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Open Educational Resources and Student Success in a Hispanic Serving Community College: Do Ethnicity and Financial Needs Matter?

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ABSTRACT

OPEN EDUCATIONAL RESOURCES AND STUDENT SUCCESS IN A HISPANIC SERVING COMMUNITY COLLEGE: DO ETHNICITY AND FINANCIAL NEEDS MATTER?

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Northern Illinois University, 2023
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This research study adopts a correlational design to explore the relationship between open educational resources (OER) adoption and student outcomes, particularly among Hispanic students and those with financial needs. The study utilizes existing institutional data from a large community college designated as a Hispanic-serving institution (HSI). The data includes student demographics, financial aid status, final exam scores, and pass/fail outcomes for courses using OER and non-OER materials. The research employs statistical analysis, such as chi-square tests and *t* tests, to assess the relationship between OER adoption and student outcomes.

The findings show that, while students in OER courses performed slightly better on average, the differences between OER and non-OER courses were not statistically significant for the overall student population. The study shows similar results for Hispanic students and students with financial needs, with no statistically difference in academic outcomes for students in OER courses compared to their counterparts in non-OER courses. OER's cost-saving benefits are especially advantageous for these underserved groups, as textbook costs have significantly increased, hindering access to higher education. This research suggests that HSI community colleges can accelerate OER adoption, providing equitable access to educational resources and

promoting student success without adversely affecting outcomes for Hispanic students and students with financial needs. The study's limitations include a single institutional context, limited OER adoption, and the use of financial aid as a proxy for identifying economically challenged students. Future research should consider multiple HSIs and alternative indicators to gain a more comprehensive understanding of OER's impact on student success.

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DE KALB, ILLINOIS

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OPEN EDUCATIONAL RESOURCES AND STUDENT SUCCESS
IN A HISPANIC SERVING COMMUNITY COLLEGE: DO
ETHNICITY AND FINANCIAL NEEDS MATTER?

BY
VASUMATHI.V. RAMAN

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A DISSERTATION OF PRACTICE SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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Doctoral Director:
Xiaodan Hu

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PREFACE

This dissertation project aimed to understand whether there is a relationship between OER implementation and student outcomes in terms of pass/fail outcomes and final exam scores. The study also studied whether this relationship exists when the data is disaggregated to Hispanic students and students with financial needs. The quantitative study used institutional data from an introductory anthropology course at a large midwestern community college. The following chapters describe this project, from the research proposal to a report on the study findings, and conclude with a scholarly reflection on my process and learnings upon completion of the project.

Chapter 1 provides the initial research proposal as an artifact from the dissertation proposal defense. The proposal was defended in March 2023, and this chapter outlines the initial purpose of the study, research questions, existing literature, and research design. The theoretical framework that guided this research was the outcomes section of the cost, outcomes, use, and perceptions (COUP) framework (Bliss et al., 2013).

Chapter 2 reports the research findings using an academic paper model. The chapter details the data collection and statistical analysis procedures conducted in Spring 2023, presents the results, and discusses the findings. Descriptive analysis and statistical models are presented to compare course outcomes between OER and non-OER courses. The findings reflect no statistical difference in student outcomes between OER and non-OER courses for the total student population and even when disaggregated to Hispanic students and students with financial needs groups.

Chapter Three is a scholarly reflection on the research process and my learning as I worked through the various phases of the project. The chapter discusses the surprising challenges of student data retrieval, even when data was retrieved from just one institution. This journey has helped me appreciate all the work that goes into research and how essential the support of peers and mentors is essential to the whole process.

CHAPTER 1

RESEARCH PROPOSAL

Community colleges, with their open-access mission, are committed to keeping their doors open to historically underserved students (Bragg & Durham, 2012). Some colleges have opted to identify themselves as Hispanic-serving institutions (HSI) to better serve Hispanic students who are one such group of underserved students. HSIs are two- or four-year postsecondary institutions in which more than 25% of the full-time students are Hispanic and at least half are eligible for federal financial aid (Santiago, 2006). There has been a steady increase in HSI, and in 2021, 18% of all postsecondary institutions were classified as HSI (Excelencia in Education, 2021). Hispanic students benefit from attending an HSI, because it provides a more understanding environment that is conducive to student success, especially for those who are first-generation students and lack the social capital to excel at other institutions (Crisp & Nora, 2010; Hurtado & Ponjuan, 2005). State funding for higher education, including HSI, has declined significantly between 1987 and 2012, reducing \$2,600 per student after adjusting for inflation (Hossler & Bontrager, 2015). This loss in state funding has resulted in significant increases in tuition, putting college out of reach for the very students that community colleges aim to serve (Hossler & Bontrager, 2015). The average tuition and fees were 19% higher in the academic year of 2019–2020 than in the academic year of 2010–2011 at public two-year institutions (\$3,800 vs. \$3,200) after adjusting for inflation (National Center for Educational Statistics [NCES], 2021). In addition to increased tuition costs, other ancillary costs such as

textbooks create significant barriers because students are not able to gauge the scope of these expenses until the beginning of the semester (Colvard et al., 2018).

Textbook costs can be upwards of hundreds of dollars each semester and play an important part in an underserved student's decision to attend college (Colvard et al., 2018). In 2021, community college students were spending, on average, \$1,420 on textbooks (Hanson, 2022). From July 2011 to March 2018, consumer prices for college textbooks increased by 40.6% (U.S. Bureau of Labor Statistics, 2021). The high cost of textbooks affects students in a multitude of ways. A 2018 survey of 24,000 university and community college students found that 64% did not purchase the required textbook, 43% took fewer courses, and 36% earned a failing grade due to the lack of a textbook (Donaldson et al., 2019). These textbook costs are only a portion of the total debt. However, for many students, particularly community college students, textbook prices can be a significant part of their overall college expenses (Buczynski, 2007).

High tuition rates and the high cost of textbooks affect all students. However, the difficulty of paying the rising tuition and textbook costs is greater for Hispanic students and their families (Kuh et al., 2006). In order to support students with financial needs, the government signed the Higher Education Act (HEA) in 1965. This act mainly aimed to provide grants for work opportunities and interest-free loans for students with unmet financial needs. For a number of years, students could generally finance college based on a combination of scholarships, part-time employment, or family income (Huelsman, 2015). However, in recent years, states have started to renege on their promise to invest in higher education. States started cutting per-student funding at public institutions, meaning that students had to take on debt to attend college. The student loan debt, which is over one trillion dollars, funds not only tuition, but also funds

textbook purchases for many students (Martin & Lehren, 2012). The heavy dependence on loans has made the college-going process different for different groups, especially Black and Hispanic students. The median wealth for White households is thirteen times more than Black households and ten times more than Hispanic households. The debt burden is, therefore, fundamentally different; Black and Hispanic students must borrow to obtain a degree, while White students are far less likely to borrow (Huelsman, 2015). High college costs, especially textbook costs, have important implications for equity in college education. Students face stark choices between having to drop a course because of high textbook costs or not purchasing textbooks, resulting in lower academic achievement (Hilton, 2016).

The adoption of open education resources (OER) relieves some financial burden that allows students to focus on their studies. OER resources are teaching, learning, and research materials that are available under an open-source or license agreement that allows sharing, accessing, and repurposing for faculty and students' needs (Bragg & Durham, 2012). According to OpenStax, a leading publisher of OER, around 48% of colleges in the USA were using OER in 2018. This has resulted in savings of over \$117 million for the students in these colleges (Ruth, 2018). The United States has 948 community colleges, and 22% of these colleges are minority-serving community colleges (MSCCs). Illinois has 20 private and public two- and four-year minority-serving institutions, 14 of which are publicly controlled MSCCs. These MSCCs are the primary pathway into postsecondary education for historically underserved and underserved students, particularly underserved racial minority students (Office of Community College Research and Leadership, n.d.) Students in these institutions, especially racial minority students, stand to benefit from the cost savings from OER. While cost savings are an important

component of OER implementation, it is also important to consider the student outcome implications, especially among the racial minority.

Purpose Statement

The purpose of this study is to investigate the relationship between OER and student outcomes in the form of final grades and pass/fail. Although multiple OER studies have examined the cost benefits, faculty, student perception of OER, and student outcomes, there does not seem to be significant research that focuses on student outcomes for Hispanic students in Hispanic-serving institutions (Delgado et al., 2019; Feldstein et al., 2012; Gurung, 2017; Magro & Tabaei, 2020). Even though there are a few studies that seem to show poor student outcomes for OER courses, a vast majority of studies show positive student outcomes for OER courses (Delgado et al., 2019; Feldstein et al., 2012; Grewe & Davis, 2017; Gurung, 2017; Magro & Tabaei, 2020). However, all these studies seem to be looking at the entire student body. They do not seem to examine how the student outcomes differ for students of Hispanic ethnicities and students with financial needs in minority-serving institutions. This study would focus on student outcomes and OER at the College of Maple (COM, which is a pseudonym for an HSI in the Midwest region) and examine whether student outcomes vary for students with Hispanic ethnicity and students with financial needs.

In 2021, 41% percent of students at COM were Hispanic, 6% Black, 6% Asian, and 38% White. Over half of all students were receiving some financial aid averaging \$4,520 (NCES, 2021). The significant majority of students who were receiving financial aid were racial minority students. In 2021, the average in-state tuition at COM was \$4,116 (NCES, 2021). For students with financial needs, financial aid seems to cover most of the tuition costs. However, students

still have unmet financial needs to cover textbooks and living expenses. Several departments at COM are adopting OER to help students mitigate high textbook costs. This move to OER means that all students taking the OER course would have access to learning materials at the beginning of the course. Students who typically delay or forgo purchasing textbooks for financial reasons stand to benefit from this early access to materials. Studies indicate that racial minority students predominantly forgo or delay buying textbooks more than White students. In 2021, the graduation rate for White students at COM was 32%, while the graduation rate for Hispanic students was 25%. Similarly, the dropout rate for White students was 18% compared to 23% for Hispanic students (NCES, 2021). At a broader level, the student success metrics, defined by graduation rates and dropout rates, seem to be better for White students.

The purpose of the quantitative study is to fill in the research gap using institutional data to examine the relationship between courses employing OER materials and student performance (pass/fail grade and score in final exams). This study will also disaggregate this analysis by two groups (Hispanic ethnicity and students with financial needs). The research hypothesis is that OER levels the playing field for Hispanic students and students with financial needs. These students who would traditionally either not purchase textbooks or delay purchasing them until late in the semester now would have access to the textbooks with other students. There is a strong association between student outcomes and OER, and the association continues to be strong when looking at students of Hispanic ethnicity or students with financial needs. This study is guided by the following research questions.

1. Is OER associated with students' academic outcomes in terms of scores in the final exam and course passing?

2. Is OER associated with students' academic outcomes in terms of scores in the final exam and course passing for Hispanic students and students with financial needs, respectively?

