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The Effectiveness of Placement Exams and a Free Remedial Summer Program at a Midsized Selective Private University

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THE EFFECTIVENESS OF PLACEMENT EXAMS AND A FREE REMEDIAL SUMMER PROGRAM AT A MIDSIZED SELECTIVE PRIVATE UNIVERSITY

by

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ABSTRACT

In order to explore the effectiveness of MSSPU's remedial placement practices and the impacts of participation in the Free Remedial Summer Program on student outcomes, this *ex post facto* study examined performance in remedial courses, persistence to graduation, and time to graduation as it relates to mathematics and English composition placement level, high school grade point averages, entrance exam scores, and participation in the Free Remedial Summer Program. Five unique statistical tests were utilized to address fifteen hypothesis related to seven research questions.

Several major findings were a result of this study. First, students who complete the mathematics placement exam and enroll outside of their recommended level, either above or below their placement level, perform better in both their first and second mathematics courses, on average, than those who enroll at the recommended level. The same was found for English composition. Second, students who place at a non-remedial level are more likely to persist to graduation, statistically. Third, neither high school grade point average nor entrance exam scores alone are strong indicators of time or persistence to graduation. However, fourth, the factors of high school grade point average, entrance exam score, and placement exam performance may be a better indicator of persistence to graduation when analyzed in a combined fashion.

Finally, students who enroll in the Free Remedial Summer Program are less likely to persist to graduation than those who enroll in remedial coursework as part of their first term. These students also are more likely to fail their first and subsequent mathematics courses. This study concludes with a brief analysis of implications for practice, recommendations for further research, and a review of best practices.

I dedicate this, and most everything I do, to my daughter, my turtle, Tesla, who has unknowingly sacrificed many evenings with mom which I hope she will never remember, and to my amazing husband, John, for being super dad always (and also sacrificing those evenings), in allowing me to pursue this opportunity. And to Tammy and Ron Hayward, the people to whom I owe my passion, stubbornness, and unrelenting belief that I can accomplish all I set my mind to. Thank you.

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CHAPTER 1: INTRODUCTION

Background of the Study

At the center of economic competitiveness, sustainability, inclusion and equity, and the reduction of poverty is education. The demand for a highly educated populace to meet the needs of a society witness to unprecedented growth in technology, knowledge, global connectedness, and global economies continues to expand (Epstein, 2012; Friedman, 2005; Rosila Nik Yaacob, 2014; Roundtable on competitiveness: building and filing the pipeline, 2006). Friedman (2005) suggests technological advances have increased global competitiveness, allowing previously underdeveloped countries to compete in ways they never have before. These countries "have a very high ethic of education" (Freidman, 2005, p. 212) and the emerging middle classes of India, China, and the former Soviet Empire, for example, aspire to be educated, often making greater sacrifices to obtain that education than most individuals in the United States (Freidman, 2005; Honawar, 2005). In this new, highly connected world, there is an emphasis on "individuals to collaborate and compete globally" (Freidman, 2005, p. 10).

The emergence of developing countries poses a threat to the United States' competitiveness in a global society and reiterates a need for an educated populace. Persistent poverty, a shrinking middle class, and a perception of uncompetitive student achievement in elementary and secondary schools serve as additional threats (Friedman, 2005; Outlook on Science Policy, 2005; United States, 1983). Trumbo and Forsythe (2012) indicate rigorous intellectual standards must be a priority for the United States if it wishes to retain power among its competitors combating mentioned challenges. They suggest an integrated, systems-level

approach in which intellectual capital is treated as a national resource, with an emphasis on science, technology, and practice.

Higher education institutions create unique environments capable of producing solutions to the complex issues posed by a global society while cultivating intellectual capital (Singh, 2011). Developing the individuals to compete in a knowledge-based society has been at the heart of academia since its foundations. Quality education proves more important now than at any other point in history (Bano & Tyler, 2015; Sum & Jessop, 2013). Dougherty and Reid (2007) note the economic and social benefits of obtaining some level of higher education for students as well as society.

While the positive impacts of higher education are well documented (Bano & Taylor, 2015; Crisp & Delgado, 2014; Friedman, 2005; Greene & Forester, 2003), a large number of college bound students are not prepared to successfully complete college level coursework (U.S. Department of Education, 2013). Greene and Forster (2003) estimate approximately 32 percent of students leaving high school were unprepared for college level work while a 2013 survey by the National Center for Education Statistics indicated 24 percent of first year undergraduate students in public institutions reported taking remedial courses in 2007-08. Other studies have found nearly 40 percent of students enroll in one or more remedial courses with reports on community college student remediation ranging from 50 percent to 70 percent (Attewell, Lavin, Domina, & Levey, 2006; Bettinger & Long, 2007; Fain, 2012; Jones, 2014; Mangan, 2012; Woodham, 1998).

