, due to a gap in the literature specific to this institution type, so it does not profess to provide information that is generalizable to other types of institutions.

**Summary**

In this chapter, the methodology of this study was presented. The study's research questions were expressed. All variables were defined conceptually and operationally.

Descriptions of the specific population and geography involved in the study were addressed.

Needed sample sizes were discovered through power analysis. Threats to internal and external

validity were expressed.

Chapter 4

**Findings**

This study had three purposes. The first purpose was to discover whether the services provided by community college libraries have a relationship with student retention after considering the impact of total library financial expenditure on that relationship. The second purpose was to discover if Pell Grant awards and nontraditional student status moderate the relationship between use of the physical library and student retention. The third purpose of this study was to fill a gap in the literature regarding associate level degree-granting institutions, pertaining to the relationships of their financial expenditure and library service use on student retention.

In this chapter, the methodology is reviewed. Decisions in the application of that methodology are presented and assumptions are addressed. Last, findings are presented for each of this study's 12 hypotheses.

**Variable Inclusion**

Thirteen variables were originally included in this study: student retention, total library expenditure, nine library service usage variables, and two moderating variables (average Pell Grant awarded and ratio of nontraditional students). Full-time equivalency (FTE) was used to standardize the sample.

The study methodology proposed to use listwise deletion to remove institutions from the study that have data missing for any variable. The methodology also proposed the removal of any variables missing data for so many institutions that it would make it impossible to reach a sample size large enough to conduct the study.

Data was missing in all variables represented in the study. Most missing data was addressed through listwise deletion of the institutions affected. Two variables had missing data that, should listwise deletion be used, an insufficient sample would result. E-serials, otherwise referred to as database usage, had 188 institutions missing data. Consultations had 172 institutions missing data. When listwise deletion of institutions missing data for these two variables was combined with the cumulative listwise deletions of institutions missing other variables, a sufficient sample size could not be obtained. Therefore, only one could be removed.

When comparing the two variables, more institutions were missing e-serials data than research consultation data. However, the e-serials variable had much larger usage within each institution in comparison to consultations. E-serials/database use was a primary service, with many more instances of use than research consultation services. E-serials/database usage was also the largest library use in relation to all other variables presented by institutions who reported it. It was decided to keep e-serials use and remove research consultations from the study.

As a result of these modifications, the final analysis used eight library usage variables, along with the total library expenditure control, two moderators, and the dependent variable student retention—twelve variables in all.

An additional study modification was that of full-time equivalency (FTE). Originally, FTE was to be pulled from ACRL Trends and Statistics survey data. FTE was pulled from both the ACRL Trends and Statistics data set and the IPEDs dataset. It was discovered through comparison that ACRL Trends and Statistics survey reports FTE at a time of year where FTE has not been finalized for reporting by Institutional Research departments. The ACRL Trends and Statistics FTE field represented incomplete data. As a result, the IPEDS dataset representation for FTE was used instead.

**Power and Sample Constraints**

As a result of removing a predictor variable, the sample size needed to meet the power for the study had to be recalculated. To discover a medium effect of $f^2 = .15$ at a power of .8 with $\alpha = .05$, $\beta = .20$, and 11 predictor variables, a sample of 123 institutions was needed.

**Participant Parameters**

This study used randomly sampled institutions for its unit of analysis. To be considered for inclusion in that sample, institutions had to meet underlying criteria. The institution had to grant an associate degree but awarding no degrees higher. The institution needed to exist within the Unites States or the District of Columbia. The institution needed to report the 2018-2019 fiscal year ACRL Trends and Statistics Survey and IPEDS annual survey. The institution needed to completely report all 11 predictor variables and dependent variable, as well as data for FTE.

Three hundred and seventy-nine institutions met these criteria in both datasets. After listwise deletion of missing variables, 129 sample institutions remained. Stattrek.com was used to generate a random sample of 123 institutions from these institutions.

**Test Methodology**

All variables not already standardized as averages or ratios were divided by their institution's FTE to offset varying institutional sizes. Only three variables were not standardized this way because they already incorporated institutional size: Pell Grant averages, nontraditional student percentage, and student retention ratio.

The mean scores for each variable were then subtracted from the institution scores for each respective variable. This process of mean centering created a meaningful intercept value. Zero for any variable then referred to its mean value.

A multiple regression analysis was conducted using four hierarchically constructed models. The first model used only total library expenditure, as well as Pell Grant averages and nontraditional students. The second model included these variables, as well as the eight predictor variables of the library services use model. The third model included model two's variables as well as and an interaction variable: the product of gate counts and Pell Grant averages. The fourth model included model two's variables as well as a second interaction variable: the product of gate counts and nontraditional students.

**Assumptions**

All variables were tested for multicollinearity. Using r = .7 of any two variables as the measure of potential multicollinearity, there appeared no issue with multicollinearity. No correlations greater than $r = .51$ were found. See table B2. Variance inflation factor (VIF) scores supported this conclusion. A VIF score greater than or equal to 10 suggests multicollinearity. No VIF scores greater than 1.81 were found.

The assumption of normality of errors and linear relationships between variables were also tested. A review of the p-p plot showed that all points were reasonably close to the line of best fit, indicating normally distributed errors. See figure B1. The standardized residual plot also showed no evidence of a violation of linearity or homoscedasticity, as well as no evidence of outliers. See figure B2. The latter was further supported by evidence of no standardized residuals outside -2.60 – 2.53.

<div align="center">

**Results**

</div>

All modeling output can be found in table B3.

**Research Question 1**

Research question one asked: At community colleges in the United States, does library service usage account for additional variance in student retention beyond total library expenditure? It was hypothesized that service usage accounts for additional variance in student retention beyond total library expenditure.

Library service usage did not account for additional variance beyond that of total library expenditure. Adding library service variables in model two did not significantly improve the model's ability to predict student retention, $\Delta R^2 = .08$, $F\ change$ $(8, 111) = 1.17$, $p = .32$.

**Research Question 2**

Research question two asked: Does the number of physical materials circulated contribute to the predictive utility of the library services usage model? It was hypothesized that the number of physical materials circulated accounts for unique variance in student retention.

Physical materials circulated did not account for unique variance in student retention, $\beta = .18$, $t(8) = 1.52$ $p = .13$.

**Research Question 3**

Research question three asked: Does the number of eBooks accessed contribute to the predictive utility of the library services usage model? It was hypothesized that the number of eBooks accessed accounts for unique variance in student retention.

The number of eBooks accessed did not account for unique variance in student retention, $\beta = -.09$, $t(8) = -0.89$ $p = .38$.

**Research Question 4**

Research question four asked: Does the number of full-text articles accessed contribute to the predictive utility of the library services usage model? It was hypothesized that the number of full-text articles accessed accounts for unique variance in student retention.

The number of full-text articles accessed did not account for unique variance in student retention, $\beta = -.13$, $t(8) = -1.25$ $p = .21$.

**Research Question 5**

Research question five asked: does the number of reference transactions contribute to the predictive utility of the library services usage model? It was hypothesized that the number reference transactions accounts for unique variance in student retention.

The number of reference transactions did not account for unique variance in student retention, $\beta = -.01$, $t(8) = -0.04$ $p = .97$.

**Research Question 6**

Research question six asked: Does the number of research consultations contribute to the predictive utility of the library services usage model? It was hypothesized that number of research consultations accounts for unique variance in student retention.

This hypothesis could not be tested, because of a lack of data reporting on this question nationally. There were not enough community college libraries reporting research consultation numbers to meet the power needs of this study.

**Research Question 7**

Research question seven asked: Does the number of presentations contribute to the predictive utility of the library services usage model? It was hypothesized that the number of presentations accounts for unique variance in student retention.

The number of presentations did not account for unique variance in student retention, $\beta = -.15$, $t(8) = -1.44$ $p = .15$.

**Research Question 8**

Research question eight asked: Does the number of attendees at library presentations contribute to the predictive utility of the library services usage model? It was hypothesized that the number of attendees at library presentations accounts for unique variance in student retention.

The number of attendees at presentations did not account for unique variance in student retention, $\beta = .05$, $t(8) = 0.54$, $p = .59$.

**Research Question 9**

Research question nine asked: Does the number of gate counts contribute to the predictive utility of the library services usage model? It was hypothesized that the number of gate counts accounts for unique variance in student retention.

The number of gate counts do not account for unique variance in student retention, $\beta = .18$, $t(8) = 1.51$ $p = .13$.

**Research Question 10**

Research question ten asked: Does the number of interlibrary loans contribute to the predictive utility of the library services usage model? It was hypothesized that the number of interlibrary loans accounts for unique variance in student retention.

The number of interlibrary loans did not account for unique variance in student retention, $\beta = -.117$, $t(8) = -1.11$ $p = .27$.

**Research Question 11**

Research question 11 asked: Does the average of Pell-grant receipt at an institution moderate the relationship between gate counts and student retention, after controlling for total

library expenditure? It was hypothesized that the average Pell Grant receipt by students attending a community college moderates the relationship between gate counts and student retention.

The interaction term, the product of Pell Grant averages and gate counts, did not contribute to model three's ability to predict student retention, $\beta = .01$, $t(1) = 0.05$ $p = .96$.

**Research Question 12**

Research question 12 asked: Does the percentage of nontraditional students attending a community college moderate the relationship between gate counts and student retention? It was hypothesized that the percentage of nontraditional students attending a community college attenuates the relationship between gate counts and student retention.

The interaction term, the product of nontraditional student ratio and gate counts, did not contribute to model four's ability to predict student retention, $\beta = .01$, $t(1) = 0.05$ $p = .96$.

**Summary and Conclusion**

This study found no evidence to support any of its 12 alternative hypotheses. The library services use model did not predict student retention above that of the total library expenditure model. None of the individual library services accounted for unique variance in student retention. Also, neither of the moderator variables explained student retention. The following chapter will discuss these findings, as well as their impact on community college librarianship, their relationship to the theoretical framework, and their contributions to future research.

Chapter 5: Discussion

This chapter is divided into four sections. The summary section reviews the study's purpose and problems, research questions, literature review, methodology, limitations, and findings. The implications section provides insights from the findings and their applications to community college library services and student self-regulated learning. The recommendations section gives direction for future research needs in community college library services. The chapter ends with a conclusion.