Literature Review

The term open education resources (OER) was first coined in 2002 at a United Nations Educational, Scientific and Cultural Organization (UNESCO, 2022) forum on the impact of open courseware for higher education in developing countries. Since then, UNESCO has embraced OER as part of its education for all missions, in partnership with the William and Flora Hewlett Foundation (Owolabi, 2021). OER materials eliminate the need for purchasing books, thereby significantly reducing student costs. Wiley et al. (2012) stated that,

We are in the middle of a revolution in education. For the first time in human history, we have the tools to enable everyone to attain all the education they desire. And best of all, this education is available at almost no cost. The key to this sea change in learning is open education resources or OER. (p.1)

This review of literature provides an overview of the detrimental effects of the high cost of textbooks on students, then introduces OER as a means of mitigating these effects, provides an overview of OER, introduces the types of research being conducted by the various OER studies, and then examines various studies focused on OER implementation and student outcomes.

Textbook Cost and the Need for OER

The traditional means of delivering content in higher education has been predominantly through textbooks. Most faculty believe that students' learning is greater when they complete the assigned readings before attending the class lesson (Hilton, 2016). Textbook costs have risen

three times the inflation rate since the 1970s (Nagle & Vitez, 2020). Textbooks can be overly expensive, and not all professors are aware of the high costs of the textbooks that they are assigning (Ayers, 2005). The cost of higher education, including the cost of textbooks, directly affects student success and retention (Lantrip & Ray, 2020). The cost of textbooks has led to one in five college students skipping or deferring a class (Bleichmar, 2018). Among students who end up taking the course, there are an increasing number of students who choose to forego the purchase of textbooks to the detriment of their learning (Buczynski, 2007). In 2020, 63% of students reported not buying a textbook even though over 90% of the students were concerned that this would negatively affect their class performance (Nagle & Vitez, 2020). The Affordable College Textbook Act introduced in the U.S. Senate directs the Secretary of Education to fund the creation of college textbooks and materials to be made available under open licenses (Carroll, 2013).

The challenge for faculty in higher education is to create or curate high-quality open course content while promoting student engagement and success. Students spend a significant amount of time trying to find bargains for textbooks, and many students delay the purchases until late in the semester (Katz, 2019). The delayed or nonpurchase of textbooks is a significant detriment to their success in the course. Although increasing access to textbooks might not be the cure-all solution for ensuring student success, it could be considered an important factor for student success. High-quality OER, when available as a free substitute for commercial textbooks, could potentially increase student success (Bissell, 2009; D'Antoni, 2009; Downes, 2007; Hilton, 2016). Textbook costs are a barrier for a vast majority of students but are an even more significant barrier for historically underserved students. Therefore, textbook affordability is a redistributive justice issue, and OER could be a potential avenue for realizing a more socially

just college experience (Jenkins et al., 2020). OER can reach socially excluded and could lead to an increase in participation (Bossu et al., 2012).

Open Educational Resources and Their Impact on Students

OER resources are teaching, learning, and research materials that are available under an open-source or license agreement that allows sharing, accessing, and repurposing for faculty and students' needs (Bragg & Durham, 2012). Most OER material comes under Creative Commons licenses. A Creative Commons license is a public copyright license that enables creators and authors to retain copyright while allowing others to copy, distribute, and make some use of their work (Creative Commons, 2016). Within the bounds of Creative Commons licensing, there are five key points to consider when using OERs: Reuse, retain, revise, remix, and redistribute. Specifically, OER content can be reused in its unaltered original format in a wide range of ways (e.g., class, study group, website). Secondly, copies of content can be retained for personal archives or references. Thirdly, content can be modified or altered to suit specific educational needs (e.g., translate the content into another language). Fourthly, content can be adapted with other similar content to create something new (e.g., incorporate the content into a mashup). Lastly, content can be shared with anyone else in its original or altered format (e.g., give a copy of the content to a friend; Wiley, 2014). OER provides ease of accessibility and flexibility not found in traditional textbooks. This, along with zero cost, makes the most sense for students, especially if the student outcomes are not affected. The ability for students to interact with their educational resources – i.e., receiving immediate feedback on websites and possibly even generating or altering OER content – can lead to greater student engagement. “Open resources

can promote active learning through student interaction with the text, particularly when they contribute to authorship” (Baker & Hood, 2011, p. 2).

Current studies on OER can be classified into four major categories: analysis of financial implications for the students and institutions (cost), examining the learning impacts of OER adoption on students (outcomes), modification to OER material (usage), and what students and faculty feel about OER (perception). Community colleges cater to racial minorities and underserved students. The tuition cost in community college is significantly less when compared to four-year institutions (NCES, 2022). Therefore, textbook costs become a major component of the costs that students must bear in community college. Textbook costs were often considered an additive burden for the students. A study at an HSI in Southern California found that nearly two-thirds of the students did not buy required materials due to cost. Of those who did not purchase the required materials, over half (56%) felt it hurt their academic performance in the course. The student’s decision to not buy a textbook was made consciously, even knowing beforehand that their performance in the class would suffer. Nearly half (44%) still made a choice not to purchase the required materials (Jenkins et al., 2020). The same study also found that Hispanic students were significantly more likely to avoid taking a class because of textbook costs and three times more likely to report failing a class because of access to a textbook (Jenkins et al., 2020).

Money saved from textbooks could improve students’ quality of life and lower the cost of education, not to mention that they could spend it on educational pursuits (Martin et al., 2017). In Illinois, for the fiscal year 2020, 47.4% of the 472,478 students were minority students (Illinois Community College Board [ICCB], 2021a). Achieving the Dream’s OER Degree Initiative allowed community colleges to introduce 6,600 OER course sections and reach 160,000 students

who were projected to have saved at least \$10.7 million in textbook costs (Thurman, 2020). Students used the financial savings from textbook costs to pay for housing, buy food, and put money in savings (Martin et al., 2017). In addition to students enjoying the benefits of reduced textbook costs, colleges adopting OER gained increased tuition revenue because more students remained in class at the tuition reimbursement date (Wiley et al., 2016).

A quantitative quasi-experimental study to see the impact of OER on student science learning in a public high school showed that in addition to reducing costs for students, OER can improve student learning or, at the minimum, not negatively impact student learning (Fischer et al., 2015). Another large study that spanned ten postsecondary institutions and had over 15,000 students, found that students in OER courses performed as well or better than students who took non-OER courses (Fischer et al., 2015). A study conducted in one department of a community college showed that the OER resulted in significant cost savings. However, there was no perceptible change in retention rates and withdrawal rates between OER and non-OER students (Hilton III et al., 2013). Another study examining student GPA, withdrawal rates, and departmental examination scores in a Houston community college found that students using OER had better overall outcomes (Hilton & Laman, 2012). Some studies tested the effect of OER material when used as a supplementary online resource. When controlled for previous academic performance, it was found that there was a significant difference when students used OER material as a supplement to the traditional textbook (Feldstein et al., 2012; Lovett et al., 2008). Allen et al. (2015) employed an experimental design with one group using OER and the other group using traditional chemistry text. Student grades were not statistically different between the two groups. Students in OER courses perform academically at least as well as or better than their peers who are not taking OER courses (Colvard et al., 2018; Hilton, 2016; Ikahihifo et al., 2017).

While the studies above did not find a statistically significant difference in student outcomes because of OER, other studies that found that OER had a better positive relationship to student outcomes than traditional courses (Pawlyshyn et al., 2013). The study also found that pass rates of math courses increased because of OER. Students using OER materials do better than students enrolled in courses with the textbook, indicating a positive correlation between OER use and student persistence (Grewe & Davis, 2017). A survey of college professors found that 34% were aware of OER, and most professors who were aware of OER trusted the quality of OER materials (Allen & Seaman, 2014).

Some studies also looked at OER implementation through an equity lens. OER is an equity strategy for higher education: providing all students with access to course materials on the first day of class serves to level the academic playing field in course settings (Colvard et al., 2018). Wiley et al. (2016) theorized that if OER courses reduced drop rates from courses (students dropping out of courses), higher education institutions would financially benefit because they would not have to return tuition for students dropping out. Their study found that there was a slight decrease in drop rates for OER classes.

Some studies that show OER increases participation among underserved groups (Bossu et al., 2012; Jenkins et al., 2020). Studies also have explored the positive impact between textbook affordability and academic achievement. However, there is a dearth of empirical studies that explore this relationship for historically underserved students. Most studies are at the overall student level and do not explore the subtleties of ethnicity or students with varying financial needs. Fischer et al. (2015) used propensity score matching to reduce the effects of race/ethnicity on student outcomes but did not look at disaggregated results by race/ethnicity. Colleges, especially community colleges, have a diverse student population, and disaggregated outcomes

become essential to understand student outcomes. HSI community colleges have the responsibility to understand and address the needs of Hispanic students. HSIs need to not only understand the impact of changes on the overall student population but also need to look at it through the lens of the Hispanic student population. This study will immensely benefit HSIs in examining OER's relationship to student outcomes, especially for Hispanic students with financial needs.

Although some studies show lower student performance for OER courses (Delgado et al., 2019; Gurung, 2017; Robinson, 2015), the majority of the studies found that OER did not adversely affect student outcomes or improve student outcomes. This, in conjunction with the significant cost savings, could be a reason for the rapidly increasing OER adoption in postsecondary institutions. Adoption rates of OER have risen from 20% in 2015–2016 to 28% in 2019–2020 (Kelly, 2021).

Theoretical Framework

This study uses the COUP (cost, outcome, use, perceptions) theoretical framework (Bliss et al., 2013). This framework is designed to study the impact of open educational textbooks and open pedagogy in secondary and postsecondary institutions. The four components of COUP, cost, outcome, use, and perceptions, are the most essential aspects of learning that would be impacted by adopting OER. OER implementation impacts financial metrics for both students and institutions. Supporters of OER believe that using OER textbooks will save postsecondary students a significant amount of money. This also has the potential to impact bookstore revenues for the institution. The cost component of the COUP framework attempts to verify the magnitude and direction of the financial impacts of OER (Open Education Group, n.d.). Proponents of OER

also claim that the adoption of OER increases student access to learning materials and increases academic freedom for faculty. This, in turn, helps improve student outcomes. The outcomes path of the COUP framework is primarily designed to provide empirical evidence about the magnitude and direction of the learning impacts of OER adoption: changes in rates of completion, changes in dropout rates, changes in percentages of students receiving C or better, and so on (Open Education Group, n.d.). The usage component of the COUP framework measures the degree to which students and faculty engage in activities related to deleting material from the OER, inserting other open materials inside the OER, moving material around within the OER, and editing OER materials (Open Education Group, n.d.). Finally, the perceptions component of the COUP framework verifies the students' and faculty's feelings about OER compared to traditional textbooks (Open Education Group, n.d.).