Increasingly, colleges and universities have utilized placement exams to determine if incoming students require remediation in one or more subjects with many studies examining the predictive value of such assessments (Martorell, McFarlin, & Xue, 2013; Scott-Clayton, 2012;

Venezia & Voloch, 2012). Students who do not meet minimum scores are enrolled into developmental courses, typically in English composition, writing, and/or mathematics. Martorell, et al. (2013) expressed concern that students who place into remedial coursework suffer unintended consequences such as dissuasion from pursuing studies, extended time to graduation, or attrition.

The cost of remediation is high to the individual student, the institution, and in the case of public schools, the state. In some states, significant portions of remediation program costs are covered by the taxpayer dollars (Bettinger, Boatman, & Long, 2013; Colorado Commission on Higher Education, 2010; Pitts & White, 1996; Scott-Clayton, Crosta, & Belfield, 2014). Florida taxpayers funded over one half of the costs of remedial programs in the state's community college system (Calcagno & Long, 2008). Frequently, students must pay out-of-pocket for developmental coursework as it is often non-credit bearing and cannot be covered by scholarships, grants, or other financial aid (Bettinger & Long, 2007; Calcago & Long, 2008; Dougherty & Reid, 2007). Scott-Clayton, et al. (2014) estimate the cost of remediation to be nearly US$7 billion annually; this figure accounts only for the actual cost of remedial course work, failing to calculate opportunity cost and impact on future outcomes.

With growing concerns regarding the cost of remediation, studies on the effectiveness of developmental education coursework and programs on student outcomes are emerging but limited. Calcagno and Long (2008) suggests some possible challenges in studying effects of remediation include longevity, student persistence, and staff attrition. The extant literature demonstrates conflicting and inconclusive results. Despite this challenge, higher education institutions have continued to implement remediation programs to address the needs of incoming

students (Attwell, Lavin, Domina, & Levey, 2006; Brothen & Wambach, 2012; Crisp & Delgado, 2014; Dougherty, et al., 2007; U.S. Department of Education, 2013).

Statement of the Problem

A growing number of individuals entering undergraduate institutions require remediation and existing literature lacks definitive judgments as to the effectiveness of current, traditional remediation interventions. As remediation can be costly, improving the effectiveness of developmental education programs is beneficial for students, institutions, and the country's overall competitiveness. The literature suggests a number of indicators may help identify students at risk of attrition, including placement exam outcomes, high school grade point average, and entrance exam scores. In 2007, remedial education was made an institutional priority through the development and implementation of mathematics and English composition placement exams and a Free Remedial Summer Program at the university at the center of this study, a mid-sized selective private university (MSSPU, herein).

Purpose of the Study

The purpose of this study was to explore the effectiveness MSSPU's internally developed placement exams for mathematics and English composition in placing students into remedial courses and the efficacy of the Free Summer Remedial Program. This study also considered the predictive value of placement exam outcome, high school grade point average, entrance exam scores and a combination thereof on persistence and graduation. The intent was to evaluate the success of the current remedial placement procedures which utilize internally development

placement examinations in assigning students to developmental coursework and identify other possible indicators of students most at risk of attrition.

Significance of the Study

Scholars have indicated a deficit in available research regarding remedial placement practices and effective remediation programs (Higbee, Arendale, & Lundell, 2005). This study aimed to contribute to the body of literature on developmental education placement and implementation, making more information available for the improvement or evaluation of existing remedial programs or the development of future programs. Secondly, the study provides the university with empirical evidence as to the effectiveness of the currently utilized placement processes. Finally, the impact of the Free Remedial Summer Program on student outcomes was evaluated. Given the high costs of remediation, it was beneficial to determine the effectiveness of the current program.

Conceptual Framework

Brothen and Wambach (2012) establish a seven-point framework for understanding and delivering developmental education with special consideration to the needs and goals of students. These key concepts constitute an educational dynamic to address student concerns rather than an "entrenched solution to a problem that students may not actually have (p. 36)." The seven key concepts include: continue and refine literary skill development courses, vary course placement requirements based on student goals and program of study, develop a range of placement testing procedures, integrate alternative teaching/learning approaches, use theory to inform practice,

integrate underprepared students into mainstream curriculum, and adjust program delivery according to institutional type.

This framework makes room for traditional remediation suggesting replacing these courses with supplemental instruction or other mainstream curricular support may not be possible or advisable. According to Brothen and Wambach (2012), many supplementary support options are not mandatory and students are unlikely to complete additional work that is not required. Though various instructional methods can align with these traditional courses such as Writing Across the Curriculum (Brown, 2006; Miller, Brothen, Hatch, & Moen, 1988) or Supplemental Instruction (Adams & Bush, 2013; Arendale, 2002; Dawson, van der Meer, Skalicky, & Cowley, 2014), the need for traditional courses remains.

While requiring traditional remediation is recommended for some, consideration to a student's goals and program of study is the second component of the framework. Consider a student pursuing a degree in art who placed into a remedial mathematics course. Because the student's likely career path would not require traditional mathematics skills, the student might be offered the option of taking a mathematical reasoning and logic courses instead of a traditional college algebra course. The framework encourages institutions to "strike a balance between requiring remediation that could delay students' progress and allowing them to make choices that may not be helpful to their academic success (Brothen & Wambach, 2012, p. 36)."