## Summary

### Problem and Purpose

This study's research problem proposed that community college libraries lack empirical guidance to effectively plan services that further their parent institutions' goals. To date, community college libraries rely largely on research from bachelor's degree granting institutions, despite suggestions that relationships between retention and library services differ by institutional type. Erroneous applications of this research may lead to ineffective library finance and service provision decisions.

A second problem with the literature in the field was that library research either addressed total library financial expenditure's relationship with student retention or used incomplete service models to examine their relationship with retention. Investigations of total library expenditure could not identify how specific services relate to student retention, and research using incomplete service usage models failed to consider the impact of funding on service success.

The purpose of this study was to discover whether the services provided by community college libraries predict student retention after controlling for total library financial expenditure.

The second purpose of this study was to discover if Pell Grant awards or nontraditional student status moderate the relationship between physical library usage and student retention. Pell Grant recipient status had been used as a control in similar studies by Soria et al. (2014) and LeMaistre et al. (2018), but its effect has not been tested at the community college level. LeMaistre et al. (2018) also found that Pell Grant recipients and nontraditional students are more likely to use the library, and that library users were more likely to be retained. The question of whether variables of Pell Grant recipient status and nontraditional student status have a moderating effect on the relationship between library use and student retention had not been addressed at the community college level.

The third purpose of this study was to fill a gap in the literature pertaining to this issue within associate level degree-granting institutions. There exist only limited numbers of studies that evaluate library activity relationships to student retention at the associate degree level (Eng & Stadler, 2015). Most studies exclude associate degree granting institutions from studies of library activity relationships with student retention (Crawford, 2014; Mezick, 2007; Teske et al., 2013).

## Research Questions

Twelve research questions were created to address these three purposes.

Research Question 1: At community colleges in the United States, does library service usage account for additional variance in student retention beyond total library expenditure?

Research Question 2: Does the number of physical materials circulated contribute to the predictive utility of the library services usage model?

Research Question 3: Does the number of eBooks accessed contribute to the predictive utility of the library services usage model?

Research Question 4: Does the number of full-text articles accessed contribute to the predictive utility of the library services usage model?

Research Question 5: Does the number of reference transactions contribute to the predictive utility of the library services usage model?

Research Question 6: Does the number of research consultations contribute to the predictive utility of the library services usage model?

Research Question 7: Does the number of presentations contribute to the predictive utility of the library services usage model?

Research Question 8: Does the number of attendees at library presentations contribute to the predictive utility of the library services usage model?

Research Question 9: Does the number of gate counts contribute to the predictive utility of the library services usage model?

Research Question 10: Does the number of interlibrary loans contribute to the predictive utility of the library services usage model?

Research Question 11: Does the average of Pell-grant receipt at an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure?

Research Question 12: Does the percent of nontraditional students attending an institution moderate the relationship between gate counts and student retention, after controlling for total library expenditure?

**Literature Review**

A literature review was conducted on topics germane to these research questions. Articles detailed relationships between library funding and student retention, relationships between

library services and student retention, differences between community colleges and other higher education institutions, and theoretical mechanisms that drive student library use and enhance student retention in library users.

Oakleaf (2011) argued that college libraries need to evaluate how well their services meet their parent institutions' outcome expectations. Libraries should work to align their service provisions more completely to their parent institution's mission and goals. To this end, librarians have considered their parent institutions' student retention outcomes in evaluating the success of their services and their use of funding. Numerous studies have found a general relationship between student retention and either total library financial expenditure or library services use models (Crawford, 2014; Eng & Stadler, 2015; LeMaistre et al., 2018; Mezick, 2007; Murray et al., 2016; Soria, et al., 2013; Teske et al., 2013).

However, most such studies find that the relationship between library activity or financing and student retention changes or disappears when the degree granting level of the institution in changed (Crawford, 2014; Mezick, 2007; Teske et al., 2013; Eng & Stadler, 2015). Two questions relate directly back to Oakleaf's (2011) research recommendations. First, do the services of a community college library serving an associate degree granting level institution have a relationship with student retention? Second, if they do not, then should student retention be used as a measure of that library's services success?

### Studies of Library Finances and Services as they Relate to Student Retention

Differences in the strength of relationships between total library financial expenditure and student retention have been found between bachelor's degree, master's degree, and doctorate degree granting institutions (Crawford, 2014; Mezick, 2007; Teske et al., 2013). Eng and Stadler (2015) found that, while student retention relationships were significant at many degree granting

levels, there were no statistically significant relationships between total library financial expenditure and student retention at the master's degree and bachelor's degree levels. Differences between the strength of relationship of library services use and student retention has also been found between bachelor's degree, master's degree, and doctoral degree granting institutions (Teske, et al; 2013).

Many studies have excluded community college libraries from analysis (Crawford, 2014; Mezick, 2007; Teske et al., 2013). Only one study, Eng and Stadler (2015), evaluated associate degree granting institution relationships between total library expenditure and student retention. That study found no relationship between total library expenditure and student retention, yet it did find relationships at the bachelor's degree and doctorate degree granting levels.

Studies of library services use fall into two different types, institution level of analysis studies and student level unit of analysis studies. Two studies addressed relationships between library service use and student retention at the institution level of analysis. Both found relationships between library service use and student retention, but neither addressed associate degree granting level institutions (Crawford, 2014; Teske et al., 2013). Crawford (2014) used an index combining multiple library services together into a single library service use expression to study library usage, but failed to illustrate individual services' contribution to the relationship with student retention. Teske et al. (2013) evaluated each individual service but did not combine the services into a model to illustrate their combined relationship with retention. The library services included in each study differed from one another, and usage amounts were obtained from different surveys. These differences limit researchers' ability to derive a coherent conclusion from the overall library service usage literature. The two studies' models, both

referred to as library services, include different services with differing operational definitions related to each study's unique dataset.

At the student level, only three studies showed a relationship between library service usage and student retention (LeMaistre et al., 2018; Murray et al., 2016; Soria et al., 2013, 2014). All used different library usage variables within their models, and each included only variables of convenience, where usage information could be more easily obtained and recorded through electronic means. Because library technologies differed across different study environments, opportunities for data collection were also different between the studies. As a result, extrapolations from this literature are difficult. A library use model that standardizes definitions and methodologies is sorely needed. But because of the technical and ethical challenges to doing this, it is unlikely to occur anytime soon. Differences in what is measured and how it is measured continue to be an obstacle in this area of research and practice.

All three of the student-level studies were conducted on bachelor's degree granting institutions and higher. Associate degree granting institutions were again excluded. The information gained from institution-level studies, however, showed that relationships between library activity and student retention vary by degree granting level of the institutions (Crawford, 2014; Eng & Stadler, 2015; Mezick, 2007; Teske et al., 2013). This suggests that student-level unit of analysis studies that fail to consider associate degree programs may not generalize to them. The literature at the student level unit of analysis, then, is of limited use to understanding community college libraries. With this in mind, all three student level of analysis studies found significant relationships between library use and student retention at the bachelor's degree level and above.

### *Identifying Potential Moderators*

The literature on library activity and retention was also used to identify control and moderator variables. While Soria et al. (2014) controlled for a variety of demographic, scholastic, and other variables known to impact retention, LeMaistre et al. (2018) found no statistically significant difference between users of library services and non-users based on gender, race, or first-generation status. Such demographic control variables were thus excluded in the current study. LeMaistre et al. (2018) did, however, find that non-traditional students and Pell Grant recipients were both statistically related to increases in library use. Soria et al. (2014) used Pell Grant recipient status as a control in their study, finding a relationship between library service use and student retention after holding that variable constant.

While the Soria et al. (2014) study treated Pell Grants as a control because of their documented relationship with student retention, the relationships found between Pell Grants and library use by LeMastre et al. (2018) suggest that this variable has connection with both library services and student retention. A valid question to ask is whether Pell Grant receipt should be treated as a moderator of the relationship between library services use and student retention, or if it is accurate to continue to understand it as a control variable. The current study thus tested Pell Grant receipt as a moderator. Due to similar relationship found by LeMastre et al. (2018) regarding nontraditional student status, it was also evaluated for moderation in the current study.

### *How Community Colleges are Different*

The lack of studies addressing community college libraries is concerning because of how different community colleges are from other higher education institutions. Community colleges developed external to K-12 elementary, secondary, and traditional higher education (Cohen et al., 2013). They are different from all these other levels of education and behave differently.

The goals and missions of community colleges encompass an eclectic collection of social, community, and individual needs unique to the U.S. culture within which they exist. These needs include adding education past the compulsory age, technical training, bridging the gap between post-secondary and university work, acting as feeder organizations for universities, minimizing lower-level freshman and sophomore education work for universities so faculty can focus on research and higher-level education functions, providing for local business and economic development through preparatory training of citizens, positively effecting dysfunctions present in society, providing cultural engagement in local communities through theatre and the arts, and providing remedial training for those unsuccessful in secondary education (Cohen et al., 2013).

The differences between the role of community colleges and other education institutions call into question whether community college administrators accurately use studies that target university programs to effectively plan community college services. Are such institutions similar enough to be generalizable to the community college level? If community colleges behave differently and few or no studies address them, what resources are community college librarians to use to evaluating services?

### *Self-Regulated Learning Theory as a Theoretical Frame*

Apart from some faculty-mandated participation in library orientation tours and other in-class library resource instruction, most library service use is voluntary and considered supplementary learning, existing outside of the in-class setting. Students may have research assignments or study needs that may be enhanced by their voluntary use of library services, but their choice to use or not use library services is often voluntary. The current study assumed the use of the library services in general to be self-regulated by the student, and thus subject to

research findings in studies of self-regulated learning theory. Prior library use literature supports this assumption (Arp et al., 2007; Beatty, 2016).

Self-regulated learning addresses the psychological and behavioral self-control of the learner in their scholarly efforts (Benbenutty 2011b). These psychological and behavioral self-control mechanisms include motivation, self-efficacy, and regulatory processes used by learners to persist and succeed in learning processes, as they are faced with deterring factors to such scholarly success (Benbenutty, 2011b).

Understandings of motivation are central to self-regulated learning theory, and are grounded in understandings from achievement goal theory (Anderman and Maehr, 1994; Kaplan and Maehr, 2007). Achievement goal theory is concerned more with the why of goals rather than what the goal is (Anderman and Maehr, 1994). If accomplished, why goals will likely lead to completion of the what goals as a byproduct, but the point of the motivating why goal is more localized to the current activity of learning, rather than a proposed future outcome. Why goals are more directly related to the tasks being conducted within the currently existing learning environment.