Previous OER studies have focused on one or more of these components of the COUP framework. Some studies primarily focus on textbook affordability and cost savings for students, which correspond to the cost component of the COUP framework (Hilton III et al., 2014; Senack, 2015). One study examining textbook affordability looked at faculty perception by combining both the cost component and the use component of the framework (Allen & Seaman, 2014). Multiple studies have examined the use and perception components of the framework (Jhangiani et al., 2016; Kimmons, 2015; Lindshield & Adhikari, 2013; Pitt, 2015). One study examined the faculty perception of OER (Allen & Seaman, 2014). There have been multiple studies that have focused on student outcomes and on student and faculty perception of OER (Hilton, 2016; Hilton III et al., 2013).

Several studies have primarily focused only on the outcomes portion of the framework (Allen et al., 2015; Fisher et al., 2015; Hilton & Laman, 2012; Robinson, 2015; Robinson et al.,

2014). Reduced educational costs, together with an increased ability to keep OER up-to-date and access to materials on the first day of the class, have the potential to impact student outcomes. This research study will only focus on the outcomes section of the COUP framework. It will attempt to extend this framework by disaggregating outcomes based on various demographics and socioeconomic characteristics (i.e., race and need-based aid eligibility). This study will therefore provide an equity lens to the COUP Framework.

Research Design

This quantitative investigation will employ a correlational design to “measure the degree of association or relationship between two or more variables using the statistical procedure of correlational analysis” (Creswell, 2015, p. 21). This design was chosen for this study because I want to find out whether there is a relationship between multiple independent variables (Hispanic ethnicity and students with financial needs, OER course) and the dependent variable (student outcome metric).

Data Source and Sample

The research will utilize institutional data from the College of Maple (COM) in Lightning Bolt, Illinois. COM is an appropriate research site for this study because it is an HSI. It also has a diverse student body in terms of ethnicity and financial need. This research site is located in the Chicago suburbs with an approximate 10,000 total enrollment, of which 40% are full-time, and the rest are part-time students. The demographic population breakdown is Hispanic 41%, White 38%, Asian 6%, Black 6%, and other race and ethnicity 4% (ICCB, 2021b).

In 2021, COM started pushing for wider adoption of OER across all college departments. The college has gauged the cost savings for the students who took the OER classes. There is a need to understand how the OER implementation is affecting student outcomes. Since COM is an HSI, they have a special interest in determining how OER implementation and student outcomes are correlated for Hispanic students and students with financial needs. To gauge the impact of OER on college students, this study will aim to collect secondary data from approximately 150 students from five OER courses (treatment group) and five non-OER courses (control group) from the same semester across the same departments. The breakdown of who these students are and the courses that would be included is yet to be determined and will be based on the approvals and access that I get from COM. The data required for this study, student ethnicity, whether the student receives financial aid, final student grade, and student pass/fail outcome for the sample defined above, will be obtained from the Institutional Effectiveness, Planning, and Research (IEPR) Digital Data Warehouse portal, accessible through COM's intranet. This is existing institutional data that is continuously collected and stored in the Digital Data Warehouse in the IEPR Department at COM.

Method

This study aims to examine the relationship between OER and two student outcome metrics (Table 1). The first outcome is the pass/fail rate of the course. This is a nominal variable that records whether the student has passed or failed the class. The second outcome variable is the percentage of points earned in the final examination. This is a continuous variable that records the percentage score earned by each student in the final examination. The independent variable in this study would be the course type OER/non-OER, which is a nominal variable. The

initial analysis will establish whether there is a relationship between the independent variable OER/non-OER and the two dependent variables.

Table 1

Proposed Variables

	Variable	Definition
Dependent	Pass/Fail	0=Fail 1=Pass
Independent	Points scored in final exam	Continuous variable
	OER Course	0=Non-OER Course 1=OER Course
Grouping Variables	Hispanic Ethnicity	0=Non-Hispanic 1=Hispanic
	Received Financial aid	0=Did not receive financial aid 1=Received financial aid

Testing Correlational Relationship Between OER Courses and Pass/Fail Student Outcome

Additionally, I will subset the secondary data by looking at only students with Hispanic ethnicity and examine whether this relationship between OER and the dependent variables continues to exist. The reason to subset the data by Hispanic ethnicity is that COM is an HSI, and there is a need to understand the relationship between OER and student success for its Hispanic students. Similarly, I will subset the secondary data by students who receive financial aid and check whether the OER and the dependent variable relationship continues to exist for this subsample. Financial aid status is a proxy for the economic background of the student, with the assumption that anyone receiving financial aid is considered to be low income.

To test the correlational relationship between the two nominal variables OER Course and student Pass/Fail, I will use the chi-square (χ^2) test of independence. The chi-square test of independence (also known as the Pearson chi-square test or simply the chi-square) is one of the most useful statistics for testing hypotheses when the variables are nominal (McHugh, 2013). The chi-square test is a nonparametric statistic, also called a distribution-free test. The chi-square (χ^2) can provide information on whether there is a relationship between two categorical variables. If the two variables are related, the probability of one variable having a certain value is dependent on the value of the other variable.

For this study, the null hypothesis for the chi-square test for these two outcome variables is that there is not a significant relationship between the OER course variable and the student Pass/Fail variable. I will calculate the expected frequency (E) for each cell in the contingency table. The next step would be to use Pearson's chi-square formula to calculate the test statistic. For this, the difference between each observation and its corresponding expected value is squared. Since we are not interested in the absolute differences, the squared differences are normalized before summing them, which gives the following formula for the chi-square value: (E= Expected Frequency, O=Observed Frequency) (Frankfort-Nachmias & Leon-Guerrero, 2021).

$$X^2 = \sum (O - E)^2 / E$$

The next step is to find the critical chi-square value using the critical chi-square value table. We can look up the critical chi-square value if the degrees of freedom (DF) and the significance level are known. For this study, I will use a significance level of 0.05. Since in this study both the dependent and independent variables have only two levels, the DF value is 1. According to the chi-square critical value table, the critical value is 3.841. If the χ^2 value that

was calculated is greater than the critical value of 3.841, we can reject the null hypothesis that the OER and Pass/Fail Grades are unrelated (Frankfort-Nachmias & Leon-Guerrero., 2021). For the subgroups of Hispanic students and students with low-income family backgrounds, respectively, I will repeat these procedures using the chi-square test to test the correlation between OER and students' passing grades.

Testing Correlational Relationship Between OER Courses and Final Exam Score

The second outcome variable, the points earned by the student in the final exam, is a continuous variable. Since the dependent variable, the points earned, are not nominal, this study will use an independent t test. The differences in the means of two groups that are mutually independent and satisfy both the normality and equal variance assumptions can be obtained by comparing them using an independent t test (Frankfort-Nachmias & Leon-Guerrero, 2021). The independent t test is used to determine whether there is a difference between the means of two independent samples (non-OER course vs. OER course). A t test has to be used because the OER independent variable has only two levels. The null hypothesis for the t test is that there is no statistical difference between the means of the OER vs. the non-OER group. I will use a level of significance (alpha) of 0.05 for this study. The t value that needs to be calculated for the t test is the ratio of mean difference and standard error. The mean, standard deviation, and sample size of exam scores for the OER group and the non-OER group will be first collected. The formula for calculating the t -value is

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where

\bar{x}_1 = mean of scores from non-OER Group

\bar{x}_2 = mean scores from the OER Group

S_1 = Standard deviation of scores from non-OER Group

S_2 = Standard deviation of scores from OER Group

n_1 = number of observations in the non-OER group

n_2 = number of observations in the OER group

Once the t value is determined, it is compared to the critical t value that is computed from the t distribution table using degrees of freedom. If the calculated t value is greater than the critical t value, the null hypothesis is rejected. If the null hypothesis is rejected, the means of exam scores between OER and non-OER groups are statistically different.

For the subgroups of Hispanic students and students with financial needs, respectively, I will repeat these procedures using an independent t test to test the correlational relationship between OER and students' passing grades.

Limitations

The data collected for this study is only collected from one HSI community college. The study can be further enhanced by extending this research to multiple HSIs across the United States. Also, COM has only recently embarked on OER implementation, and there are only a few departments that have started adopting OER. This limits the sample data that can be collected. Future research could have a bigger sample size when more departments start adopting OER. This study aims to use financial aid as a proxy for students with financial needs. However, this might not be a good proxy because some students have financial needs but may not apply for financial aid. This study looks at the impact of OER on Hispanic ethnicities. It can be expanded

to include other races and ethnicities. Another question that can be answered in future research is whether the relationship between OER and student success is better for Hispanics versus other races.

Significance

Community colleges cater to various ethnicities and students with financial needs (Saenz, 2002). The increase in the cost of textbooks and tuition rates led to an overall increase in student debt, with Hispanic students and students with financial needs being most affected. The debt burden affects enrollment, completion, and persistence rates for Hispanic students and students with financial needs (Shapiro et al., 2017). Community colleges started implementing OER to reduce the debt burden of these students. Multiple studies on these implementations have shown a positive correlation between cost saving and OER (Colvard et al., 2018; Lieberman, 2018). In addition to the benefit of saving money for the students, higher education institutions are interested in identifying additional benefits of OER. Multiple studies have been conducted that show positive student outcomes for passing grades and dropout rates (Fisher et al., 2015; Hilton III et al., 2013; Hilton & Laman, 2012). Most of the OER research has focused on four-year institutions. There is a lack of research that examines the relationship between student outcomes and OER implementation in community colleges. More research is needed for these racial ethnicities and students with financial needs in a community college, especially in an HSI. This study will fill in the gap by studying the relationship between OER and student outcomes. This study will also examine the correlation between Hispanic ethnicities, students with financial needs, and the OER intervention.

COM is a Hispanic-serving institution with equity and inclusion as one of six strategic pillars in its 2022- 2025 strategic plan. This strategic pillar aims to create success for every student and employee by providing a supportive, barrier-free environment that enables them to achieve academic, career, and personal goals. Hispanic students at community colleges traditionally face challenges related to access and affordability. COM wants to ensure it approaches all policy and implementation decisions with equity and inclusion in mind. This is done by making sure all policy decisions are data-informed decisions. In a previous study conducted internally, COM determined that students save upwards of \$175 per semester because of OER implementation. This study to examine the relationship between OER implementation and student success can provide insights into whether OER improves educational outcomes for students and will inform future COM policies and practices related to OER adoption and implementation.

Further, a unique lens is needed to look at OER implementation to examine the relationship between OER and student success for two groups: students of Hispanic ethnicities and students with financial needs. This study would do this by disaggregating secondary data by these two groups. This study is directly related to the equity and inclusion pillar of COM's current strategic plan and would help COM identify the disparities in student outcomes between groups due to OER. If the findings from this evidence-based study indicate that OER implementation leads to a more equitable student outcome, it might suggest that COM can increase the pace of OER implementations across the community college as well as help other HSI institutions that are looking into implementing OER.