Though more difficult for institutions with a high number of students requiring remediation, integrating alterative learning styles and approaches lends to an adaptable education environment. Differentiating instruction to meet the needs of students allows instruction to be student centered; research suggests differentiated instruction yields greater student outcomes

(Curtis & Harte, 1991; Lightweis, S., 2013; Wambach & delMas, 1998). This approach integrates skill development in a more intuitive manner.

Supporting the concept of individualized instruction based on student needs and goals, Brothen and Wambach (2012) recommend adjusting the nature of developmental education based on the type of institution. The face of remediation should reflect the institution's focus; a community college remediation program should look different than the developmental education efforts at a research institution. Instructional practices effectively improving the performance of a remedial community college student may not work for the student at a traditional research institution (Crisp & Delgado, 2014; Quint, Jaggars, Byndloss, & Magazinnik, 2013).

Moving away from the traditional ad hoc approach of instruction, educators "must make theory a more central part of their practice… [doing] a better job of uniting reflective thought with action (Brothen & Wambach, 2012, p. 37)." Making courses challenging and the work students complete in those courses meaningful for their long term goals requires educators to understand the application of existing developmental education theory. These theories provide frameworks that explain why specific strategies would be effective with certain student populations (Acevedo-Gil, Santos, Alonso, & Solorzano, 2015; Willingham & Price, 2009; Vasquez Mireles, 2010).

Integrating underprepared students in college coursework is a primary component of Brothen and Wambach's (2012) framework. In order for integration of remedial students into mainstream courses to be successful, faculty members must approach teaching and learning with a perspective different than traditionally utilized in higher education. Smittle (2003) outlines six practices for effective developmental education in mainstream courses: commit to teaching underprepared students, demonstrate good command of the subject matter and the ability to teach

a diverse student population, address non-cognitive issues that affect learning, provide open and responsive learning environments, communicate high standards, and engage in ongoing evaluation and professional development. Despite research supporting the importance of instructional knowledge, most faculty remain subject matter experts in their field with little interest in developing their skills as educators (Wiseman, Hunt, Shukov, & Mardahaev, 2007). Paired courses, a system in which students take a mainstream course with a connected skills development course or workshops, are low cost and effective ways to integrate developmental students (Kirk & Lerma, 2005; Miller et al., 1988; Wilcox, deMas, Stewart, Johnson, & Ghere, 1997).

The seventh component of the framework recommends developing a range of placement assessment procedures. While the emphasis on recent years has been to make placement exams as valid and reliable as possible, emerging studies suggest the traditional forms of placement tools may be ineffective. Available research indicates the impact of being assigned to and/or taking remedial courses can have long term, detrimental effects on a study (Jacobson, 2006). As such, basing a decision on a single test with disregard to other factors, such as performance in high school coursework, is unjustifiable (Brothen & Wambach, 2012; Burdman, 2012; Scott-Clayton, Crosta, & Belfield, 2014).

Supporting this seventh component of the framework, Scott-Clayton, Crosta, and Belfield (2014) address the high risk of mis-assigning a student. The majority of institutions use a single, brief placement assessment to assign students to remedial coursework (Parsad, Lewis, & Greene, 2003). When these assessments improperly place students, the ramifications can be felt in the short and long term student achievements (Martorell & McFarlin, 2011; Pascarella & Terenzini, 2005).

In some cases, truly prepared students can be assigned to remedial coursework. This can occur because a student failed to take the placement exam seriously or simply had an off day. While the costs of a prepared student taking remedial course work include additional tuition and time, costs may also include discouraging a student from pursuing studies or delaying their time to graduation (Brothen & Wambach, 2012; Martorell & McFarlin, 2001). Martorell and McFarlin (2011) found marginal students, those who test just slightly above or below the cut off for remedial coursework generally had no to negative impacts on student outcomes overall.

Conversely, students who are underprepared but move directly into college level coursework face potential costs. Peer effects on first year student performance have been widely studied. Evidence suggests students who are underprepared and who enroll in traditional college level courses without supplemental support may depress the achievement of their peers though some studies suggest the peer effects are positive for the remedial student (Carrell, Fullerton, & West, 2009; Griffith & Rask, 2014; Oosterbeek & van Ewijk, 2014). In addition to potentially hindering the performance of classmates, a student who truly needs remediation but fails to receive additional developmental education is likely to struggle with persistence to degree and degree outcomes (Scott-Clayton, et al., 2014).

Ensuring the accuracy of the placement assessments used by universities is of interest to students and institutions alike. Scott-Clayton, et al. (2014) suggest the creation of an evaluative system utilizing placement exams as just one of the tools used to determine a student's need for remediation. Evaluation components might include the results on the placement exam, high school academic performance, and performance on the SAT or ACT entrance exams.

Scott-Clayton's (2014) study utilized placement exam results, high school transcripts, college grades, and demographic information to explore the effectiveness of placement exams

and whether the screening tools provide unequal evaluation depending on race or gender. Findings concluded, of the population studied, students taking the placement exams at over 50 community colleges, nearly 25% were improperly assigned to remedial mathematics. More alarming, one third were severely mis-assigned in English courses (Scott-Clayton, et al., 2014). Mis-assignments overwhelmingly underplaced students with few students being overplaced. The researchers concluded utilizing high school transcripts in addition to placement exams could significantly reduce placement errors.