Within the why goal, there are two different types of motivations (Ames, 1992). One of these is the mastery motivation, within which the why goal is focused on enhancement of knowledge or skill for the sole purpose of enhancement of one's knowledge or skill (Ames, 1992). There is also the performance motivation, which is more focused on external impacts within the why goal (Ames, 1992). Examples of performance motivation could be not appearing stupid, outperforming peers, and appearing intelligent.

Mastery and performance motivations articulate with avoidance and approach frames, that inform on whether the student is either attempting to acquire something or prevent

something (Elliot, 1999; Elliot & McGregor, 2001). As an example, mastery avoidance would be if a student studied so as not to be uneducated on a topic, where a performance avoidance would be if a student studied so as not to appear uneducated to his fellow students. Of the four frames, the mastery approach has been shown to be more positively related to student self-regulated learning (Lichtinger & Kaplin, 2011).

Sommet and Elliot (2017) further linked these previous four frames with two self-determination theory reasons for learning, autonomous versus controlled reasons. Self-determination theory adds a scale addressing internalized reasoning for the learning, with autonomous reasons being the most internalized and controlled reasons being least internalized. If a student believes the content to be of use to his current and/or future life, his motives to learn the material become more autonomous. However, if the student sees no value of the material to his life, the student's motivation to learn the course material will be more controlled by external motivators. Sommet and Elliot (2017) found that, when evaluated separately from one another, both mastery frame and autonomous reasons enhanced self-regulated learning. Sommet and Elliot (2017) found that mastery frame and autonomous reasoning explain different variation in self-regulated learning, but overlap in some way to impact one another's effectiveness in explaining their respective unique variances.

Three phases exist in self-regulated learning, forethought, enactment, and management phases. The forethought phase includes activities of preparation for learning, such as defining tasks that need to be performed and planning. The enactment phase includes all activities conducted once the learning process has started, including monitoring, controlling, and evaluating learning while engaged in learning tasks. The management phase includes post

learning activities, such as reactions to and reflections on the learning process and activity after completion (Pintrich, 2000; Zimmerman, 2000; Zusho & Edwards, 2011).

Self-regulated learning includes a toolbox of skills that together produce a higher likelihood of persistence and learning success. These skills include controlling the environment within which learning will occur, seeking appropriate help when the need arises, seeking out and engaging self-regulation opportunities, metacognition in the development of study practices, acquisition of effective cognitive learning strategies, and delayed gratification (Benbenutty, 2011a). While Self-regulated learning skills applications can exist in areas outside of the library, such activities occur significantly in library use.

Self-regulation skills acquisition and use enhance the likelihood of persistence in short-term and long-term learning goals, and enhance the quality of student coursework (Lichtinger & Kaplan, 2011). Weinstein et al. (2011) profess a link between learner acquisition of self-regulated learning strategies and enhancement of student success, persistence, and student retention. Zusho and Edwards (2011) also states that students who lack self-regulation skills may be less likely to be retained.

**Methodology**

This study was a non-experimental, cross-sectional study conducted at the institution-level of analysis. It studied the 2018-2019 fiscal year reports of all community college libraries in the United States who reported complete data to both the ACRL Annual Survey and IPEDS.

Institutions were deleted listwise from the study when they did not include data on variables inherent to the current study. Of the reported library service variables in the ACRL Annual Survey, all but one was used. The number of research consultations conducted annually

had to be removed from the study, because the number of institutions missing data for the variable made the study sample size impossible to attain.

After the removal of research consultations, eight variables made up the library service model, including physical materials circulated, electronic books circulated, e-serials used, reference transactions, number of presentations, number of attendees at presentations, number of gate counts for library entry, and number of interlibrary loans borrowed. The study also included one control variable, total library financial expenditure for the year, and two moderator variables, average Pell Grant received and the ratio of nontraditional students attending the institution. The dependent variable was student retention. All library-related variables were taken from the ACRL Annual Survey data set. All education related variables unrelated to libraries were taken from the IPEDS data set for the same year.

A multiple regression analysis was conducted using four hierarchically constructed models. The first model included total library expenditure, Pell Grant averages, and nontraditional student ratios. The second model added eight library service variables. The third model then added an interaction variable: the product of gate counts and Pell Grants. The fourth model added a second interaction variable to model two: the product of gate counts and nontraditional students.

**Limitations**

This study is confined to community colleges in the United States. Results reflect only associate degree granting institutions and cannot generalize to other education levels. Results are also confined to the definitions of library variables used in the ACRL Annual survey and IPEDS.

One considerable threat to internal validity threat could not be addressed. Library services parallel those provided by other departments on campus. Libraries provide library

specific services through service desks, synchronous and asynchronous instruction, and faculty vetted presentations of subjects from other departments. Some of these services, however, are provided by other departments as well. If these departments are less likely to use their libraries for self-regulated learning—preferring to facilitate it themselves—then self-regulated learning may still occur at the institution, but not as an effect of library services use. As a result, library service usage may have little effect on retention.

A second internal validity issue comes from the variability of library services across institutions. Even when variables are defined and collected similarly, it is still possible that library services manifest differently between institutions. As an example, if one library practices traditional lecture-based instruction while another practices more modern action-based instruction practices, both are reported only as instances of instruction. This study cannot determine if these different instruction types affect student retention differently. If the manifestation of library services variables differs across institutions, but still conform to the definitions in the ACRL Annual Survey, there may be a high degree of variability in their effects. This would make it more difficult to identify effects.

Another internal validity threat could arise from the broad geographic region represented in the study. The study includes community colleges from across the United States, which includes smaller regions that may have different cultural norms or accreditation standards from one another. While a more localized study would have been preferred, the sample size identified in the power analysis could not be obtained in a smaller geographic region.

**Findings**

The null hypothesis was accepted for all research questions in this study. In model one, total library expenditure was not associated with student retention. In model two, library services

were also not associated with student retention. No individual service had a relationship with student retention. In model 3, Pell Grant eligibility failed to moderate the relationship between gate counts and student retention. And similarly, in model 4, nontraditional students failed to moderator that relationship.

## Implications

### Research Mandate

Oakleaf (2011) argued that libraries should address parent institutions' target outcomes. But what if the service libraries provide are not related to such outcomes? While multiple studies have found relationships between either total library financial expenditure or library service usage and student retention at degree granting level's higher, community college libraries do not share that relationship within the literature. Eng and Stadler (2015) found no relationship between total library expenditure and student retention at the associate degree granting level, even while bachelor's degree granting level institutions were found to have statistically significant relationships between total library expenditure and student retention. The current study not only supported the understanding that no relationship between library expenditure and retention exists at the community college level, but also found no evidence that a relationship between library services usage and student retention exists either.

If there is no relationship, and there should be, librarians are duty bound to their institutions, as well as to the library field more generally, to address the deficiency. Librarians should question why relationships between library activities and student retention do not exist at the community college level as they do at other degree granting levels.

**An Introduction to the Underlying Problem**

Studies cannot address whether community college libraries should have a relationship with student retention, only that they do or do not. It is, however, this researcher's opinion that community college library activities should have a relationship with student retention, and that the lack of such a relationship is related to a deficiency in their utilization in the community college setting, rather than a natural lack of relationship.

Self-regulated learning skills are needed for students to succeed in postsecondary education (Bembenutty, 2011b). Additionally, the literature supports the understanding that libraries engage self-regulated learning by design through their services (Arp et al., 2007; Beatty, 2016). Libraries are thus providing the services traditionally requested of them, evolving those services as necessary to meet the self-regulated learning mission of the institution. The lack of relationship is not the result of deficiencies in the librarians' desire to perform those duties, nor is it due to diminished effort to provide for such needs. Diminished service quality may be partially to blame, but, as we will see, such diminished quality is more a result of the problem than a cause.

What we are likely seeing in the lack of relationship between library service use and student retention is the detachment of the library from how community college faculty and administration facilitate student learning. Libraries have evolved in their ability to meet the needs of students, but simultaneously have been set aside as a tool for solving many of the issues that currently plague community colleges and larger society. Such issues include the digital divide, gaps between the skills of college graduates and the needs of employers, information literacy, and the development of lifelong learning skills.

Use of library services is voluntary, both at the student level and at the faculty level. As we will see through our later examination of the integration model of retention at the community college setting, faculty can choose to introduce librarians and library services as a valid learning service, or they can choose to do the opposite. They can also choose to require research components that engage academic level supplemental information and offer opportunities to develop self-regulated learning skills, or they can teach solely to in-class content.

If faculty choose not to engage out of class research requirements, then students will inevitably have no reason to use the library. Their grades and progress at the institution will then not be linked to library activities. Such a decision not only bypasses the benefits of learning that can be gained from library service interactions, but also detaching those services, statistically and practically, from the processes that lead to student retention and persistence to graduation. In such an environment, there should be no expectation that there would be a relationship between student retention and library services use, or between student retention and total library expenditure.

Such a decision by faculty to exclude library activities from required course expectations could be due to one of two reasons. First, services or resources may be perceived as subpar. Second, faculty may not know about the services or understand how those services can benefit their students or assist in solving their problems. Either way, such detachment puts libraries in a vicious cycle, both financially and functionally. Because the libraries cannot serve the institutional outcome, their funding is decreased in favor of other departments or activities designed to fill the gap left by their exclusion. Library administrators are then forced to either cut quality services or neglect library staffing in a way that further impedes liaison library activities necessary for keeping the library relevant in the minds of faculty.

This disconnect inevitably weakens the library's position at the community college level and worsens the student learning experience. Institutions may work to meet student retention outcomes by eliminating research competencies from student success expectations, but students miss out on self-regulated learning, problem solving, and metacognition skills—key skills sought by employers (McGunagle & Zizka, 2020). And relatedly, libraries grow further detached from institutional aims.

**Financially Induced Library Service Detachment from Student Retention**

Community college libraries' separation from their parent institution's goals have been exacerbated by failure to maintain staffing at functional levels and through financing deficiencies. Hoffman et al. (2020) conducted a study on U.S. academic library staffing and expenditure trends from 1996 through 2016. It is the most current and comprehensive reflection of its kind and includes information at all degree granting levels. Average number of librarians remained constant from 1996 through 2016 for all institution types except for doctorate granting institution, which saw an increase in 2012 followed by a significant decrease from 2012 through 2016. It would appear at first glance that community college library staffing changes were appropriately similar to other institution types, and even more fortunate than doctorate granting institutions. However, when librarian numbers are defined through student FTE per librarian, a different picture emerges.