CHAPTER 2

OPEN EDUCATIONAL RESOURCES AND STUDENT SUCCESS IN A HISPANIC-SERVING COMMUNITY COLLEGE: DO ETHNICITY AND FINANCIAL NEEDS MATTER?

Community colleges provide higher education to many students from diverse backgrounds. Their open-access mission has made ensuring accessible education, especially for historically underserved students, a priority for them (Bragg & Durham, 2012). Some community colleges have recognized the need to address the specific needs of Hispanic students, who are considered historically underserved groups. Because of this, some colleges have opted to pursue federal designation as Hispanic-serving institutions (HSI). An HSI can be either a two- or four-year institution with a minimum Hispanic enrollment of 25%, where at least half of the Hispanic students are eligible for federal financial aid (Santiago, 2006). By achieving this designation, a community college is then eligible to apply for additional, competitive federal funding. This funding aims to help the community college to increase Hispanic students success by addressing challenges they face, such as financial and language barriers and educational resources barriers (U.S. Department of Education, 2023). In recent years, there has been a steady increase in the number of HSIs. In 2021, 18% of all postsecondary institutions were classified as emerging HSIs (Excelencia in Education, 2021). Scholarship suggests that Hispanic students may benefit from attending an HSI because there exists environments that are more conducive to student success, especially for first-generation students (Crisp & Nora, 2010; Hurtado & Ponjuan, 2005).

In FY 2002, Illinois state funds covered 72% of public university costs compared to 28% from tuition and fees. In FY 2020, the state covered only 35.6% vs. 64.4% of tuition costs (Illinois Board of Higher Education, n.d.). This means that higher education costs have primarily shifted from the government to students and their families. As a result, many students, particularly historically underserved students, find it increasingly challenging to access and afford higher education (Mitchell et al., 2019). These financial barriers to higher education directly conflict with the mission of community colleges, which aims to provide open access to historically underserved student populations (Hossler & Bontrager, 2015). According to the National Center for Educational Statistics (NCES), in 2021, the average tuition and fees at public two-year institutions were 19% higher in the academic year of 2019-2020 compared to the academic year of 2010-2011 (\$3,800 vs. \$3,200), adjusted for inflation. Besides rising tuition costs, students face significant barriers due to additional expenses such as textbooks (Boise State University, 2023; Jenkins et al., 2020; Reppond, 2019). These ancillary costs pose challenges because students often struggle to anticipate the full extent of these expenses until the beginning of the semester (Colvard et al., 2018).

The use of textbooks plays a vital role in higher education, but their exorbitant prices can make them a significant barrier for underserved students. The financial burden associated with textbook costs is so significant that it can impact a student's decision to pursue higher education (Colvard et al., 2018). Community college students spent an average of \$1,420 on textbooks in 2021 (Hanson, 2022). Over the period from July 2011 to March 2018, the prices of college textbooks rose by 40.6% (U.S. Bureau of Labor Statistics, 2021). The high cost of textbooks can have significant adverse effects on students. For example, a survey of 24,000 university and community college students in 2018 found that 64% did not purchase the required textbook, 43%

took fewer courses, and 36% received failing grades due to not having the required textbook (Donaldson et al., 2019). Although textbook costs represent only a fraction of the overall cost of attending college, for many students, particularly those attending community college, it can be a significant portion of their overall college expenses (Buczynski, 2007). The impact of these costs goes beyond financial strain and affects students' academic choices and outcomes (Wittkower & Lo, 2019).

Rising tuition fees and soaring textbook costs impact all students. However, Hispanic students and their families face even more significant challenges in affording these expenses (Kuh et al., 2006). For many years, students could rely on scholarships, part-time jobs, and family income to afford college (Huelsman, 2015). However, in recent times, students increasingly rely on loans to cover the cost of their education, which is mostly tuition and the expenses of purchasing textbooks (Martin & Lehren, 2012). This heavy reliance on loans has disproportionately affected Black and Hispanic students. The cost of college, including textbooks, dramatically impacts the fairness of higher education. Students often have to make tough decisions, such as dropping classes because they cannot afford the cost of textbooks or not buying textbooks at all, which can hurt their academic performance (Hilton, 2016).

The use of open education resources (OER) can alleviate some financial burden on students and enable them to focus on their studies. OER resources are educational materials, including teaching aids and research resources, available under a license agreement or open-source arrangement. This allows for sharing, accessing, and adapting the resources to suit the needs of both teachers and students (Bragg & Durham, 2012). OER has gained significant traction in the U.S. OpenStax, a prominent OER publisher, reported that in 2018, approximately 48% of colleges in the United States utilized OER. This adoption has resulted in significant cost

savings for students, amounting to over one hundred and seventeen million dollars (Ruth, 2018). There are 948 community colleges in the United States, with 22% classified as minority-serving community colleges (MSCCs). In Illinois, there are 20 minority-serving institutions, both private and public, offering two-year and four-year programs. Among these institutions, 14 are publicly controlled MSCCs. These colleges serve as an essential gateway to higher education for historically underserved and underserved students, especially those from underserved racial minority groups (Office of Community College Research and Leadership, n.d.). By adopting OER, students in these institutions, especially racial minorities, could benefit from the cost savings. However, it is essential to consider the potential implications of OER on student outcomes, particularly among racial minorities.

The goal of this study is to explore the correlation between OER and student outcomes, specifically in terms of final grades, pass/fail outcomes, and final exam scores. While previous research has explored various aspects of OER, such as cost benefits, faculty and student perceptions, and overall student outcomes, there needs to be more significant research focusing specifically on Hispanic students at Hispanic-serving institutions. Although some studies have indicated lower student outcomes for OER courses, most research has shown positive outcomes. However, these studies have predominantly analyzed the overall student population without considering potential differences in outcomes for Hispanic students and students with financial needs in minority-serving institutions (Delgado et al., 2019; Feldstein et al., 2012; Gurung, 2017; Magro & Tabaei, 2020). The study was conducted at the College of Maple (COM), a pseudonym for an HSI in the Midwest region, to address this gap. The research investigates whether student outcomes vary based on Hispanic ethnicity and financial needs when using OER. By focusing on the unique context of COM, the study intends to provide valuable insights into the relationships

between OER and student outcomes and highlight any disparities among different student groups. The following research questions guided this study:

1. Is OER associated with students' academic outcomes in terms of scores in the final exam and course passing?
2. Is OER associated with students' academic outcomes regarding scores in the final exam and course passing for Hispanic students and students with financial needs, respectively?

Literature Review

The concept of OER originated in 2002 during a UNESCO forum on the impact of open courseware in higher education for developing countries. Since then, in collaboration with the William and Flora Hewlett Foundation, UNESCO has embraced OER as part of its education initiatives (Owolabi, 2021; UNESCO, 2022). This literature review aims to examine the negative consequences of expensive textbooks on students and introduces OER as a solution to alleviate these challenges. It provides an overview of OER, including its definition and principles. Additionally, it explores the types of research being conducted in the field of OER and highlights studies that focus on the implementation of OER and its impact on student outcomes.

Textbook Cost and the Need for OER

The traditional approach to delivering educational content in higher education has relied heavily on textbooks. It is widely believed by faculty that students benefit from completing assigned readings before attending class (Hilton, 2016). However, textbook costs have risen at an alarming rate, three times higher than inflation since the 1970s (Nagle & Vitez, 2020). This issue directly affects student success and retention, but not all professors are aware of the high costs of

textbooks they assign (Ayers, 2005; Lantrip & Ray, 2020). To make matters worse, many students opt out of buying textbooks due to the high cost, leading to one in four students skipping or deferring a class altogether (Bleichmar, 2018). This problem has only worsened over time, with more students choosing to learn without textbooks, negatively affecting their academic performance (Buczynski, 2007). A recent survey showed that 64% of students did not buy a textbook, despite more than 90% expressing concerns about its negative impact on their academic performance (Nagle & Vitez, 2020).

To address the issue of textbook affordability, the Affordable College Textbook Act was introduced in the U.S. Senate, aiming to fund the creation of college textbooks and materials made available under open licenses (Carroll, 2013). Faculty in higher education face the challenge of creating or curating high-quality open course content while promoting student engagement and success. Students invest significant time searching for affordable textbooks, often delaying their purchases until later in the semester (Katz, 2019). This delay or nonpurchase of textbooks significantly hinders their success in the course. While improving textbook access may not be a comprehensive solution, it is still essential for enhancing student success. High-quality OER can replace commercial textbooks, enhancing student success (Bissell, 2009; D'Antoni, 2009; Downes, 2007; Hilton, 2016). Textbook affordability is not only a barrier for most students but an even more significant barrier for historically underserved students. This makes textbook affordability an issue of redistributive justice, and OER could provide a potential solution to create a more socially just college experience (Jenkins et al., 2020). OER could reach socially excluded students and increase participation (Bossu et al., 2012). This study aims to investigate the effectiveness of OER in mitigating financial barriers faced by students, particularly those from historically marginalized backgrounds by providing free access to high-

quality course materials, and potentially improving student retention, engagement, and achievement.

Factors Affecting Student Outcomes in Community Colleges

Community colleges have a fundamental responsibility to remove barriers to education. In addition to removing these barriers, the colleges also have a responsibility to ensure that there is constant monitoring and improvement of student outcomes. To improve student success and reduce equity gaps, community colleges need to understand factors that contribute to poor student outcomes. Some factors affecting student outcomes are socioeconomic barriers, lack of institutional support, and educational preparation (Genthe & Harrington, 2022). Students often cite a lack of financial resources as the most significant barrier to student persistence (Zell, 2010). Many community college students must balance work and family issues in addition to studying (Crisp & Nora, 2009). This leaves little time for studying, which affects their grades and success outcomes. Lack of adequate financial resources affects all students, but disproportionately affects minority students, especially Black and Hispanic students (Whitcomb et al., 2021).

Besides financial reasons, lack of institutional support is often cited as a key factor affecting student outcomes. This includes poor advising services, disengaged faculty, and a lack of information from support services (Genthe & Harrington, 2022). College students are motivated in learning environments that support their autonomy and their competence (Pisarik, 2009). Academic advisors play a key role in student persistence and achievement (He & Hutson, 2016). Many community college students are unaware of institutional resources like access to free technology and tools that would allow them to succeed. Academic advisors need to

proactively access reporting tools that can help them identify and communicate with students who are performing poorly in midterm exams (Buchanan et al., 2022).

Finally, 60% of incoming first-year students in community colleges are unprepared and are required to enroll in remedial courses that do not count as degree-earning credits (NCES, 2020). Racially or ethnically minority students, especially Hispanic students, are even more likely to come in unprepared and fail academically. While studying student outcomes, it is imperative to look at student outcomes disaggregated to minority and financially affected groups because the student outcomes for these students are very different from the total student population.