Research Questions

The research addresses questions regarding the effectiveness of the mathematics and English composition placement exams in assigning students to developmental courses. Additional questions address the relationship between student placement, high school grade point average, and entrance exam score and persistence to graduation. Finally, this study compared the performance of students who completed remedial instruction during their first and subsequent semesters, as applicable, versus those who participated in the Free Summer Remedial Program. The research is guided by these questions.

1. To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement exam, and those who enter a mathematics course above or below their recommended course?
2. To what extent does student performance vary between those who enter a recommended English composition course, based on the English composition placement exam, and those who enter an English composition course above or below their recommended course?

3. To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?
4. To what extent is high school grade point average predictive of persistence and time to graduation?
5. To what extent are entrance exam scores predictive of persistence and time to graduation?
6. To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?
7. What differences exist in remedial course and subsequent courses grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?

The purpose of research question one was to determine whether the mathematics placement exam effectively placed students in to a mathematics course. Similarly, research question two's purpose was to determine whether the English composition placement exam effectively placed students in to an English composition course. The purpose of research question three was to determine if the level of placement on the mathematics and/or English composition placement exams could be an indicator of long-term persistence to graduation. This question also aimed to identify if, among those students who completed the placement exams and graduated, the level of placement was correlated to the number of terms of enrollment needed to graduate. If a correlation was found, the university could utilize this information to identify students at higher risk of attrition to provide additional support and access to programs and initiatives to increase

their likelihood of persistence to graduation. Additionally, as the cost of tuition per semester is approximately US$16,000, addressing the need to extent enrollment may be beneficial to MSSPU and the students alike.

The primary purpose for research question four was to understand how high school grade point average may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of factors including placement exam scores, high school grade point average, and entrance exam scores may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

The primary purpose for research question five was to understand how entrance exam scores may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of factors including placement exam scores, high school grade point average, and entrance exam scores may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

Research question's six primary purpose was to understand how mathematics and English composition placement exam scores, high school grade point average, and entrance exam scores may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of these factors

may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

Finally, he primary purpose of research question seven was to explore the efficacy of the Free Remedial Summer Program. The program, offered to students who complete the mathematics placement exam and are identified as requiring remediation are able to enroll in their remedial mathematics course at no cost to the student during the summer term prior to enrolling in credit bearing coursework. Specifically, the researcher aimed to determine if students who complete their remedial coursework as a participant in the Free Remedial Summer Program perform better in their first mathematics course and second mathematics course. The researcher also sought to determine the impacts of participation on persistence to graduation.

Definition of Terms

Academic performance is defined by a student's cumulative grade point average.

Academically underprepared student refers to a student who is not equipped with the prerequisite skills or knowledge to be successful in college-level work.

Attrition refers to the reduction in the number of students due to drop out or failure to retain.

Attrited refers to a dropping out of coursework.

College-level work is defined by those courses that are credit bearing and apply to the completion of an undergraduate degree.

Developmental education refers to a set of remedial courses in mathematics, writing, or reading utilized by college students who lack the skills necessary to perform college-level work;

remedial education and compensatory education may be used interchangeably with developmental education. Specifically, these courses are MA4, MA6, MA143 and COM122.

Entrance exam refers to the SAT or ACT.

Freshman or **First Year Student** refers to traditional first year college students who enter the university having completed no previous coursework at any other institution; these students may have earned college credit via CLEP, IB, or AP examinations.

High School Grade Point Average (HS GPA) is the grades from all high school course work averaged for the period of enrollment. This study utilized a 4.0 scale.

MSSPU refers to the mid-sized selection private university at the center of this study.

Persistence refers to a student's continuation through completion (graduation) of their degree.

Placement level refers remedial or non-remedial scoring on the mathematics or English placement exams.

Retention is the continuation of student enrollment from one semester to the next.

Subsequent course refers to the first course completed for college credit in the subject area (either mathematics or English) following the completed of the remedial course.

Supplemental instruction refers to the academic support model that utilizes peer-assisted support.

Methodology

This *ex post facto* study utilized quantitative methodologies in order to evaluate the relationships between placement in remedial courses and performance, and persistence to graduation using archival data. The study utilized evaluative research, also referred to as program evaluation or outcome assessment (Babbie, 2013). Dependent variables included

grades in remedial and subsequent courses, persistence, and time graduation. Independent variables include placement into developmental mathematics and English composition courses, high school grade point average, entrance exam scores, and participation in the Free Remedial Summer Program. Prior to completing the statistical tests, assumptions were tested using summary statistics, Levene's test for homogeneity of variances, scatter plots, and significance levels for interactions between the treatment and the outcome.