In 1996 the mean number of students per librarian at associate degree granting institutions was 868.9. By 2016 that number had grown to 1276.5, a 47% increase in students per librarian. Bachelor's degree granting institutions had 349.6 students per librarian in 1996, growing to 580.6, in 2016, a 66% increase. Master's degree granting institutions had an increase from 471.4 students per librarian in 1996 to 1020.1 students per librarian in 2016, a 116%

increase. Doctorate degree granting institutions had an increase from 383.1 students per librarian in 1996 to 977.2 students per librarians in 2016, a 155% increase. While all other library types registered a greater percentage increase of student-to-librarian ratio, community colleges started at a greater deficit of librarians to students, and thus ended the period with a student-to-librarian ratio 25% greater than the master's degree granting level, the closest student-to-librarian ratio to community colleges represented.

It is possible that this ratio strains libraries' effectiveness in serving their institutions. It is concerning that this ratio reached the number that it did, and that the consequences may be so significantly dire as to divorce library use from student retention. What is potentially more concerning, however, is that student-to-librarian ratios at other institution types are following suit, but at a quicker pace. If the student-to-librarian ratio is even partially to blame for the library service use detachment from student retention and trends continue, all institution types may find their library service connections to retention becoming non-existent.

It is worth noting again that Eng and Stadler's (2015) found that there was no longer a relationship between library financial expenditure and student retention at the master's degree level. This was a change from a weak relationship at the master's degree level in a 2007 study (Mezick, 2007). Master's degree granting institutions had the next highest student-to-librarian ratio in 2016 (Hoffman et al., 2020). The change in library expenditure-to-student retention relationship at the master's degree level could be further evidence that such institution types are following community colleges into decreased usefulness resulting from neglected student-to-librarian ratios.

Simple student-to-librarian ratios are not enough to understand what is going on with library staffing in the library, however. Hoffman et al. (2020) also reported trends in finances related to staffing. All finances have been corrected for inflation.

In 1996, the mean percent of total library expenditure spent on staff was 54% at the community college level, and that percent increased to 72% in 2016. For baccalaureate institutions, it was 45% in 1996 and 56% in 2016. For master's institutions, it was 51% in 1996 and 54% in 2016. For doctorate degree granting institutions it was 46% in 1996 and 43% in 2016. The percentage increases between 1996 and 2016 of total library expenditure spent on staff per institution type was 18% for community colleges, 11% for bachelor's degree institutions, 3% at the master's level, and -3% for doctoral degree granting institutions.

The 72% of total library expenditure spent on staff in 2016 at community colleges is likely validation that library directors understand the importance of library staff, but there is more to the story. The mean actual amount spent on staff for community colleges in 1996 was $487,000 and $509,000 in 2016. That is only a 4.5% increase in spending on library staff. That means that staff funding increases as a percentage of total library expenditure were more reflective of cuts in other library services funded, than a legitimate increase in library staff.

In other words, the $509,000 spent on staff in 2016 represents 72% of the total library expenditure, while the $487,000 spent on staff represents 54% of the total library expenditure in 1996. If we do the math, the mean total library expenditure adjusted for inflation would be $706,944 for 2016 and $901,851.85 for 1996. Subtracting staffing costs from 2016 mean total library expenditure leaves $197,944 left for non-staff resources, compared to $414,852 in 1996. The mean community college library budget unrelated to staff was cut by $216,907 after

adjusting for inflation. The library director likely had to work within budget, cutting resources to keep existing staff. Losses in the quality of library resources was likely created as a result.

Changes in means for actual spending on library staff at higher degree granting levels were 16% increase for bachelor's institutions, 8% decrease for master's degree institutions, and a 5% increase for doctoral institutions. Again, there are concerning trends in master's level institutions, with 8% staff funding decreases reflected within a 3% increase in the percentage of total library expenditure being spent on staff. That means that decreases in total library expenditure were greater than the 8% staff funding decrease. In this environment there is a decrease in staffing accompanied by cuts in resources. This trend data existed at the same time that Eng and Stadler (2015) found that library expenditure to student retention relationships ceased to exist at the master's level. It compounds the concerns regarding the 25% increase in student-to-librarian ratios at the master's degree level for the same period. This is further evidence that the master's degree granting institutions may have followed community colleges into funding disfunction that likely led to a divorce of library services from student retention.

**Mismatching Staff Numbers to Duties Required**

The impact, or lack thereof, of library services on student retention cannot be understood only within funding and staff numbers, because these numbers do not express the activities being funded, the workload being performed, or the relationships between those activities and the proposed library services they support. Librarianship has changed significantly over the years and continues to evolve.

Modernized products and accesses that make it easier for end user students and faculty to locate and use information are more expensive than previous library service methods that are no longer viable in the current information world. As an example, card catalogs of the early 90s

required a typewriter, index cards, limited knowledge of what information was to be types on each card, and a specialized piece of furniture used in the storing and retrieving of the index cards. Now, modern online public access catalogs (OPAC) require an integrated library computer system used to store and manage catalog and patron records, an OPAC on the website, multiple databases, a website, and a discovery service to enhance usability. Such required products are more expensive. Still, they are required because students and faculty will not resort to retro physical card catalog searching over modern research techniques, nor should they be expected to.

Modern librarians also need specific technical knowledge in Machine Readable Cataloging language (MARC), Resource Description Access (RDA) standards for metadata creation and use, Dublin Core standards for broader metadata projects, W3 html standards, CSS and JavaScript coding, IP authentication processes, password access processes, proxy server authentication processes, link resolver processes, knowledge of database authentication and set up, discovery service management, and computer trouble shooting skills. Additionally, librarians must conduct much more complex staff development to keep up with future trends in library technological infrastructure, such as that conducted when library cataloging changed from Anglo-American Cataloging rules second edition standards (AACR2) to (RDA).

That knowledge is required just to make modern library resources available to the public. The knowledge does not include additional necessary skills needed to teach and promote resources effectively to facilitate the service community's ability to use such library resources. Library directors additionally need to be skilled in coordination and collaboration, and adept at price negotiation, accounting, strategic planning, human resources, and other business-related functions.

The Standards for Accreditation of Master's Programs in Library and Information Studies govern American Library Association accreditation of librarian master's degree programs. According to the curriculum standards of that document, programs curriculums should integrate "technology and the theories that underpin its design, application, and use," "provide direction for future development of a rapidly changing field," and "promote commitment to continuous professional development and lifelong learning, including skills and competencies that are needed for practitioners of the future" (American Library Association, 2019). Though broad, these curriculum expectations and the resulting master's programs in library sciences reflect the technological complexities of modern librarianship.

Significantly more time and cognitive effort is required to perform such modernized skills and maintain the knowledge and proficiency required to provide related services. Even if student FTE increases had not occurred between the 1990s and the present, these modern functions would still require significantly more staff time to perform, relative to their antiquated past counterparts. In smaller institutions, staff specialization cannot be used to address broad proficiency and knowledge requirements. In such libraries, a single librarian is required to take on continued learning in and application of multiple skills that would have been separated out into multiple different librarian specialty positions at a larger university. Such decreased specialization likely serves to complicate time management and cognitive load requirements in positions at smaller community college institutions. Due to these issues, community colleges are likely more prone to diminished functionality resulting from staff funding disfunction.

**Selling the Library**

Of significant importance to library service use is the specialty skill of liaison librarian. Liaison librarianship focuses on supporting teaching, learning and research activities of the

service community. Much of the duties of liaisons involve convincing faculty that library resource and services use is a viable option for academic enterprises (Solis & King, 2017). Sometimes, faculty need to be convinced that use of library resources by students is more appropriate than resources of less quality (Auten et al., 2016). Liaison librarianship means consulting with faculty to identify their needs and advocating the use of library resources or services that serve those needs (Solis & King, 2017).

In part, liaison duties can be understood as sales (Bell, 2017; Solis & King, 2017). Bell (2017) promotes SPIN sales methodology as a viable model for liaison librarians. The SPIN acronym stands for situation, problem, implication, need/payoff.

Within this model, librarians gain an understanding of the situations prior to meeting with faculty. Situational activities include identifying faculty interests, evaluating CVs, reviewing the faculty member's prior research, and reading syllabi and course descriptions of courses taught by the faculty member.

The librarian then attempts to put himself in the user's frame of reference and imagines what problems library resources could help the faculty member solve. Problem activities are concerned with asking users about difficulties they are experiencing in their role as teachers, researchers, or other functions.

Once problems are understood and the faculty member is sufficiently self-motivated to address the problem, the librarian moves on to the implications phase. The librarian works with the faculty member to discover the implications of the problem. The librarian asks what impacts the problem has on the faculty member's activities, workflow, or other functions.

In the needs/payoff stage, the librarian introduces specific library services to the faculty member that could address or solve the problem. This stage is designed to advocate for library

service use by the faculty and/or their students, as a solution to the problem that has been identified.

SPIN sales require several things, including knowing the user, being concerned about the user's needs and problems, taking time to understand those problems and their implications, and developing a relationship whereby the user trusts your judgment enough to help them solve their problems. That kind of engagement is time consuming and requires skills honed by appropriate training and practice. Additionally, the library resources must be of sufficient quality to effectively solve the user's problems.

Librarians do not have to engage SPIN. Regardless of the specific methods used, effective sales or advocacy roles still rely on developing relationships (Bell, 2017). That takes time and effort.

Understaffed libraries may cut corners in their relationship building time in favor of efforts to maintain resource quality. After all, if library resources are not maintained, there is nothing to sell to faculty. Underfunded libraries may have to choose between purchasing/renewing quality resources and retaining staff levels necessary to maintain and effectively market the services the library does keep, as the information presented by Hoffman et al. (2020) implies. A catch-22 situation arises in underfunded and/or understaffed libraries. On the one hand, faculty and students will not use cheap, poorly maintained, ineffective, and inefficient resources. On the other hand, when money saved through staff shortages and remaining staff time are used to maintain library resources at a high quality, there is insufficient staff time left to market resources effectively. Both scenarios disconnect library use from teaching and learning at such institutions, and would likely result in separating institution level self-regulated learning efforts and student retention outcomes from library service use.