Open Educational Resources and Their Impact on Students

OER refers to teaching, learning, and research materials that are freely available for use, sharing, and modification by anyone due to their open-source or open-license agreement. This means that educators, students, and researchers can access, share, and repurpose these resources according to their needs and preferences (Bragg & Durham, 2012). These resources are typically licensed under Creative Commons licenses, allowing creators and authors to retain copyright while enabling others to copy, distribute, and use their work (Creative Commons, 2016). When examining the utilization of OERs within the confines of Creative Commons licensing, it is crucial to consider five key points: reuse, retain, revise, remix, and redistribute. These principles highlight the flexibility and freedom OERs offer regarding content usage (Beaven, 2018).

Various studies examining student outcomes in OER courses have shown mixed results. A number of studies show improving student outcomes because of OER adoption. For example, an extensive study across ten postsecondary institutions demonstrated that students in OER

courses performed equally or even better than non-OER courses (Fischer et al., 2015). Another study conducted in a Houston community college found that students using OER had better overall outcomes in terms of GPA, withdrawal rates, and departmental examination scores (Hilton & Laman, 2012). Other studies showed significant positive outcomes when OER was used as a supplementary resource to the traditional textbook when controlled for previous academic performance (Feldstein et al., 2012; Lovett et al., 2008).

However, not all studies showed positive outcomes. A significant portion of the studies did not find a statistical difference in academic outcomes between students in OER courses vs. non-OER courses. For example, Allen et al. (2015) conducted an experimental design study with one group using OER and the other using a traditional chemistry text. No statistical difference in learning outcomes was found between students in OER courses when compared to students in non-OER courses. Another study compared the learning outcomes of a hybrid machine-guided online interactive learning termed Interactive Learning Online and traditional face-to-face classes (Bowen et al., 2014). The study employed a randomized trial study design with two independent groups of public university students on six campuses in the United States. The study measured learning outcomes like pass rates and final exam scores. It found no statistically significant difference in student outcomes between the two groups. Other recent studies have shown that students in OER courses show no statistically significant difference in outcomes when compared to students in non-OER courses (Colvard et al., 2018; Hilton, 2016; Ikahihifo et al., 2017). Although there are studies suggesting lower student performance in OER courses, as identified by Delgado et al. (2019), Gurung (2017), and Robinson (2015), the overall body of research indicates that OER does not have an adverse effect on student outcomes and may even result in improvements.

Multiple studies indicate that OER can increase participation among underserved groups (Bossu et al., 2012; Jenkins et al., 2020). Additionally, research has explored the positive impact of textbook affordability on academic achievement. However, there remains a noticeable gap in empirical studies examining this relationship for historically underserved students, particularly regarding ethnicity and varying financial needs. One study conducted in a four-year HSI revealed that Hispanic students were significantly more likely to avoid taking classes due to high textbook costs (Jenkins et al., 2020). Additionally, the study found that Hispanic students were three times more likely to fail a class due to a lack of access to required textbooks, further emphasizing the need for institutions to ensure that all students have access to the necessary course materials, regardless of their financial background (Jenkins et al., 2020). However, the research gap in this study was that it failed to explore the alternative resources that students used instead of purchasing required course materials, such as sharing textbooks or using open educational resources. Many studies have focused on student outcomes due to OER without delving into the nuanced differences among ethnic groups or students with distinct financial circumstances. While Fischer et al. (2015) employed propensity score matching to mitigate the influence of race/ethnicity on student outcomes, they did not provide disaggregated results based on race/ethnicity. Community colleges designated as HSIs, like COM, have a responsibility to identify and address the needs of Hispanic students. It is imperative for HSIs to not only examine the overall impact of interventions like OER on student outcomes but also analyze them through the lens of the Hispanic student population and other underserved groups. This study focuses on the relationship between OER and student outcomes, particularly among Hispanic students and those with financial needs. It will provide valuable insights into how OER initiatives can effectively support these student groups.

Theoretical Framework

The COUP (cost, outcome, use, perceptions) framework, developed by Bliss et al. (2013), serves as the theoretical foundation for this study. This framework examines the effects of open educational textbooks and open pedagogy in secondary and postsecondary educational institutions. By analyzing the four components of COUP, the study aims to explore the fundamental aspects of learning that are influenced by adopting OER. OER implementation impacts financial metrics for both students and institutions. Supporters of OER believe that using OER textbooks will save postsecondary students a significant amount of money. This also has the potential to impact bookstore revenues for the institution. The cost component of the COUP framework examines the financial impacts of adopting OER for students and educational institutions. It focuses on the potential cost savings for students by using inexpensive or freely available OER materials instead of traditional textbooks. The component also considers the financial implications for institutions, such as bookstore revenues and tuition revenue changes due to drop rates, enrollment intensity, and student persistence. By studying the cost component, this research aims to provide empirical evidence on the financial aspects of OER adoption and inform decision-making for students and institutions (Open Education Group, n.d.).

The outcomes path within the COUP framework focuses on providing empirical evidence regarding the learning impacts of adopting OER. It aims to measure and analyze various outcomes, such as changes in course completion rates, changes in dropout rates, and changes in the percentages of students receiving a grade of C or better. This path aims to understand the magnitude and direction of these impacts resulting from OER adoption. This empirical evidence

contributes to evaluating and assessing the effectiveness of OER in improving student learning outcomes (Open Education Group, n.d.).

The usage component of the COUP framework focuses on assessing the extent to which students and faculty engage in various activities related to manipulating OER. This includes deleting material from the OER, inserting other open materials within the OER, moving material around, and editing OER materials. By measuring usage, the framework aims to evaluate users' level of active involvement and customization of OER. This information provides insights into how individuals utilize the flexibility and adaptability offered by OER to meet their specific educational needs. (Open Education Group, n.d.).

Compared to traditional textbooks, the perceptions component of the COUP framework focuses on assessing the attitudes and feelings of students and faculty members toward OER. This component aims to verify and understand individuals' perceptions, opinions, and beliefs regarding OER. It explores factors such as satisfaction, preference, perceived value, usability, and overall experiences with OER. By examining perceptions, the framework provides valuable insights into the acceptance and reception of OER among the educational community, helping to inform future adoption and implementation strategies (Open Education Group, n.d.).

Previous studies on OER have examined different components of the COUP framework within the context of OER adoption. Some studies have focused on the cost component, exploring textbook affordability and student cost savings (Hilton III et al., 2014; Senack, 2015). One study examining textbook affordability also considered faculty perception by combining the cost and usage components of the framework (Allen & Seaman, 2014). Multiple studies have explored the usage and perception components of the COUP framework (Jhangiani et al., 2016; Kimmons, 2015; Lindshield & Adhikari, 2013; Pitt, 2015). These studies have investigated how

students and faculty engage with OER and their perceptions of its usage and effectiveness. A separate study examined the faculty perception of OER (Allen & Seaman, 2014).

Furthermore, studies have focused on student outcomes and exploring student and faculty perceptions of OER (Hilton, 2016; Hilton III et al., 2013). These studies aimed to understand the impact of OER adoption on student learning outcomes, considering students' and faculty members' perceptions and experiences. Several studies have primarily focused on the outcomes portion of the COUP framework (Allen et al., 2015; Fisher et al., 2015; Hilton & Laman, 2012; Robinson, 2015; Robinson et al., 2014). These studies examined how OER adoption and associated benefits, such as reduced educational costs and timely access to materials, influenced student outcomes. The potential impact of OER on student outcomes is significant and warrants further investigation.

In line with the research mentioned above, this study will exclusively concentrate on the outcomes section of the COUP framework. It aims to extend the framework by disaggregating outcomes based on various demographics and socioeconomic characteristics, specifically focusing on race and need-based aid eligibility. By adopting an equity lens, this study contributes to a more comprehensive understanding of the relationship between OER adoption and student outcomes, considering the diverse student population and addressing potential disparities within the COUP framework.

Research Design

This study employs a correlational design to measure the degree of association or relationship between two or more variables using statistical procedures (Creswell, 2015). This design was selected because the study examines the relationship between multiple independent

variables (Hispanic ethnicity, students with financial needs, and OER course) and a dependent variable (student outcome metric). By employing a quantitative approach with a correlational design, this study seeks to provide empirical evidence regarding the relationships between various factors (independent variables) and student outcomes (dependent variable). Using statistical analysis enabled me to assess the strength and direction of these relationships, contributing to a deeper understanding of the impact of OER adoption on student outcomes, particularly among Hispanic students and those with financial needs.

Data Source and Sample

The study utilized existing institutional data from a large midwestern community college. Using existing institutional data allows for the analysis of real-world student information, enhancing the external validity of the study findings. By obtaining the necessary ethical approvals and securing cooperation from relevant stakeholders, the study ensured adherence to ethical guidelines and established a collaborative partnership with the community college. This approach strengthens the validity and credibility of the research outcomes. The research used institutional data from the College of Maple (COM) in Lightning Bolt, Illinois. COM is an appropriate research site for this study due to its designation as an HSI and its diverse student population regarding ethnicity and financial need. The college is situated in the Chicago suburbs and has a total enrollment of approximately 10,000 students, with 40% full-time and 60% part-time students. The student demographics consist of 41% Hispanic, 38% White, 6% Asian, 6% Black, and 4% representing other races and ethnicities (ICCB, 2021). Over half of all students received some form of financial aid, with an average amount of \$4,520 (NCES, 2021). Notably, many students receiving financial aid were racial minority students. COM's graduation and

dropout rates also show disparities between White and Hispanic students. In 2021, the graduation rate for White students was 32%, while for Hispanic students, it was 25%. Similarly, the dropout rate for White students was 18% compared to 23% for Hispanic students (NCES, 2021). These student success metrics suggest that White students have better outcomes overall.

While financial aid covers most of the tuition costs for students with financial needs, financial needs related to textbooks and living expenses still need to be met. To address this, in 2021, COM initiated efforts to promote the broader adoption of OER across all departments. Several departments at COM have adopted OER and provide all students in OER courses with access to learning materials from the beginning of the course. This early access to materials is particularly beneficial for students who typically delay or forgo purchasing textbooks due to financial reasons, with studies indicating that racial minority students tend to face more challenges in affording textbooks than White students. The college has already assessed the cost savings for students who have enrolled in OER classes. However, exploring how OER implementation influences student outcomes is necessary. Given COM's HSI status, there is a particular interest in examining the correlation between OER implementation and student outcomes, specifically among Hispanic students and those with financial needs.