To explore the effectiveness of the placement tools, a Pearson Chi square was utilized to compare the performance (grade) of students who enroll in the course to which they placed against those who enroll in a course a level below their placement; similarly, the population of those who enroll in the course to which they placed will be compared to those who enroll in a course a level above their placement. This was completed for the mathematics placement exam and English composition placement exam.

Pearson Chi Square tests were also utilized to explore the relationship between mathematics and English composition placement exam scores and persistence to graduation while independent samples t-tests were utilized to explore the same independent variables on time to graduation. Logistic regressions were utilized to explore the relationship between all three independent variables, placement, high school grade point average, and entrance exam score, on persistence to graduation.

Pearson's correlation coefficient testing was utilized to determine the relationships, if any, between placement and time to graduation, high school grade point average and time to graduation, and entrance exam scores on time to graduation. A multiple linear regression was run to determine the covariate impacts of mathematics and English composition placement, high school grade point average, and entrance exam scores on time to graduation.

A Pearson Chi Square was utilized to compare the differences, if any, between student outcomes who complete the Free Summer Remedial Program and those who do not. Using the remedial course grade for both groups, the test was conducted with participation in the program as the independent variable (participation or non-participation) and performance in the remedial course and subsequent course serving as the dependent variables; a relationship between persistence to graduation and participation in the Free Remedial Summer Program was also explored using this test.

Delimitations

The sample for this study was delimited to students enrolling in one mid-sized selective private university in the southeastern region of the United States (MSSPU) who completed the optional placement exams (mathematics and English composition) and were subsequently placed into a remedial course. The study only examined English and mathematics placement exams and developmental coursework and utilized data from fall 2007 to fall 2015. Only those students who enter the university as true first year students, having attended no previous higher education institution, were included.

Limitations

The following limitations were established for this study:

1. This study utilizes the data from MSSPU only, limiting the generalizability.
2. This study does not consider external factors that may impact student performance such as advising, living community, student motivation, or external academic supports.

3. Because completion of the mathematics placement exam and the English composition placement exam is not required, some incoming freshman are not included in the population of this study.
4. The nature of scoring for the English composition placement exam is subjective; however, scoring was completed by the same scoring team for each of the years utilize in this study.
5. The data have been provided by MSSPU's Office of Institutional Research and it is assumed all data are accurate and complete.
6. There are inherent design and statistical analysis issues with correlational studies as correlation merely demonstrates an association, or lack thereof, between variables without the ability to confirm a causal relationship.

Organization of the Study

This study is presented in five chapters. Chapter 1 presents the background of the study, statement of the problem, theoretical framework, research questions, definition of terms, overview of methodology, purpose and significance of the study, delimitations, limitations, and assumptions. Chapter 2 provides a review of literature related to the study including an overview of MSSPU and an exploration of pertinent topics such as underprepared students in higher education, the history of and trends in remedial and developmental education, policies guiding remediation, effectiveness of remediation, placement tools, and the development of the mathematics and English composition at MSSPU. This chapter, Chapter 3, describes the methodology utilized for this study and includes an introduction, restatement of the problem, population and sample, data collection, treatment of the data, methods of data analysis and

summary. Chapter 4 presents the researcher's findings and Chapter 5 summarizes the study, discusses findings, explores implications on practice, offers recommendations for further research, and provides conclusions.

CHAPTER 2: REVIEW OF LITERATURE

Introduction

The primary purposes of this study is to investigate the effectiveness of the mathematics and English composition placement exams utilized by MSSPU, the predictive value of placement exam performance and admissions factors including high school grade point average, and entrance exam scores on student outcomes, and the differences in student outcomes when students participate in the Free Remedial Summer Program. This chapter explores the literature that provides the context for this study. Topics will include an overview of MSSPU, the history of and trends in remedial and developmental education, policies guiding remediation, effectiveness of remediation, and placement tools utilized by institutions with specific interest to the development of the mathematics and English composition placement exams at MSSPU.

Underprepared Students

The extant literature regarding underprepared students in higher education focuses on a number of variables and demonstrates a desire of institutions and researchers alike to better understand best practices to best serve students who demonstrate a need for remedial education. Additionally, with rapid changes to the dynamic of higher education institutions, such as the transition of many community colleges to four-year state universities, concerns abound regarding the equity of accessibility to postsecondary educational opportunities. While the body of literature is growing, research as to the effectiveness of placement practices, impact of faculty and administrators, supplementary services, and advising on the success of underprepared students fails to look at the broader picture of remediation.

The History of Remedial Education

The United States bolsters a rich history of higher learning and within that history are traces of nearly four centuries of remediation practices. In 1636, Harvard College became the first higher education institution in the United States. The college assigned tutors to those students struggling in Latin and Greek, courses equivalent in requirement to today's mathematics and English composition courses (Breneman & Harlow, 1998; Merospos & Phipps, 2000; Thelin, 2011). Research suggest the College of William and Mary, established in 1693, and the University of Pennsylvania, established in 1740, offered similar tutoring services (Thelin, 2011; University of Pennsylvania, 2015; University of William and Mary, 2015).