Lindstrom and Shonrock (2006) addressed parallels in librarian and faculty goals of enhancing student critical thinking, problem solving, and information skills. These goals are integral to information literacy, which Lindstrom and Shonrock (2006) argued would be better served through collaboration between librarians and faculty. The goals of critical thinking, problem solving, and information skills are also central concepts in self-regulated learning, particularly as they relate to metacognition development (Benbenutty, 2011a; Flavell, 1979; Weinstein et al., 2011). Relationships between librarians and faculty are essential to mutual desired ends of student success, including student retention and persistence to graduation. Separation of libraries from the overall academic strategy, regardless of the cause, decreases organizational cohesiveness in meeting parallel department goals.

In their work advocating the need for high quality resource use at the community college level, Auten et al. (2016) found that faculty members did not require students to use high quality resources in papers. Faculty often did not specify library resource use as a requirement for papers, despite recognition that papers were of poorer quality when alternative sources were used. Students continued ignoring quality resources, even after library instruction that promoted them. Students continued to favor online websites over library materials.

Project Information Literacy, a national study, found that students continue to prefer open internet resources, even when faculty direct students to use library resources, unless that direction included specific research instructions in assignment requirements. Left to their own devices, students will continue using familiar resources previously used, even when those strategies do not match the requirements of the current topic (Bell, 2011).

Auten et al. (2016) found that faculty support of library resources increased after librarians conducted two staff development sessions. Faculty required more library resource use

in papers, requested more library instruction sessions, and embedded librarians in their classes. Library embedment is a form of co-teaching that gives librarians greater access to students in those classes.

The Auten et al. (2016) work is evidence that faculty acceptance of library resources is an effective way to increase student use of library resources. Project Information Literacy took this understanding further by recommending that curriculum committees integrate information literacy instruction expectations across disciplines to strengthen student research skills (Bell, 2011).

All the information addressing liaison librarian work points to the same conclusion. If faculty do not see library services or resources as useful, or if the relationship between the library and the faculty is not continually engaged, then consistent research and study expectations by faculty inclusive of library services will likely not occur. Students will then revert to habits that bypass library services in favor of habitual and often ineffective strategies. When that happens, faculty will either find non-library ways of supporting information literacy and self-regulated learning, or will drop or minimize such expectations, in favor of content driven instruction that minimizes the develop of self-regulated learning skills. Either action removes the library service use relationship to student retention.

**Other Self-Regulated Learning Issue Specific to Community Colleges**

Cohen et al. (2013) argue that one of the roles of community colleges is to act as a bridge between secondary and bachelor's degree educational opportunities for students who did not perform well enough in secondary school to meet entry requirements at bachelor's degree granting institutions. If diminished performance in secondary school is reflective, even in part, of a diminished ability of such students to effectively apply self-regulated learning strategies, then

minimizing the importance of those self-regulated learning skills through greater reliance on faculty knowledge may enhance the students' short-term success in course completion and persistence to graduation. That activity could disengage self-regulated learning acquisition from student retention. Such disengagement is incongruent with expected junior level coursework at transfer universities. It is also incongruent with employer expectations post-graduation (McGunagle & Zizka, 2020).

Faculty at community colleges may be taking on more of the planning of learning strategies and thus limiting self-regulated learning opportunities for students not ready to take on the weight of responsibility for self-regulation in their learning. That is a laudable short-term strategy, but over the long-term a transition to self-reliance fueled by proficiency in self-regulated learning is needed. Post-graduation, students will need to effectively apply self-regulated learning strategies to be successful as they transition to either bachelor's degree programs or life-long learning environments that are individualized and wholly different from traditional in-class learning.

Zucho and Edwards (2011) presented the idea that well-meaning people can inadvertently damage self-regulated learning acquisition. The example they used was one of parents who do not afford students the opportunity to self-regulate. Such parents may assist in coursework, edit projects, remind students of deadlines, and even contact instructors to negotiate poor student performance. To acquire self-regulated learning skills and reap the rewards of its use, students must seek out self-regulated learning opportunities.

Faculty can also damage self-regulated learning skills acquisition, if efforts to assist students exceed appropriate scaffolding efforts. If instruction confines all learning strategies to instructor planned processes, even ones that appropriately teach the content, self-regulated

learning acquisition will suffer. Students may learn the content, pass the class, and be retained into the next semester, but a healthy personal ownership and increased competence in students' learning strategies and motivations to learn may be payment for that success. There is a balance to be had, and community college programs should work to scaffold students with minimal self-regulated learning skills while progressing the student into greater self-sufficiency. Community college libraries are distinctly positioned to assist in these endeavors, offering appropriate study spaces outside of the classroom, access to supplemental information resources, and reference staff available to help the student should they request.

Another barrier to community college student retention may exist in the lack of social integration. Tinto (1993) proposed that students are more likely to be retained if they become integrated into the college community. He proposed that there are two forms of such integration, social and academic, and that integration may be formal or informal.

Tinto (1993) further states that students who attend community colleges are less likely to be integrated than those from institutions providing degrees at bachelor's degree and above. He reasons that community college students are less inclined to participate socially on campus, due to responsibilities and life functions off campus, such as full-time work and family obligations. As a result, they are less likely to participate in academic and social interactions outside of class, detaching them from his integration framework theory.

It is possible that, in the case of community college resource use, students' disengagement from library specific self-regulated learning processes could be a result of self-regulated learning model of retention bumping up against Tinto's integration framework theory. Students at community colleges would be less likely to use the library, because to do so would

require them to stay on campus outside of class, which Tinto (1993) expresses they are less likely to do.

Such an understanding is plausible to a degree, but would not explain the lack of connection between electronic resource use available from home, and student retention. Additionally, at least some community college students are retained and persist to graduation, so integration framework theory should not be seen as a death sentence for student success, nor the library's role in it. If we considered the library's role as such, we would also be forced to consider other services outside of the classroom as equally unrelated to retention, such as the Student Success Center.

Regardless, the idea that Tinto saw community college student integration in such a black and white frame misrepresents his views. Tinto (1993) further argued that community college students should not be understood as having no integration related interactions and receiving no benefit from the model. He proposes that informal contact with other students and faculty may have some benefit to student retention in community college students.

Karp et al. (2010) conducted a qualitative exploratory study of two urban community colleges, to test the assumption that Tinto's integration framework theory did not apply at that degree level. The study consisted of repeatedly interviewing of a sample of 44 students, once at the beginning of their second year and again six months later, provided they could be located. Of the original 44 students, 36 were reinterviewed at the 6-month mark. The study found that participation in formal extracurricular clubs and organizations did not produce integration for these students. However, integration did occur as a result of informal information networks in which the students developed relationships with classmates and faculty. These networks of trusted individuals served similar integration roles in the community college setting as more

traditional Tinto applications do at the four-year setting. Network contacts were made in the in-class setting through introduction, discussion, or class projects. Information networks at community colleges differ from traditional Tinto ideas in that academic and social integration developed and existed simultaneously within the same experience. Networks developed outside of the academic activities, in strictly social settings, did not produce similar integration as did those developed in the academic setting. Networks developed inside the academic setting retained their integration traits even in non-academic social settings.

Subjects presented such networks as providing a sense of belonging in the college. Relationships with teaching faculty in the classroom often led to introductions to other service department staff, including the library, that were then added to the information network and engaged as trusted contacts. One subject specifically mentioned, as an example of such network contact, feeling comfortable, knowing the library, and knowing who to ask when you need help.

Within this understanding of the integration framework, it becomes more important for librarians to collaborate with teaching faculty and be introduced to become part of students' information networks. The information network model proposed to be active at the community college level produces parallels between the integration framework and self-regulated learning in their mutual goal of student retention.

Integration framework and self-regulated learning complement one another at the community college level, rather than running counter to one another. As was the case with self-regulated learning, in the information network model, student retention relationships with library services use become non-existent when classroom faculty do not promote student use of library services.

The fact that community college library literature on retention is confined to only two studies fails to provide strength of context for results in other library research in the field. For instance, studies that find increases in library resource uses in relationship to increases in liaison library activities are important to librarians, whose traditional goal has been to increase circulation and use, but are less important to non-librarian administrators and faculty partners.

Wahl (2007) showed 372% increases in database use at Front Range Community College by increasing the number of in-class library instruction sessions occurring. These results support an understanding that liaison work specific to self-regulated learning, which also applies faculty in-class introduction of librarians to student information networks, can produce significant usage enhancement.

Deatherage (2020) conducted a study at a small Midwest community college identifying correlations between the number of library instruction sessions in one year and the following year's database use at $r(8)=.702$ $p=.035$, when no such relationship existed between the two variables within the same year. The study suggests that the payoff from library instruction, a liaison librarian duty, may be delayed until the following year. Library directors should consider such logic in their decisions to decrease instruction efforts through staff cuts, in favor of funding of databases when addressing budget constraints.

These studies of library usage in relation to liaison librarian duties fall in line with the Karp et al. (2010) findings that integration at the community college level occurs through information networks created in class through introduction and relationship creation. Liaison library engagement through collaboration with faculty in an in-class setting is thus important to student decisions to use or not use library services outside of class at the community colleges.

That understanding appears to engage Tinto (1993) integration framework through Karp et.al. (2010) understandings of information networks.

Such library usage increases matter for librarians, but this usage fails to related to larger institutional outcomes considered important by non-librarian academic vice presidents, chief financial officers, college presidents, and other decision-making members on college councils or college boards. Without that relationship, library service numbers are inconsequential to decision-making at the community college administration level. Circulation and use increases for the sake of circulation and use increases will do little to convince non-librarian decision-makers that there is a negative impact to decreasing library funding and resulting activity.

Librarians may not be able to make the case for such connections, as exemplified in the student retention discussion herein, for two reasons. First, staffing numbers in community colleges, produced by budget requirements, do not afford the time to conduct the research necessary to quantitatively present such connections. Second, if the current researcher's understandings are correct, and budget decreases are creating a feedback loop that further incentivizes faculty decisions not to include library resources, then damage to library statistically testable relationships with student outcomes may inaccurately express library services as useless to that institutional outcome. In other words, the library services may be important to the outcome, but they have been removed from the curriculum by faculty at the in-class point of contact and thus cannot impact student retention at all.