To assess the impact of OER on college students, this study collected secondary data from approximately 183 students. The study sample consisted of students in five Anthropology 121 courses utilizing OER (treatment group; $n = 85$) and students in five Anthropology 121 non-OER courses (control group; $n = 98$) from Fall 2022. Data from the institutional data warehouse in Fall 2022, including student ethnicity, financial aid status, final exam scores, and pass/fail outcomes, was retrieved from the Institutional Effectiveness, Planning, and Research (IEPR) Digital Data Warehouse portal accessible via COM's intranet. This existing institutional data is

continually collected and stored in the Digital Data Warehouse managed by the IEPR Department at COM.

Method

This study examined the relationship between OER and two student outcome metrics (Table 2). The first outcome is a pass/fail of the course. This variable is a discrete variable that indicates whether the student has passed or failed the course. The second outcome variable is the score earned in the final examination. This continuous variable records the score earned by each student in the final examination. The independent variable in this study is the course type: OER/non-OER, a nominal variable. The entire sample was used to determine whether there is a relationship between the independent variable OER/non-OER and the two dependent variables. After the overall relationship between the independent variable and the dependent variable was examined, the data was then subsetted to students with Hispanic ethnicity ($n = 72$), and the same tests were run to examine the relationship between OER and the two student metrics. The reason to subset the data by Hispanic ethnicity is that COM is an HSI and needs to understand the relationship between OER and student success for its Hispanic students. The final analysis was to subset the data by students who receive financial aid ($n = 65$) and examine whether OER and the dependent variable relationship exist for this subsetted data. Financial aid status is a proxy for the economic background of the student, with the assumption that anyone receiving financial aid was considered to be low income (Table 2).

Table 2

Dependent and Independent Variables

	Variable	Definition
Dependent Variable	Pass/Fail	0=Fail 1=Pass 2=Withdrew
	Points scored in the final exam	Continuous variable
Independent Variable	OER Course	0=Non-OER Course 1=OER course
	Hispanic Ethnicity	0=Non-Hispanic 1=Hispanic
	Received Financial Aid	0=Did not receive financial aid 1=Received financial aid

Analytic Strategy

The data analysis plan explored whether there are statistically significant differences between OER and non-OER groups for the two student metrics of pass/fail and final exam scores. All statistical analysis was done in Python using SciPy.stats subpackage of SciPy. The initial exploratory data analysis developed descriptive profiles of the sample regarding outcome variables for the full sample and each subsample based on students' Hispanic ethnicity and financial aid status.

Inferential statistics using the chi-square test of independence was used to understand whether there was a difference between OER and non-OER groups for the pass/fail metric. This test was done using the chi2_contingency module in the SciPy.stats sub-package. The chi-square

test of independence (also known as the Pearson chi-square test or simply the chi-square) is one of the most valuable statistics for testing hypotheses when the variables are nominal (McHugh, 2013). The chi-square (χ^2) can provide information on whether there is a relationship between two categorical variables. For the final exam score metrics, the difference between OER and non-OER groups for the points scored in the final exam metric was examined using the t test of independence. Comparison of the means of the two mutually independent groups that satisfy both the normality and equal variance assumptions can be obtained by independent t test. The independent t test determines whether there is a difference between the means of two independent samples (control: non-OER course vs. test - OER course) (Frankfort-Nachmias & Leon-Guerrero, 2021). Since the dependent variable, the final exam scores earned, is not a nominal variable, the study used an independent t test to compare the means of the two groups. The t test was conducted using the `ttest_ind` module in SciPy.stats sub-package.

The data was then subsetted to Hispanic students. For this subsetted “Hispanic” and “financial aid receiving students” data, the same chi-square test of independence test was done for the pass/fail metric. Similarly, the t test of independence was done on the subsetted Hispanic group and financial aid recipients, respectively, to understand the difference in groups between OER and non-OER courses for the final points scored metric.

Limitations

This study’s significant limitation is its reliance on data collected from a single Hispanic-serving community college. While the findings provide insights into the impact of OER on student success within this specific institutional context, generalizability to the broader population of HSIs is constrained. To address this limitation, future research endeavors should

extend the investigation to encompass multiple HSIs across diverse regions within the United States. A more comprehensive understanding of the effects of OER implementation on student success can be achieved by including a broader range of institutions to account for potential variations in student demographics, institutional characteristics, and regional factors.

Moreover, the current study is constrained by the recent initiation of OER implementation at COM, resulting in a limited number of departments adopting OER. This limited OER adoption restricts the available sample data and may influence the generalizability of the findings. In addition, the design of this study was restricted to one Anthropology course in the Social sciences division. The study conclusion are not generalizable and might be different if the study was expanded to other courses in other divisions. Future research should be conducted over an extended timeframe to mitigate this limitation, allowing for the gradual adoption of OER across additional departments. A more robust analysis can be conducted by capturing data from a larger sample size to provide a more accurate representation of the relationship between OER and student success

Furthermore, this study employs financial aid as a proxy for identifying students with financial needs. It is essential to acknowledge that this approach may only capture part of the spectrum of students facing economic challenges, as some students with financial needs may choose not to apply for financial aid. To address this limitation, future research should explore alternative indicators or measures to identify students with financial needs more comprehensively. For instance, incorporating self-reported data or administering surveys that directly assess students' economic situations would provide a more nuanced understanding of the relationship between OER and student success for students with varying financial circumstances.

Additionally, this study focuses exclusively on the impact of OER on Hispanic students. To broaden the scope and inclusivity of the research, future investigations should expand their analysis to include other racial and ethnic groups. This expansion would enable comparative analysis, facilitating the identification of potential variations in the relationship between OER and student success across different racial and ethnic populations. Finally, it would provide valuable insights into potential disparities in outcomes, allowing for a more comprehensive understanding of the differential effects of OER adoption on student success among various racial and ethnic groups.

By addressing the limitations above, future research endeavors can enhance the current study's findings and contribute to a more comprehensive understanding of the impact of OER on student success within HSIs. By expanding the study to multiple HSIs, including a larger sample size, employing alternative indicators of financial need, and considering the experiences of diverse racial and ethnic groups, a more robust analysis can be achieved, leading to more informed policy and practice recommendations.

Results

Descriptive Statistics

In the sample, 183 students were enrolled in the ten anthropology (ANT-121) courses during the fall semester of 2022. Five courses out of the ten courses in the sample were OER courses, and the other 5 were non-OER courses. Out of the 183 students, 85 had registered for the OER course, and 98 had registered for the non-OER course. There were 33 Hispanic students out of 85 students (40%) in the OER courses in the sample. There were 39 Hispanic students out

of the 98 students (40%) in the non-OER courses in the sample. There were 31 students who received financial aid out of 85 students (35%) in the OER courses in the sample. There were 35 students who received financial aid out of the 98 students (36%) in the non-OER courses in the sample.

In terms of descriptive statistics of pass/fail metrics, 80% of students in OER courses passed compared to only 66.3% of students in non-OER courses. When looking at a subsetted Hispanic data, 75.8% of Hispanic students passed the course compared to 59.0% of students in non-OER courses. For students who received financial aid, 80% of the students passed the course, whereas only 66.3% of the students passed the course for non-OER courses (Table 3).

Table 3

Descriptive Statistics Pass/Fail Metric

Subset	Characteristic		OER Frequency (%)	Non-OER Frequency (%)
All	Pass/Fail	Pass	68 (80.0)	65 (66.3)
		Fail	4 (4.7)	10 (10.2)
		Withdrew	13 (15.3)	23 (23.5)
		Total	85 (100.0)	98 (100.0)
Hispanic	Pass/Fail	Pass	25 (75.8)	23 (59.0)
		Fail	2 (6.1)	4 (10.3)
		Withdrew	6 (18.1)	12 (30.8)
		Total	33 (100.0)	39 (100.0)
Students Receiving Financial Aid	Pass/Fail	Pass	25 (80.0)	24 (68.6)
		Fail	2 (4.7)	4 (11.4)
		Withdrew	4 (15.3)	7 (20.0)
		Total	31 (100)	35 (100.0)

Course withdrawal rates vary across courses depending on the course complexity, and student demographics (McKinney et al., 2018). This study was based on 10 different classes of the same course. The descriptive statistics show that the withdrawal rates for the OER courses were lower when compared to the non-OER course across all samples in this study. Further research is needed to determine whether the withdrawal rates for this Anthropology course is consistent with scores from previous years.

For the final exam scores metric, the mean score of the students in the 5 OER courses was 89.8 with a standard deviation of 16.5 compared to a mean score of 84.1 with a standard deviation of 18.9 for the students in the non-OER courses. For the subsetted Hispanic student data set, the mean score in the final exam for OER courses was again higher than the mean score for non-OER courses. The mean scores for students receiving financial aid were also higher for OER courses when compared to non-OER courses (Table 4).

Table 4
Descriptive Statistics Final Exam Score

Subset	OER M (SD)	non-OER M (SD)
All	89.8 (16.5)	84.1 (18.9)
Hispanic	85.4 (21.8)	81.9 (21.7)
Students Receiving Financial Aid	89.3 (21.7)	82.9 (19.3)

Chi-Square Test of Independence Results

Total Sample of Pass/Fail Metric

This analysis answers part of the first research question: Is OER associated with students' academic outcomes in terms of course passing? The analysis was run on the entire sample data ($n = 183$). When the entire sample was considered for the pass/fail/withdraw metric for the OER group, 68 students passed, four failed, and 13 withdrew. For the non-OER group, there 65 students passed, 10 failed, and 23 withdrew. This data was fed into the `chi2_contingency` function, and the following results were obtained - $\chi^2(2, N = 183) = 4.52, p = .105$. With a p -value of .105, which is greater than the significance level of .05, the null hypothesis cannot be rejected. This implies there is no significant association between OER courses and the pass/fail/withdrawal metric. Therefore, the difference in pass, fail, and withdrawal numbers between OER and non-OER courses is not statistically significant for the full sample (Table 5).

Table 5

Sample of All Students in the Ten Courses

Intervention	Passed	Failed	Withdrew
Observed			
OER	68	4	13
non-OER	65	10	23
Expected			
OER	71.2	7.5	19.3
non-OER	61.7	6.5	16.7

Sample Subset to Hispanic Students - Pass/Fail Metric

This analysis answers a part of the second research question: Is OER associated with students' academic outcomes regarding course passing for Hispanic students? The sample data was a subset of Hispanic students ($n = 72$). When the Hispanic sample was considered for the pass/fail/withdraw metric for the OER group, 25 students passed, two failed, and four withdrew. For the non-OER group, 23 students passed, four failed, and 12 withdrew. This data was fed into the `chi2_contingency` function, and the following results were obtained - $\chi^2(2, N = 72) = 2.27$, $p = .322$. With a p -value of .322, which is greater than the significance level of .05, the null hypothesis cannot be rejected. This indicates that there is no significant association between OER courses and the pass/fail/withdrawal metric for the Hispanic sample. The difference in pass, fail, and withdrawal numbers between OER and non-OER courses is, therefore, not statistically significant (Table 6).