Believed to be the first formal remedial courses, the University of Wisconsin offered reading, writing, and arithmetic intervention courses beginning in 1849 when the institution opened (Taylor, 2001; University of Wisconsin, 2014). Other courses offered included geography and Latin. Though many students never graduated, the twenty men who served as the inaugural class "laid the groundwork for an institution that's treasured worldwide today" (University of Wisconsin, 2014, p. 1). Failure to graduate and the need to build developmental skills and knowledge necessary for success in the collegiate environment was easily justified in 19th century America. Access to primary and secondary education was limited making remediation unavoidable (Bogue & Aper, 2000; Thelin, 2011).

Until the 1840s, education in the United States was completely private. In the Colonial period, only white and primarily wealthy children received an education of which topics included reading, writing, simple math, and prayers. Male students would be offered more advanced academic subjects to help prepare them for roles they would soon fill in the community while

female students became, essentially, housewives and mothers (Pulliam and Van Patten, 2012; Thelin, 2011).

Education in Colonial times began at home, with the task of teaching reading primarily falling upon the mother, tracing letters and words in sand, dirt, ash, and dust. With paper and books in short supply, most children began to read the Bible, filled with passages familiar to them from readings at church or in the home. Established schools became a product of desire to expand beyond the knowledge available from one's parents and were typically community driven for males and home driven for females, with governess coming in to the home for young ladies (Wright, 1957). Impoverished children did not receive literacy or religious education, instead undertaking apprenticeships to build skills laying the ground work for vocational education (Pulliam & Van Patten, 2012). Though some areas had loose policies to support education of the children, none were strictly enforced and it was not until education reformers, such as Horace Mann of Massachusetts and Henry Barnard of Connecticut, moved for statewide common-school systems (Messerli, 1972; Thursfield, 1945).

Both Mann and Barnard emphasized the importance of educational opportunities for all children with the vision of schools as a tool to bring together an increasingly diverse population; a publically funded school system would help preserve social stability and prevent crime as well as poverty in a developing and changing society (Pulliam & Van Patten, 2012). They and other advocates for common-schools believed schools should be universal, non-sectarian, free, and aimed at civic responsibility, character building, and social efficacy (Cubberley, 1947; Messerli, 1972; Thursfield, 1945). By 1918, compulsory attendance laws for elementary-age children existed in all states.

While a belief persists that a time existed in early United States history in which all students enrolled in colleges were appropriately prepared and all courses offered were college level, this "simply never existed" (Merisotis & Phipps, 2000, p. 69). The access to and nature of preparatory education did not allow for such a reality. Despite this, the debate whether higher education institutions should be places of remediation spans centuries. An 1828 Yale Report dissuades the admission of students unprepared to tackle college level work. Forty years later, Charles W. Eliot took a firmly different stance in his inaugural address as president of Harvard, stating

> What has been said of needed reformation in methods of teaching the subjects which have already been nominally admitted to the American curriculum applies not only to the University, but to the preparatory schools of every grade down to the primary. The American college is obliged to supplement the American school. Whatever elementary instruction the schools fair to give, the college must supply… The university is not build in the air, but on social and literary foundations which preceding generations have bequeathed. (Eliot, 1869, p. 32)

The role of higher learning institutions in helping academically deficient students find success in college is fiercely debated today as it was in the 1800s with a number of historical events leading to the rising need of remediation (Spann, 2000).

Increased Access to Higher Education

A number of policies enacted beginning in the mid-19th century and changing demographics drastically altered the face of higher education in the United States. Access-granting legislation resulted in growing socioeconomic and ethnic diversity among students.

This section considers Morrill Land Grants Acts, Post WWII rise in junior colleges and vocational schooling, the G.I. Bill, the Elementary and Secondary Schools Act of 1965, Truman's Commission Report, the Higher Education Reauthorization Acts, the Civil Rights Act of 1964, and vocational education acts and their impacts on higher education access.

Morrill Land Grant Acts

In 1850, the Michigan Constitution was ratified, calling for the creation of an agricultural school "for instruction in agriculture and the natural sciences connected therewith" (art. XIII, § 11, 1850). On February 15, 1855, then Michigan Governor Kinsley Bingham signed a bill establishing the Agricultural College of the State of Michigan, the United States' first agriculture college with five faculty members and 63 students. Now known as Michigan State University, the school served as a model for the Morrill Land Grant Acts (Michigan State University, 2015).

The Michigan movement was led by a professor at Illinois College, Jonathan Baldwin Turner. Turner advocated for a land-grant bill to fund industrial colleges in each state, drafting a resolution stating such. On February 8, 1853, the Illinois Legislature adopted the resolution. Representative Justin Smith Morrill of Vermont introduced a bill based off of this resolution altering one primary component; Turner's plan provided an equal grant to each state while Morrill's bill allocated land based on the number of senators and representatives in Congress. The Morrill Act, first proposed in 1857, was vetoed by President James Buchanan after passing through Congress in 1859 (Bogue & Aper, 2000; Snodgrass, 2011).