Librarians are more likely to find evidence at the student level of analysis, but the difficulties of collecting student level library data, as discussed earlier, diminish such research opportunities. Additionally, student unit of analysis studies are more time consuming. Librarians with high student-to-librarian ratios, such as those expressed for community colleges by

Hoffman et al. (2020), are less able to expend the amount of time needed to conduct and publish such research.

In conclusion, it is this researcher's opinion that community college libraries' ability to contribute to student retention has been damaged by a feedback loop created between funding and curriculum disconnection of library services. Faculty decide not to include library resources in curriculum, which disconnects library services from student retention outcomes, which leads to funding cuts, which diminish quality of services and library staff levels, which prevents librarians from marketing quality resources to faculty, which causes faculty to decline inclusion of library services in the curriculum. Resulting diminished library opportunity to participate in student self-regulated learning activities and integration framework model applications at the community college level will detach libraries from the community college mission entirely. If left unchecked, community college libraries will inevitably become extinct, not out of any true understanding of their usefulness, but because the community college system has malfunctioned in a way that starves and eventually buries them.

## Recommendations

While the implications of this study are grounded in the literature, the lack of answers to additional questions continue to hinder our understanding. Future research is needed to explore these topics.

An important next step is to discover whether high student-to-librarian ratios diminish or remove relationships between library services and student retention in the community college setting. It is proposed that high workload caused by such high ratios may diminish liaison and other librarian work in a way that removes library service relationship with student retention.

Quantitative analysis can look for moderating effect of student FTE-to-librarian ratios on the relationship between library service and student retention.

Another question that needs answering is whether decreases in funding, and the resulting removal of quality resources have divorced library service usefulness from faculty and student expectations and needs. If funding limits have necessitated diminished resource quality to the point where end-users no longer find them useful, then faculty and staff may apply alternative resources and means of self-regulated learning external to the library. Such studies should also identify what these other non-library services are. It is difficult to quantify quality of resources, so qualitative studies may be more useful in answering these questions. Interviews or case studies may be used.

A third question that needs answering is whether decreases in library service relationships with student retention at other degree granting levels, such as master's degree institutions, are occurring for similar reasons as those proposed to produce the lack of such relationships in community colleges. In other words, have library services and staffing become so damaged by underfunding that faculty at other institution types choose not to address them in class or require research components?  Following, does that complete or near complete removal of library service expectations from the curriculum remove library services from consideration in institution level student retention outcomes?  A quantitative evaluation can be done to discover whether the ratio of student FTE-to-librarian has a moderating effect on the relationship between institution type and the strength/existence of library service relationships with student retention at institutions. If student-to-librarian ratios do not moderate these two variables, then we know that the difference in library service relationships with student retention is based on some other function expressed within the institutions' degree granting levels. If there is moderation, we gain

an understanding of the extent to which such moderation is responsible. This question has become more important as student-to-librarian ratios have increase while library service-to-student retention relationships have ceased across the same time-period. The industry needs to know if the two are related.

Such a study would require the researcher to identifying the existence and strength of library service relationships to student retention for institutions of all degree granting levels. The researcher would then include as a variable the degree granting level of all institutions being studied, as well as a variable representing the strength of the library service-to-student retention relationship or lack thereof for each institution. The researcher would then calculate student-to-librarian ratios for all institutions studied and include them as a moderation variable.

While institution unit of analysis studies would be prone to student-to-librarian ratio issues, student level unit of analysis studies may be less so. Even if such ratios prevent librarians from helping all or even most students engage their self-regulated learning needs, it is probable that sporadic partnerships with individual faculty still leads some students to engage library services. Community college librarians could conduct research evaluating probability of retaining those students, compared to students who do not use the library.

Such research is fraught with difficulty though. As the literature illustrates, gaining student specific library service information is hard, if not impossible for some library service variables. Many institutions do not have proxy servers, which have been consistently used in the literature to acquire database login data. Even if an institution does use a proxy server, such login records may be an inaccurate representation of individual student database use. Internet protocol address authentication is often used on campus, which disables individual login requirements for accesses made on a college computer.

Another concern is that, in a strained staffing environment with necessarily limited liaison functions, library users are likely those who have previously been acclimated to library use and self-regulated learning strategies. The study would then exclude those students who require development of self-regulated learning skills or have not used libraries in the past. The study would not be an evaluation of retention related to the library's ability to enhance self-regulated learning skills. Instead, it would be a study of the relationship between retention and the library's ability to meet a particular group of students' expectations that there be a sufficient library within which to use their self-regulated learning skills.

The study would also be unable to differentiate between benefits of library use and benefits of applying successful learning strategies acquired prior to library use. High school GPA and placement testing could be used as controls, but if the library is primarily used by students with prior self-regulated learning acquisition, the application of such controls would likely remove statistical benefit of such library use.

Additionally problematic to student unit of analysis studies are non-digital services existing in the physical library. To gain individualized information of who is using the physical space of the library, the study sample would need to check in at the desk upon entry. Such a procedure would likely change individual behavior. Students who would naturally use the library may be deterred from doing so if they felt they were being watched or individually counted. Students who usually do not use the library may be more motivated to use the library simply because of the knowledge that the librarians are counting such instances in consort with their teacher.

Collaboration between the librarian and the instructor would be needed to inform students of the study and give instructions for students to sign-in when entering the library. That would

warrant an introduction by the instructor of the librarian and/or at least a minimal presentation of library service availability. Such an introduction may engage the information network that Karp et al. (2010) presented as the mechanism for employing Tinto's (1993) integration framework at the community college level. If the integration framework and self-regulated learning partner to facilitate library use, then such an introduction would likely negate the proposition that the study can exclude some students from application of the foundational theoretical frame relevant to the study. The researcher would be evaluating library use in two groups, both of which have been engaged by Tinto's integration framework, rather than one that has and one that has not.

Future studies should further address the integration framework and information networks in the community college environment. The study cited was an exploratory study with a limited sample size, using snowball technique as a recruiting tool (Karp et al., 2010). Accuracy may be limited as a result. Research both inside and outside of the library should be done to further develop such understandings at the community college level.

Additionally, the nature of modern technology that facilitates network development and use outside of an in-person experience may have changed the mechanisms and implications of the integration framework at other degree granting levels, not just community colleges. Such research may find that an update to Tinto's frame may be in order.

Lastly, modern librarian roles are no longer confined to curation of information. Librarians have a role in addressing equity and equality in information access related to the digital divide (Aqili & Moghaddam, 2008). Within the digital divide frame, access to information has to do with users' ability to use technology designed to access information, rather than merely having physical access to that technology (Peters, 2003). Users need skill and

opportunity to use such modern digital information resources in a sophisticated and autonomous way, which requires training in information literacy (Aqili & Moghaddam, 2008).

Librarianship, as a field, is well placed to provide the digital and information skills and access necessary to meet the digital equity challenge (Aqili & Moghaddam, 2008). Libraries have a role to play within digital equity that is important for protecting democracy, intellectual freedom, civil rights, identity, independent choice, decision-making, and privacy (International Federation of Library Associations and Institutions, 2002).

It is this researcher's understanding that proficiency in such skills require a high level of self-regulated learning development specific to information resource use. To that end, research should be conducted to evaluate the success of community college students who have been afforded research components engaging librarians in the classes they take, in comparison to those who have not. Such an evaluation should not only address subject matter content, but also include skills in problem solving, critical thinking, and information evaluation.

## Conclusion

This study began by asking whether library services use was related to student retention at community colleges after accounting for variation produced by total library expenditure. Further, within such an analysis, were the relationships between student retention and library services moderated by either Pell Grant awards or nontraditional student status? The study found no relationships between library services use after controlling for total library expenditure. It also found no relationship between total library expenditure and student retention. The study also found no moderating effect for either Pell Grant awards or nontraditional student status on a relationship between library services use and student retention.

The study hinged on several understandings. First, library services use engaged self-regulated learning as a theoretical model. Second, self-regulated learning was related to student retention in the literature. Third, such self-regulated learning was the theoretical frame responsible for library financial expenditure and library services use relationships with student retention for other degree granting institution levels in higher education. Fourth, relationships at the community college level would be similar to the relationships found at the other degree granting levels. Fifth, the single instance found in the literature addressing the topic at community colleges found no relationships between total library expenditure and student retention, because of temporary mismatch between traditional library services and online learner needs. Modernization of library services after that study were thought to have addressed the issue. Sixth, the similar lack of relationship at the master's degree level in that same study were thought to be a result of similar mismatch. Prior studies at master's degree level showed a weak relationship between total library expenditure and student retention.

The lack of relationships in this study contradicted the understanding that similar results in the prior study by Eng and Stadler (2015) were temporary. Some other mechanism exists at the community college level that eliminates relationships between library services use and student retention. Self-regulated learning theory research expresses an association with retention. Library services apply self-regulated learning by design. The logic of the theoretical frame appeared sound.

The literature was consulted for evidence of a possible cause for the difference in relationships seen at the community college level, relative to relationships at other degree granting levels. The change in master's degree institutions from having a relationship between

library expenditure and retention in a study by Mezick (2007) to not having a relationship in a study by Eng and Stadler (2015) may provide a solution.

When examining library staffing and funding trends from 1996 through 2016, Hoffman et al. (2020) found significant increases in the number of students per librarian for institutions at all degree granting. Master's degree institutions and community colleges had much larger student-to-librarian ratios than other institutions, both of which were over 1000 students per institution. It is possible that both institution types reached a threshold for the ratio that diminishes library services so severely as to remove their relationship to student retention.

Additionally, percentage of total library expenditure spent on staff, when compared to inflation corrected mean amounts spent on library staff revealed total library financial expenditures decreases occurred, while staff funding stayed relatively stationary at the community college level and decreased by 8% for master's degrees. The staffing finance information becomes concerning when viewed through the lens of the lack of library services use-to-student retention relationships at these two degree-granting levels.

This researcher believes a feedback loop is in play, which hides the retention enhancing potential of library services at these two degree-granting levels. Faculty choose not to require student use of library resources. Then library services become absent from curriculum requirements. Then library services are functionally disconnected from student persistence and success expectations. Then library services become statistically disconnected from student retention ratios. Then library funding is diminished. Then library service quality and marketing diminish, which lead faculty to not include library resources in their classes. In such a system, library service, as a concept, is just as valid to self-regulated learning and resulting student

retention, but would show no statistical relationship due to their artificially incentivized continual exclusion from the curriculum.