Table 6

Sample Subset to Hispanic Student's Course

Intervention	Passed	Failed	Withdrew
Observed			
OER	25	2	4
non-OER	23	4	12
Expected			
OER	26	3.25	9.75
non-OER	22	2.75	8.25

Sample Subset of Students Who Received Financial Aid - Pass/Fail Metric

This analysis answers a part of the second research question: Is OER associated with students' academic outcomes regarding course passing for students with financial needs? The total sample data was a subset to include only students who received financial aid ($n = 65$). When the financial aid sample was considered for the pass/fail/withdraw metric for the OER group, 24 students passed, two failed, and four withdrew. For the non-OER group, 24 students passed, four failed, and seven withdrew. This data was fed into the `chi2_contingency` function, and the following results were obtained - $\chi^2(2, N = 65) = 1.11, p = .575$. With a p value of .575, which is greater than the significance level of .05, the null hypothesis cannot be rejected. This indicates that there is no significant association between OER courses and the pass/fail/withdrawal metric for the financial need sample. The difference in pass, fail, and withdrawal numbers between OER and non-OER courses is, therefore, not statistically significant for students with financial need (Table 7).

Table 7

Students Accepting Financial Aid

Intervention	Passed	Failed	Withdrew
Observed			
OER	24	2	4
non-OER	24	4	7
Expected			
OER	22.2	2.77	5.08
non-OER	25.8	3.23	5.92

T-Test Difference Between Mean

Total Sample of Final Exam Scores

This analysis answers part of the first research question: Is OER associated with students' academic outcomes in terms of final exam scores? The total sample was used for this analysis ($n = 183$). When the entire sample was considered for the final exam scores metric, the mean score of the students in the 5 OER courses was 89.8 with a standard deviation of 16.3 compared to a mean score of 84.1 with a standard deviation of 18.8 for the students in the non-OER courses. The two groups, OER and non-OER, from the total sample were produced. When the t test was run on these two groups, the following metrics were obtained. Students taking anthropology OER courses had higher final exam scores ($M = 89.8, SD = 16.3$) than did students taking anthropology non-OER courses ($M = 84.1, SD = 18.8$), $t(183) = 1.90, p = .06$. The null hypothesis cannot be rejected that there is not a significant relationship between OER and non-OER courses on final exam scores (Table 8).

Table 8

Sample of All Students

Intervention	M	SD
Observed		
OER	89.8	16.3
non-OER	84.1	18.8

Subsetting Sample Final Exam Scores of Hispanic Students

This analysis answers part of the first research question: Is OER associated with students' academic outcomes in terms of final exam scores for Hispanic students? The analysis was run on the sample data subsetting only to include Hispanic students ($n = 72$). When the final exam scores metric was considered for the subsetting Hispanic sample, it was found that the mean score of the Hispanic students in the 5 OER courses was 85.4 with a standard deviation of 21.4 compared to a mean score of 72.1 with a standard deviation of 33.2 for the students in the non-OER courses. The entire sample was divided into two groups: OER and non-OER. When the t test was run on these two groups, the following metrics were obtained. Hispanic students who took anthropology OER courses had higher final exam scores ($M = 85.4, SD = 21.4$) than did Hispanic students taking anthropology non-OER courses ($M = 72.1, SD = 33.2$), $t(72) = 1.71, p = .09$. Again, the null hypothesis cannot be rejected, and there is no significant relationship between OER and non-OER courses for Hispanic students on final exam scores (Table 9).

Table 9

Sample of Hispanic Students

Intervention	M	SD
Observed		
OER	85.4	21.4
non-OER	72.1	33.2

Subsetted Sample Final Exam Scores of Students Who Received Financial Aid

This analysis answers part of the first research question: Is OER associated with students' academic outcomes in terms of final exam scores for students with financial need? The analysis was run on the sample data subsetted to include only students who received financial aid ($n = 65$). When the subsetted financial-aid-receiving student sample was considered for the final exam scores metric, the mean score of the students in the 5 OER courses was 89.4 with a standard deviation of 21.3 compared to a mean score of 76.9 with a standard deviation of 28.4 for the students in the non-OER courses. The entire sample was divided into two groups, OER and non-OER. When the t test was run on these two groups, the following metrics were obtained. Financial-aid-receiving students taking anthropology OER courses had higher final exam scores ($M = 89.4, SD = 21.3$) than did financial aid-receiving students taking anthropology non-OER courses ($M = 76.9, SD = 28.4$), $t(65) = 1.78, p = .08$. Since the p value of .08 is greater than the significance level ($alpha = 0.05$), the null hypothesis cannot be rejected, and it is concluded that there is no significant relationship between OER and non-OER courses for students with financial need on final exam scores (Table 10).

Table 10

Sample of Students with Financial Need

Intervention	M	S
Observed		
OER	89.4	21.3
non-OER	76.9	28.4

Discussion

The two research questions in this study, Is OER associated with students' academic outcomes in terms of scores in the final exam and course passing, were answered using two statistical techniques: a *t* test for final exam scores and a chi-square test of independence for course passing. The descriptive statistics of course passing and final exam scores indicated that students in OER courses performed better than students in non-OER courses. However, when the statistical tests were applied to the total sample, there was no statistical difference between OER and non-OER courses. This finding aligns with multiple other studies that failed to show statistically significant differences in student outcomes between OER and non-OER courses (Allen et al., 2015; Bowen et al., 2014, Lovett et al., 2008).

Similarly, the second research question, Is OER associated with students' academic outcomes regarding scores in the final exam and course passing for Hispanic students and students with financial needs, was also examined by using statistical techniques for final exam scores (*t* test) and course-passing (chi-square test of independence) on a subsetted list. This research question was primarily intended to see whether there was a correlation between OER and student outcomes for underserved student groups. The descriptive statistics showed that Hispanic students and students with financial need in OER courses performed better than students in non-OER courses. However, the statistical tests showed that there was no statistical difference between OER and non-OER courses for the two underserved groups: Hispanic students and students with financial need. Textbook costs are a significant barrier for underserved students to access higher education, and OER is a potential means to achieve a more socially just college experience (Jenkins et al., 2020). Even though this study could not

demonstrate a positive correlation between OER and student outcomes for underserved students, it also did not indicate a negative correlation. The results from this study suggest that while OER may improve access, it does not yield a negative correlation between student outcomes.

Student withdrawal was also a metric that was measured as part of the course passing student outcome. Addressing student withdrawal rates is a complex issue that involves understanding and mitigating a variety of factors. While OER can be a valuable resource, it's just one piece of the puzzle, and a holistic approach that takes into account academic readiness, socio-economic factors, course difficulty, and various support mechanisms is crucial for improving student outcomes (McKinney et al., 2018). Improving course withdrawal rates often requires a multi-faceted approach that includes providing student advising, institutional policies for creating an inclusive campus culture, and faculty involvement (Akos & James, 2020).

OER studies generally show either positive results or produce results that indicate “do no harm” because students in OER courses do as well as those in traditional courses (Lovett et al., 2008, p. 8). The conclusion of this study is essentially aligned with the “do no harm” findings from various other studies. One study found that common methods used to examine OER efficacy are unlikely to detect positive effects based on predictions of the access hypothesis (Grimaldi et al., 2019). The access hypothesis states that OER benefits learning by providing access to critical course materials. It, therefore, predicts that OER should only benefit students who would not otherwise have access to the materials (Grimaldi et al., 2019). However, most studies, including this one, have not controlled for students who otherwise would not have access to the materials, and it could be a reason for the null hypothesis results. However, considerable cost savings for the students are considered the primary goal for most OER interventions. Many students indicated they used the saved money to reinvest in their education by paying tuition,

purchasing materials for other courses, or taking additional courses. The next most common responses included day-to-day expenses and savings (Ikahihifo et al., 2017). Maintaining or improving student outcomes is also an important goal for OER intervention. However, most OER interventions would be considered successful even if no improvement in student outcomes is found as long as student outcomes are maintained.

Multiple studies have suggested various methods to increase support and engagement of students at HSI's (Garcia & Ramirez, 2018; Wolfe et al., 2019). Faculty support and connection with students, financial aid, academic advising, and mental health services are part of institutional policies that will help with improving student outcomes and access (Espinoza & Espinoza, 2012). The use of OER is considered to be an additional tool to provide equal access to educational materials to all students (Grimaldi et al., 2019). However, improvement in access does not imply an improvement in learning outcomes (Tlili et al., 2023). This conclusion lines up with the conclusion of this study that increased access did not lead to statistically significant improvement in student outcomes.

In addition, this study looked at the relationship between OER and student outcomes for Hispanic students and those with financial needs. The rapid increase in textbook costs over the last decade has had a significant impact on access to higher education for all students, especially for Hispanic students and students with financial needs (Colvard et al., 2018). However, this study indicates that underserved groups in OER courses seem to perform as well, if not better, than their counterparts in non-OER courses.

Textbook costs have significantly increased at a rate much greater than regular inflation, with a 1041% increase in textbook costs between 1977 and 2015, while there was only a 308% increase in inflation (Popken, 2015). Students, on average, pay \$1,240 for textbooks alone in one

academic year (College Board, 2019). As a result, the cost-saving benefits of OERs are an important reason why community colleges are implementing OER. OER courses with zero cost provide significant cost savings for students and are expected to continue growing in higher education institutions, especially in community colleges. These savings are advantageous for all students, with a particular benefit for underrepresented groups like Hispanics and those with financial needs. HSI community colleges with a significant Hispanic population can greatly benefit a large number of their students because of OER implementation. This study addresses concerns about whether OER courses adversely affect student outcomes for Hispanic and those students with financial need. Although the result from this study is encouraging, this study was restricted to one course in one community college. A broader study involving multiple community colleges and courses is necessary to validate the conclusion of this study.

Implications for Community Colleges

While the conclusions from this study are not generalizable to all community colleges, the limited results are encouraging. If other research across multiple community colleges and courses confirms the conclusion of this study, the significant cost savings that can be passed on to the students is an important reason for colleges to accelerate the pace of OER implementation. To accelerate the implementation and adoption of OER, community colleges need to raise awareness of OER and its benefits to underserved groups like Hispanic students and those with financial needs. Integration with financial aid offices could be used to raise awareness of OER and its benefits among underserved groups and students with financial needs. OER awareness also needs to be increased among faculty members. This can be done by conducting workshops and informational sessions touting the benefits of OER. As the adoption of OER increases within

the college, care must be taken to ensure there is continuous monitoring of student outcomes. While conducting this research, it became apparent that the community colleges would benefit tremendously by having a system in place to continuously monitor and evaluate OER course outcomes. This would allow community colleges to not only look at the short-term impacts like student pass rates that this study looked at but also look at long term impacts of OER courses on student metrics like graduation rates and retention rates.