The bill was resubmitted in 1861 with an amendment to include institutions to teach military tactics in addition to agriculture and engineering and the act was signed in to law by President Abraham Lincoln in July of 1862. It is worth noting the secession of many states

during this time period helped is passage through Congress (Snodgrass, 2011). In 1890, a second Morrill Land Grant Act required each state, specifically aimed at those states that had seceded during the passage of the initial act, show race was not an admissions criteria. This act established the majority of what are now predominantly black colleges and universities (Snodgrass, 2011; Thelin, 2011).

Further, the acts established public institutions in every state and, while the focus of the grants were primarily agriculture, engineering, and mechanics, schools were encouraged to offer liberal arts instruction as well (Thelin, 2011). Land-grant institutions became the educational homes for the working class. Students who wanted to pursue higher learning could do so without experiencing exclusion and condescension from those attending private liberal arts institutions (Bogue & Aper, 2000).

The Junior/Community College

In 1901, Joliet Junior College in Illinois became the first official junior college in the United States responding to growing pressure from universities to relegate lower level and vocational education to outside entities. The idea emerged for these junior colleges to be situated within existing institutions where appropriate with others operated offsite independently from the university when better fitting the needs of that community (Vaughan, 2006). Through the first several decades, junior colleges focused primarily on general studies with the aim of preparing students to successfully tackle remaining courses at local universities (Vaughan, 2006; Young, 2006).

Cohen and Brawer (2003) explored the dynamic of these institutions through the framework of their initial development. In the early 20th century, they were thought to be an

entry way to public universities. However, these universities did not cease offering lower-level courses and continued accepting freshman and sophomore students, the very purpose and population of the original junior colleges. As inadequately prepared students were typically relegated to junior colleges, these community schools fell naturally in to the role of alternative institution where they remain today.

During the Great Depression in the 1930s, community colleges began to offer job training in an effort to ease widespread unemployment. Traditional four year institutions were not a feasible source of the kind of workers the country was in need of. With engineers and supervisors making decisions about workplace projects and initiatives, a need for semiprofessionals, educated in a specific skill or set of skills grew (Thelin, 2011; Young, 2006).

The country struggled through the Great Depression, entering in to the Second World War which lasted until 1945. The war created a manufacturing boom and as soldiers returned in need of additional training and skill development. This, along with Truman's Commission Report of 1947, helped to create a network of public, community-based colleges that served local needs (Thelin, 2011; Young, 2006).

G.I. Bill

Land-grants and junior colleges positively affected White males wanting to complete a higher degree primarily. However, the G.I. Bill, formally referred to as the Servicemen's Readjustment Act, opened the door for people of color and those of lower socioeconomic status. The act, initiated in 1944, provided a range of benefits to World War II veterans. Benefits included low-cost mortgages, low-interest business loans, and, having a great impact on the

demographics of colleges and universities, cash payments of tuition and living expenses to pursue higher learning.

Prior to the war, a collegiate education was an unreachable dream for the average American. The GI Bill allowed millions to pursue degrees after returning from war rather than flood the job market. The peak enrollment year under these benefits was 1947; in this year, 49 percent of college students were veterans. The original bill expired on July 25, 1956. At that time, 7.8 million of the nearly 16 million World War II veterans had utilized the benefits for an educational program (Jolly, 2013; Levinson, 2005; Veterans Affairs, 2015).

The bill has been updated twice. In 1984, Congressman Gillespie V. Montgomery of Mississippi pushed forth changes to emphasize home loan guaranty and educational programs. In 2008, it was revamped to give veterans with activity duty service on or after September 11, 2001 enhanced educational benefits covering additional educational expenses, a living allowance, stipend for books and, new to the program, the ability to transfer unused benefits to a spouse or child (Veterans Affairs, 2015).

The Truman Commission on Higher Education

The 1947 President's Commission on Higher Education was an unprecedented report offering insight in the higher education institutional system in the United States. The six volume report was unique not only in its grandiose size but in its focus as the first commission specifically charged with assessing educational systems. Historically, this task was typically left to states under the guides of the Tenth Amendment. The report emphasized improving policies in two major areas, improving access to and equity of higher education and expanding the role of community colleges (Gilbert & Heller, 2013; Thelin, 2011; Vaughan, 2006).

For what was arguable the first time, a national debate on higher education appeared. While the report did not spark immediate legislative changes, it undoubtedly set the stage for federal intervention in education and sparked conversations that remain ongoing decades later (Gilbert & Heller, 2013). Access and equity recommendations encouraged institutions to end discrimination based on race, religion, and gender while eliminating financial barriers through the development of a federal scholarship program (Gilbert & Heller, 2013; Hutcheson, 2007).

The commission successfully helped redefine junior colleges, encouraging them to be renamed community colleges as it better fit the type of student attending and their academic and career plans. The commission also proposed a radically different tuition structure and made recommendations for how a network of community colleges could be planned and designed. The vision included community college tuition being free for students with financing being supported by the local communities with supplemental financing from the state (Gilbert & Heller, 2013; Hutcheson, 2007; Kim & Rury, 2007). While the report's specific suggestions were not all implemented, it began the era of federal involvement in higher education now known in the United States (Kim & Rury, 2007; Thelin, 2011).