　　While the logic used is grounded in the literature, the application of student-to-librarian ratio understandings to the current problem is speculative. All the current study can state for certain is that it found no relationships between community college library service usage and student retention. Further study is needed discover whether the speculations herein are valid.

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Appendices

## Appendix A: Prior Research in Libraries and Student Retention

Table A1. Prior Research: Total Library Expenditure and Retention.

| **Eng & Stadler (2015)** | |
|---|---|
| Population: Industry wide in U.S. 1179 schools in 2010. 1194 schools in 2011 | |
| Data source: 2010 and 2011 ACRL Annual Survey data | |
| Findings | |
| Doctorate degree granting | $r$ = -.033 for 2010 and r = .5 for 2011, $p$ = not reported |
| Master's degree granting | $r$ = -.002 for 2010 and $r$ = -.22 for 2011, $p$ = not reported |
| Bachelor's degree granting | $r$= .531 for 2010 and $r$ = .592 for 2011, $p$ = not reported |
| Associate degree or certificate granting | $r$=-.031 for 2010 and $r$=.007 for 2011, $p$ = not reported |
| **Crawford (2014)** | |
| **Population:** Four-year public institutions in Pennsylvania, $n$ = 83 for total library expenditure analysis | |
| **Data source:** IPEDS and Academic Library Survey (ALS) | |
| **Findings:** Library Expenditure (only doctorate, master's, bachelor's degree granting institutions included.) | Strong correlation, $r$ = .608, $p$ = .01 |
| **Important observation:** When included in a multiple regression model including extra-library variables, library expenditure and library service index drop out of the model | |

Table A1 (Cont.)

| | |
|---|---|
| **Teske, DiCarlo & Cahoy (2013)** | |
| **Population:** 200 four-year institutions classified by Southern Regional Education Board. Six categories of Carnegie classification were grouped into three groupings based on degree granting level and number of classification of instructional programs (CIP) those degrees reside in. | |
| **Data source**: National Center for Education Statistics | |
| **Findings:** Total population (bachelor's, master's, doctorate degrees combined) | Moderate correlation, $r = .561$, $p < .01$ |
| Group 1: 30+ doctoral degrees granted across 5+ CIP, or 100+ doctoral degrees granted across 10+ CIP | Moderate correlation, $r = .538$, $p < .01$ |
| Group 2: 30+ masters in 5+ CIP, or 100+ master's degree in 100+ CIP granting | Weak correlation, $r = .004$, $p < .01$ |
| Group 3: Bachelor's degree in 5+ CIP, or 30+ master's degree granting | Moderate correlation, $r = .496$, $p < .01$ |
| Type of retention used for dependent variable: First-year retention (IPEDS) | |
| **Mezick (2007)** | |
| **Population:** Industry wide 586 American institutions, which represents 47% of the population reported in ACRL/ARL (bachelor's, master's, doctorate granting institutions) | |
| **Data source:** ARL Annual Statistics (in later years this was called ACRL Annual Statistics) | |
| **Findings:** Total population (all institution types combined) | Moderate correlation, $r = .453$, $p = .01$ |
| Doctorate degree | Moderate correlations $r = .476$, $p = .01$ |
| Master's degree | Weak correlation, $r = .318$, $p = .01$ |
| Bachelor's degree | Moderate correlation, $r = .505$, $p = .01$ |
| Type of retention used for dependent variable: Fall-to-fall retention (IPEDS) | |

Table A2. Prior Research: Library Use Models and Retention

| **LeMaistre, et al. (2018)** | | | |
|---|---|---|---|
| Variables included in the library use model: | | | |
| electronic resource login through the proxy server | | | |
| Control variables: High school GPA, gender, first-generation status, and Pell Grant recipient | | | |
| Data gained from internal institutional collection methods (student level of analysis) | | | |
| Findings: Significant correlation between library use and one term retention. | | | Wald $F(1) = 16.64$, $p < 0.001$ |
| **Murray, et al. (2016)** | | | |
| Variables included in the library use model: | | | |
| checkouts | electronic resources | computer lab use | interlibrary loans |
| attendance at instruction sessions | enrollment (for-credit information literacy course) | use of library writing center | use of library oral communication writing center |
| Data gained from internal institutional collection methods (student level of analysis) | | | |
| Findings: Significant findings that library use predicts fall-to-spring retention. | | | $\chi2 = 575.72$, $p < .001$, Nagelkerke $R^2 = .31$ |
| **Crawford (2014)** | | | |
| Variables included in the library use model: | | | |
| circulation | gate counts | attendance at instruction sessions | reference transactions |
| Data gained from ACRL Trends and Statistics (institution level of analysis) | | | |
| Findings: Significant correlation between library service index to retention rates. | | | $r=.39$ $p<.01$ |

Table A2 (Cont.)

| Soria, et al. (2013) | | | |
|---|---|---|---|
| Variables included in the library use model: | | | |
| database logins | electronic book use | book loans | electronic journal use |
| interlibrary loans | peer consultations | reference chats | website logins |
| workshops attended | workstation use | | |

| Control variables: Gender, race/ethnicity, international status, Pell Grant recipient, first-generation college student, military veteran status, ACT composite scores or a SAT composite scores converted to ACT composite scores, the number of AP credits transferred into the university, whether the student lived on campus, whether student participated in freshman seminar, and membership in Access to Success program |
|---|
| Data gained from internal institutional collection methods (student level of analysis) |

| Findings: Significant correlation between library use and 1st to 2nd semester retention. | $\chi 2(1) = 6.86, p < .01$ |
|---|---|

| Teske, et al. (2013) | |
|---|---|
| Variables and results | |
| | |
| Volumes added to the collection in a year:<br><br>Doctorate granting ($r$=.365 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.221 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.399 $p$<.01)<br>All groups combined ($r$=.425 $p$<.01) | Total collection size:<br><br>Doctorate granting ($r$=.654 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.267 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.285 $p$<.01)<br>All groups combined ($r$=.636 $p$<.01) |
| Circulation per FTE:<br><br>Doctorate granting ($r$=498 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.255 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.428 $p$<.01)<br>All groups combined ($r$=.458 $p$<.01) | Reference transactions:<br><br>Doctorate granting ($r$=.385 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.365 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.08 $p$<.01)<br>All groups combined ($r$=.460 $p$<.01) |
| Reference transactions per FTE:<br><br>Doctorate granting ($r$=.230 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.038 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.102 $p$<.01)<br>All groups combined ($r$=.145 $p$<.01) | Presentations:<br><br>Doctorate granting ($r$=.532 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.409 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.192 $p$<.01)<br>All groups combined ($r$=.617 $p$<.01) |

Table A2 (Cont.)

| **Teske, et al. (2013) (Cont.)** | |
|---|---|
| Attendees at presentations:<br><br>Doctorate granting ($r$=.496 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.464 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.191 $p$<.01)<br>All groups combined ($r$=.594 $p$<.01) | Attendees at presentations per FTE:<br><br>Doctorate granting ($r$=.248 $p$<.01)<br>Master's granting in 5 + CIP ($r$=.06 $p$<.01)<br>Master's less than 5 CIP or bachelor's degree granting ($r$=.116 $p$<.01)<br>All groups combined ($r$=.005 $p$<.01) |
| Dependent Variable: First-year retention rates | |

**Appendix B: Findings**

Table B1. Descriptive statistics for all variables in this study.

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| RetentionMeancent | 0.0000 | 8.25865 | 123 |
| TotalExpmeancent | 0.0000 | 114.39608 | 123 |
| PellaidMeancent | 0.0000 | 684.38163 | 123 |
| NontradMeancent | 0.0000 | 0.18514 | 123 |
| PhysCircMeancent | 0.0000 | 2.12671 | 123 |
| DigitalCircMeancent | 0.0000 | 41.52271 | 123 |
| EserialsMeancent | 0.0000 | 511.09269 | 123 |
| TransactionsMeancent | 0.0000 | 6.08244 | 123 |
| PresentationsMeancent | 0.0000 | 0.02961 | 123 |
| AttendanceMeancent | 0.0000 | 2.52891 | 123 |
| GateCountMeancent | 0.0000 | 22.90528 | 123 |
| ILLMeancent | 0.0000 | 0.20353 | 123 |
| Pellaidinteraction | -453.5282 | 16471.18996 | 123 |
| Nontradinteraction | -0.6821 | 3.98507 | 123 |

Table B2. Pearson R correlations for multicollinearity checks.

| | | RetentionMeancent | TotalExpmeancent | PellaidMeancent | NontradMeancent | PhysCircMeancent | DigitalCircMeancent | EserialsMeancent | TransactionsMeancent | PresentationsMeancent | AttendanceMeancent | GateCountMeancent | ILLMeancent | Pellaidinteraction | Nontradinteraction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pearson Correlation | Retention Meancent | 1.000 | -0.161 | 0.080 | 0.036 | 0.037 | -0.060 | -0.079 | -0.063 | -0.082 | 0.010 | 0.049 | -0.098 | 0.057 | 0.012 |
| | TotalExpmeancent | -0.161 | 1.000 | -0.030 | -0.026 | 0.411 | 0.039 | -0.079 | 0.438 | 0.208 | 0.019 | 0.513 | 0.261 | -0.055 | -0.187 |
| | PellaidMeancent | 0.080 | -0.030 | 1.000 | 0.123 | 0.159 | 0.022 | 0.372 | -0.048 | 0.034 | 0.044 | -0.029 | 0.021 | 0.024 | 0.021 |
| | NontradMeancent | 0.036 | -0.026 | 0.123 | 1.000 | 0.074 | 0.193 | 0.139 | -0.022 | -0.156 | -0.033 | -0.162 | 0.113 | 0.019 | -0.167 |
| | PhysCircMeancent | 0.037 | 0.411 | 0.159 | 0.074 | 1.000 | 0.117 | 0.013 | -0.020 | 0.309 | 0.013 | 0.287 | 0.416 | -0.050 | -0.059 |
| | DigitalCircMeancent | -0.060 | 0.039 | 0.022 | 0.193 | 0.117 | 1.000 | 0.165 | -0.025 | 0.031 | 0.186 | 0.099 | 0.012 | -0.115 | -0.087 |
| | EserialsMeancent | -0.079 | -0.079 | 0.372 | 0.139 | 0.013 | 0.165 | 1.000 | 0.029 | -0.037 | -0.003 | -0.089 | -0.033 | -0.354 | -0.120 |
| | TransactionsMeancent | -0.063 | 0.438 | -0.048 | -0.022 | -0.020 | -0.025 | 0.029 | 1.000 | 0.064 | 0.006 | 0.446 | 0.009 | -0.110 | -0.194 |
| | PresentationsMeancent | -0.082 | 0.208 | 0.034 | -0.156 | 0.309 | 0.031 | -0.037 | 0.064 | 1.000 | 0.278 | 0.271 | -0.070 | -0.128 | -0.075 |
| | AttendanceMeancent | 0.010 | 0.019 | 0.044 | -0.033 | 0.013 | 0.186 | -0.003 | 0.006 | 0.278 | 1.000 | 0.050 | -0.058 | -0.021 | -0.017 |
| | GateCountMeancent | 0.049 | 0.513 | -0.029 | -0.162 | 0.287 | 0.099 | -0.089 | 0.446 | 0.271 | 0.050 | 1.000 | -0.032 | -0.085 | -0.281 |
| | ILLMeancent | -0.098 | 0.261 | 0.021 | 0.113 | 0.416 | 0.012 | -0.033 | 0.009 | -0.070 | -0.058 | -0.032 | 1.000 | 0.109 | 0.056 |
| | Pellaidinteraction | 0.057 | -0.055 | 0.024 | 0.019 | -0.050 | -0.115 | -0.354 | -0.110 | -0.128 | -0.021 | -0.085 | 0.109 | 1.000 | 0.129 |
| | Nontradinteraction | 0.012 | -0.187 | 0.021 | -0.167 | -0.059 | -0.087 | -0.120 | -0.194 | -0.075 | -0.017 | -0.281 | 0.056 | 0.129 | 1.000 |