Many community colleges are still in the nascent stage of OER implementation. While looking at short-term goals of OER implementation like cost savings and course outcomes makes sense, colleges should develop a clear long-term OER strategy. The long-term strategy should include factors like institutional policies and faculty engagement to ensure continued success based on OER implementation. Community colleges should continue to engage in and support research efforts to understand OER implementations better. In addition, collaborating with other community colleges will allow community colleges to understand and adopt evidence-based best practices. Community colleges also need to adopt a culture of continuous improvement in their OER initiatives. Colleges should ensure that OER materials are regularly reviewed and updated. They also need to get constant feedback from students and faculty and use that to ensure the ongoing success of OER. Community college practitioners should capitalize on these insights to enhance the quality of education, reduce financial barriers for students, and promote equitable access to learning resources. OER is another tool that community colleges can use to promote equity but it must be used in conjunction with other institutional policies and strategies to ensure success.

CHAPTER 3

SCHOLARLY REFLECTION

Reflection on the Dissertation Process

Over the course of the last 15 years, I have taught economics in multiple community colleges in Illinois. All these colleges serve a diverse student population, with a sizable number of students coming from low-income backgrounds and minority groups. Equity is one of the goals of these community colleges because they want to provide equal access to educational opportunities and resources for all students. When I first started teaching in community colleges, I did not truly understand the meaning of equity. I tried to be fair to all students, but it never occurred to me that minority students and students from low-income backgrounds might need additional support. One of the first things that made me aware of the challenges faced by many of my students was when I assigned assignments from the textbook to my students. A number of my students would not turn in the assignments even though they seemed to be enthusiastic students who actively participated in class. When I tried to find out why, I realized that they had not even bought the textbook and therefore were unable to finish the assignments. On further inquiry, I found out that the textbook cost was very high, and they could not afford to buy the textbook for a 16-week course. Of course, there were other students in my class who could afford the textbook and had access to the material from the beginning of the course. Students who could not afford the textbooks had a distinct disadvantage and did not do well in the tests and exams in my course. This bothered me to a great extent. However, I could not do anything because most colleges had prescribed textbooks that all the faculty had to follow. Also, I was an adjunct

instructor for most of my teaching career and had very little influence on what textbooks were prescribed for the courses.

I became a full-time instructor at COM in 2019. The Dean of the social sciences division approached me to see whether I would be interested in spearheading OER implementation within the economics department at COM. I was initially apprehensive about forgoing publisher textbooks for my class and completely collecting and collating OER material for my course. However, the ability to provide an economics course where the students are not forced to buy an expensive textbook was very tempting as I knew from experience that it would help my students. The chair of the economics department and I agreed to create an OER course as a proof of concept. The creation of teaching material and student assessment material using OER, especially without the use of publisher-provided material, was a challenging task, but we managed to create and run these proof-of-concept courses. The courses were highly successful. From a teacher's perspective, I felt that I had more control over the material and how I wanted to teach my classes. More students turned in the assignments on time, and our assessments showed that students did better in this proof-of-concept course than in normal courses. With the success of our proof-of-concept courses and because we had collated a set of OER materials, we were able to encourage all the faculty in the economics department to adopt OER. All the economics courses at COM are now OER courses, and I consider that to be one of my proudest achievements.

As an early adopter of OER within my college, I was invited to be a faculty representative in a newly formed OER committee. When I joined the committee, it was clear that we had a good idea about the overall cost savings for students due to OER implementation. However, the committee had no idea about OER's impact on student outcomes. Also, the

committee could not answer questions about OER's impact on disaggregated groups like Hispanic students and students with financial needs. As I was thinking about topics for my dissertation, a study whose goal was to investigate the relationship between OER and student outcomes seemed to be an obvious choice. I also had a personal interest in this topic because of my involvement with OER as a faculty and as a member of the OER committee. My philosophical orientation is post-positivist, and therefore I was clear that I was going to use a quantitative method for this research. Since this was the research that the OER committee was interested in, I did not have to struggle for institutional support. As a faculty member, I could not access databases that housed the information needed for my research. However, because of the strong institutional support for the research, especially from the dean of the social sciences division, I was able to request the required data retrieval and formatting from institutional databases. The first few months of the research were spent understanding previous studies and literature around OER implementation and student success. I believe my choice of the COUP framework as a theoretical framework for my research was a good choice because it is a framework for looking at OER implementations, and other studies have used this. I relied heavily on the advice of my dissertation chair to construct my research plan and analytic design. My initial plan was to use regression analysis to determine the relationship between OER and student outcomes. Regression analysis is generally used to predict the value of the dependent variable, and in this research study, we were not trying to predict a value. I therefore changed the statistical techniques to chi-square of independence and *t* test because I just wanted to analyze the relationship between the dependent and independent variables.

When it came to pulling the data I needed for the study, I wanted to pick a course that was being run as OER and non-OER simultaneously. I found an introductory anthropology

course with five OER classes and five non-OER classes, which ran in Fall 2022. The sample size of 183 was an acceptable sample size for this test. I was also going to run the tests on the total sample subsetted to just Hispanic students and students with financial needs. The subsetted samples for both Hispanics and students with financial needs were above the acceptable sample size of 50 for the chi-square test and 40 for the t test.

Most of the challenges I faced with this research were identifying and accessing the data I needed. The data I required for my research was fairly basic, and at the outset, I had assumed that acquiring the data would be a trivial task but was apprehensive about the whole approval process required to get access to this data. To my surprise, there was a lot of support for the research, and the approval for data access came fairly quickly. However, when I tried to find courses that had both an OER and a non-OER component, I found that not all divisions maintained this demarcation. This meant that my initial search for the courses became restricted to only divisions that had this clear demarcation. OER implementation is in its nascent state at COM, and one learning from this study is that every course being offered should be clearly identified as an OER or a non-OER course in the college database to help future OER studies.

Another major challenge I faced during this research was getting access to the final exam scores, which was an outcome I was testing in my research. The IEPR Department at COM was responsible for collecting data for extracting and formatting for my research. IEPR was able to access all the other data that I needed for my research except the final exam scores. I found that the final exam scores are kept in a separate database. IEPR could access this data and join it back with the other data for my analysis, but to extract final exam scores, they needed approval from the instructors of each of the classes. Initially, I had selected an introductory psychology course to run my study on. I approached the instructors of the 10 introductory psychology courses for

permission to extract the final exam scores. I did not get a response from a majority of the instructors, even after repeated attempts to get their approval. There was also some pushback from two instructors citing privacy concerns even though I had clearly outlined that this was an approved study and there would not be any data that could be used to identify individual students.

I then approached the chair of the OER committee, who is also the dean of the social sciences division, to see if he could help. He suggested I find a course within the social sciences division. I found an anthropology course that ran in Fall 2022, which yielded the sample size I needed. My request for approval from instructors from the anthropology division was ignored initially. However, a follow-up email from the dean asking for help with the research resulted in all the instructors approving my request. IEPR was then able to extract the final exam scores and join them back to the other data. Finally, I had the data that I needed to conduct my research. This whole ordeal of trying to get approval from individual instructors made me realize the difficulty of getting research data and how important it is to have influential people support your research. If I had not had the dean's support and his direct intervention on my behalf, I would have been stuck without access to the final exam scores.

Application to Professional Practice

I was an early adopter of OER as an instructor. I have been a strong proponent of OER and have encouraged other instructors to embrace OER in their courses. OER has proven beneficial in alleviating some financial burden on the students by providing free course material. This makes education more equitable and accessible, which is the goal of most community colleges. Also, OER materials can be tailored to meet the requirements of the students and can be

kept up to date with the latest developments in the field. Through my experience, I discovered the need to incorporate digital tools like videos, simulations, interactive modules, and open online courses to significantly improve student engagement and participation. In the summer of 2023, I had the opportunity to present my views of OER at a National Institute for Staff and Organizational Development conference, providing insight from the perspective of a faculty member at a community college. As a faculty member, I could present my views on the benefits of creating an OER-based course. Even though I stated the many benefits of OER, there were still questions about whether the lack of publisher textbooks could harm student learning. This study's findings could be used to demonstrate that the lack of publisher books because of OER does not harm student learning.

As a faculty member, I had not been exposed to the other administrative functions and departments across COM. The study forced me to reach out and make connections with other departments and administrative functions. I was fortunate to have the institutional support to conduct the research. I will be sharing the results of my research with the OER committee and hope that the results of my study will encourage COM to accelerate the pace of OER implementation within the college. The OER committee can use this study, in addition to the cost savings data, to encourage more faculty and departments to adopt OER. The descriptive data analysis showed encouraging results for Hispanic and low-income students. As COM is an HSI, it would be especially encouraged by the findings of this study, as the adoption of OER will help Hispanic students immensely. The positive equity implications of OER implementation would be corroborated by using my study in conjunction with other research. My role is expected to expand significantly in the coming years when I become chair of the economics department. This

role will mean that I need to continue to encourage the adoption of OER by new faculty members within the department.

Application to Research Practice

The dissertation process has allowed me to gain a deeper understanding of the research process and the patience and rigor required to conduct academic research. I came to understand the iterative nature of research with respect to conducting an exhaustive literature review, finding other research studies, and evaluating methodologies. I remember struggling with the basic formulation of my research questions, and I am thankful to my dissertation chair Dr. Hu for guiding me through this process of formulating the right questions.

I came into the EdD program with very limited exposure to conducting research. I felt the rigor of the program and its focus on conducting research in a community college setting was highly effective in providing me with a foundation for the dissertation process. It was this program that helped me identify my philosophical orientation and identify that quantitative research is the type of research I wanted to conduct. I successfully completed the research methods course in this program. However, as I began this study, I realized that I had to re-learn the statistical techniques and tools. Even though there was a steep learning curve to this, I am glad for this process that helped me gain a solid foundation for further quantitative research. I also enjoyed learning the basics of the Python programming language to use its statistical models for my research. The process of identifying the variables that I needed for the study and the process of requesting this data from my institution has allowed me to gain knowledge about the kinds of data available within the institution. This will help me when I conduct future research because I now know who to approach and how to ask for this information. I faced numerous

challenges in acquiring data. These challenges were frustrating while I was conducting this study, but on reflection, it has improved my problem-solving skills and taught me valuable life lessons in navigating potential pitfalls and overcoming hurdles.

One of the biggest takeaways from this process is that learning is a continuous process. I intend to continue to do periodic literature reviews and keep abreast of newer OER studies. I have two goals going forward. First, I want to expand this study to other minority groups like Blacks and Asians to see if there is a relationship between OER and student outcomes for these minority groups. Second, I will conduct a qualitative study to understand student and faculty perspectives on OER implementation which will further enhance the findings of this research. Overall, I found that the dissertation process taught me valuable lessons in data analysis, critical thinking, and learning to approach problems systematically. I am extremely grateful to my dissertation committee and all my professors who helped me along the way.

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