Table B3. Models' summary.

| Variables | Model 1 B | SE | β | t | p | Model 2 B | SE | β | t | p | Model 3 B | SE | β | t | p | Model 4 B | SE | β | t | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total expenditures/FTE | -0.011 | 0.007 | -0.158 | -1.752 | 0.082 | -0.019 | 0.009 | -0.267 | -2.215 | 0.029 | -0.019 | 0.009 | -0.267 | -2.204 | 0.030 | -0.019 | 0.009 | -0.267 | -2.187 | 0.031 |
| Average amount of Pell grant aid awarded | 0.001 | 0.001 | 0.072 | 0.797 | 0.427 | 0.001 | 0.001 | 0.094 | 0.953 | 0.343 | 0.001 | 0.001 | 0.094 | 0.924 | 0.357 | 0.001 | 0.001 | 0.093 | 0.914 | 0.363 |
| Nontraditional Student | 1.016 | 4.055 | 0.023 | 0.251 | 0.803 | 2.592 | 4.276 | 0.058 | 0.606 | 0.546 | 2.584 | 4.298 | 0.058 | 0.601 | 0.549 | 2.633 | 4.428 | 0.059 | 0.595 | 0.553 |
| Initial circ physical/FTE | | | | | | 0.706 | 0.465 | 0.182 | 1.521 | 0.131 | 0.708 | 0.468 | 0.182 | 1.513 | 0.133 | 0.707 | 0.470 | 0.182 | 1.504 | 0.135 |
| Initial Circ digital/FTE | | | | | | -0.017 | 0.019 | -0.085 | -0.887 | 0.377 | -0.017 | 0.019 | -0.085 | -0.879 | 0.381 | -0.017 | 0.019 | -0.085 | -0.876 | 0.383 |
| E-serials usage/FTE | | | | | | -0.002 | 0.002 | -0.125 | -1.249 | 0.214 | -0.002 | 0.002 | -0.123 | -1.127 | 0.262 | -0.002 | 0.002 | -0.122 | -1.109 | 0.270 |
| Transactions/FTE | | | | | | -0.006 | 0.149 | -0.005 | -0.043 | 0.966 | -0.006 | 0.150 | -0.004 | -0.040 | 0.968 | -0.006 | 0.151 | -0.004 | -0.038 | 0.970 |
| Number of presentations/FTE | | | | | | -41.643 | 28.934 | -0.149 | -1.439 | 0.153 | -41.509 | 29.207 | -0.149 | -1.421 | 0.158 | -41.471 | 29.350 | -0.149 | -1.413 | 0.161 |
| Attendance/FTE | | | | | | 0.168 | 0.313 | 0.051 | 0.536 | 0.593 | 0.167 | 0.314 | 0.051 | 0.532 | 0.596 | 0.167 | 0.316 | 0.051 | 0.530 | 0.597 |
| Gate count/FTE | | | | | | 0.065 | 0.043 | 0.179 | 1.511 | 0.134 | 0.065 | 0.043 | 0.179 | 1.505 | 0.135 | 0.065 | 0.044 | 0.181 | 1.472 | 0.144 |
| ILL received/FTE | | | | | | -4.751 | 4.268 | -0.117 | -1.113 | 0.268 | -4.773 | 4.315 | -0.118 | -1.106 | 0.271 | -4.786 | 4.342 | -0.118 | -1.102 | 0.273 |
| PellGateInteract | | | | | | | | | | | 2.349E-06 | 0.000 | 0.005 | 0.047 | 0.963 | 2.234E-06 | 0.000 | 0.004 | 0.044 | 0.965 |
| NontradGateInteract | | | | | | | | | | | | | | | | 0.010 | 0.205 | 0.005 | 0.050 | 0.960 |
| Constant | 4.439E-05 | 0.742 | | 0.000 | 1.000 | -0.002 | 0.738 | | -0.002 | 0.998 | -0.001 | 0.741 | | -0.001 | 0.999 | 0.006 | 0.757 | | 0.008 | 0.993 |
| Observations | 123 | | | | | 123 | | | | | 123 | | | | | 123 | | | | |
| R-squared | 0.032 | | | | | 0.108 | | | | | 0.108 | | | | | 0.108 | | | | |
| SE | 8.230 | | | | | 8.180 | | | | | 8.217 | | | | | 8.254 | | | | |
| Δ $R^2$ | 0.032 | | | | | 0.075 | | | | | 0.000 | | | | | 0.000 | | | | |
| F change (3, 119) | 1.314 | p = .273 | | | | (8, 111) 1.173 | p = .322 | | | | (1, 110) 0.002 | p = .963 | | | | (1, 109) 0.002 | p = .960 | | | |
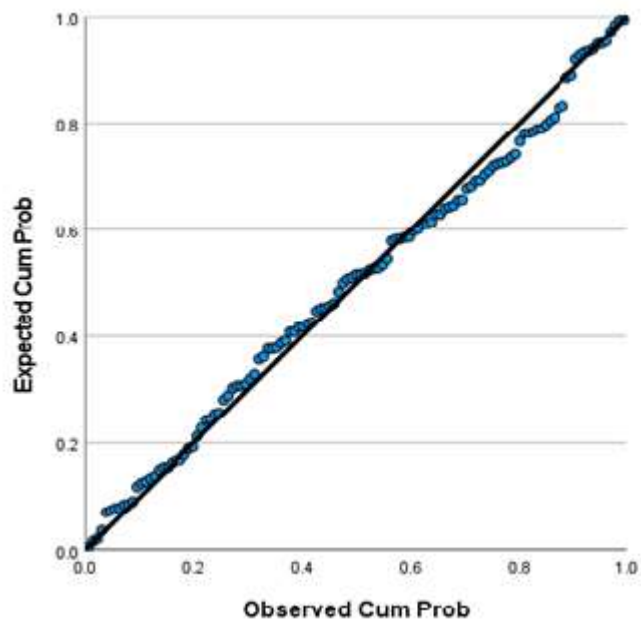
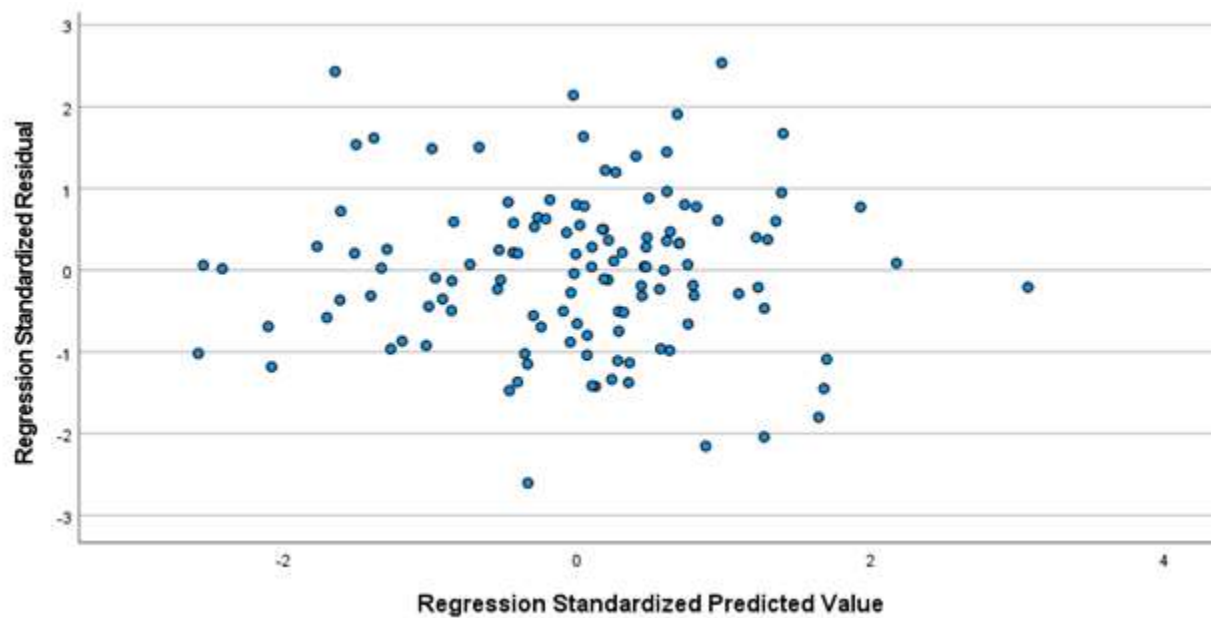Figure B1. Normality P-P plot of standardized residual dependent variable: Full-time retention rate.



Figure B2. Scatter plot of regression standardized residuals and regression standardized predictor values for full-time retention rates.