The Elementary and Secondary Schools Act of 1965

The debate as to the efficacy of primary and secondary education in the United States in preparing students for success in collegiate degree programs began centuries ago and propagated extensively in the 21st century in an era of accountability and assessment (Bogue & Aper, 2000). When discussing remediation in higher education institutions, the question often arises as to why, if public schools throughout the country are properly preparing graduates for career and college life, such a need for remediation exists at all, let alone continues to grow (Bogue & Aper,

2000, Cohen & Brawer, 2003; Vaughan, 2006). The Elementary and Secondary Schools Act of 1965 was the first attempt by the federal government to improve academic performance in public schools.

As part of President Lyndon B. Johnson's War on Poverty, the Elementary and Secondary Education Act is an extensive statute funding public K-12 education. With an emphasis on equal access to education, the act established high standards and systems of accountability with the aim of diminishing the achievement gap between students of color and low socioeconomic status and wealthy, white students (The Elementary and Secondary Education Act, 1965). The act was reauthorized in 2001 under President George W. Bush, known as No Child Left Behind (No Child Left Behind Act, 2011).

The Higher Education Facilities Act of 1963

Signed in to law by President Lyndon B. Johnson, the Higher Education Facilities Act of 1963 drastically increased funding for college aid. The act provided more funding for five years than what had been appropriated under the land grants in a century (Levinson, 2005; Thelin, 2011). In his remarks on December 16, 1963, President Johnson remarked the act was "very important legislation" of which to be proud. He outlines the key accomplishments which include: classrooms to accommodate several hundred thousand additional college students, the building of 25 to 30 new community colleges each year, the construction of technical training schools, the growth of graduate schools, the improvement of library facilities, the increase of funding, and the development of expanded programs dealing with science, mathematics, foreign language, and other valuable components under the National Defense Education Act (Levinson, 2005; Johnson, 1963).

The Higher Education Act of 1965

The 1960s saw a number of changes to federal involvement in education. Shortly after signing the Higher Education Facilities Act of 1963, President Johnson signed in to law the Higher Education Act of 1965. The legislation intended to increase resources at institutions across the nation and provide financial assistance for students. Federal funding was increased for universities, scholarships and grants were created for low income students, and low-interest loans became available to students (Higher Education Act, 1965; Thelin, 2011). The act was reauthorized in 1968, 1971, 1972, 1976, 1980, 1986, 1992, 1998, and 2008. Set to expire in 2013 after the 2008 reauthorization, Congress voted to extend the policy through 2015 while exploring issues including "affordability and college costs; access, persistence and completion; better information for consumers; student loan programs; accreditation and oversight; innovation; and the burden of federal regulations" (American Council on Education, 2015).

Vocational Education Acts

Though community colleges began offering vocational and job skills training in the mid-20th century, legislation regarding vocational education acts specifically emerged in the 1980s. The Carl D. Perkins Vocational and Technical Education Act of 1984 put the quality of technical education at the forefront with an emphasis on positive impacts on the United States' economy (P.L. 98-524 Sec. 404(a)(2)). The bill is named after Senator Carl Perkins whose long career included decades of support for educational access to the under-privileged. The popular Perkins Loan federal aid program is named after him as well, a no interest loan program for low-income students. The act included five topics to be studied by the National Research Center for Career and Technical Education, as outlined by Lewis and Stone III (2013), including:

- Effective methods for providing quality vocational education to handicapped and disadvantaged individuals, those preparing for occupations nontraditional for their gender, single parents and homemakers, limited English proficient, and the incarcerated
- Constructive involvement of the private sector in public vocational education
- Successful methods of reinforcing and enhancing basic academic skills in vocational settings
- Development of curriculum materials and instructional methods relating to new and emerging technologies, and assessments of the nature of change in the workplace and its effects on jobs
- Identification of institutional characteristics which improve the preparation of youth and adults for employment (p. 110).

The Perkins bill was reauthorized in 1998. In 2006, President George W. Bush signed in to law an additional reauthorization referred to as the Carl D. Perkins Career and Technical Education Improvement Act of 2006 (Lewis and Stone III, 2013; Staklis and Klein, 2014). The bill passed nearly unanimously by Congress. The law made three major changes. The term vocational education was replaced with career and technical education. The remaining two changes involved finances: funding for technical preparatory programs received a unique funding stream and state administrative funding was placed at 5 percent of the state's allocated budget (Staklis and Klein, 2014).

Another act, the Workforce Investment Act of 1998 provided a framework under which the nation's workforce would be prepared and eventually employed to meet both the needs of businesses and the needs of prospective employees and individuals who desired career advancement. The act consists of five sections; section one of the legislation emphasizes training and employment programs focused on local needs, convenient access for customers to

employment, education, training, and information services, student options in program choices, training accountability, and business inclusion in the process. The remaining sections reauthorize previous legislation related to employment and workforce initiatives (P.L. 105-220 Sec. 112(936)). The efficacy of this act proved unconvincing and failed reauthorization in 2014 (Decker and Berk, 2011; Association for Career and Technical Education, 2015).

The National Research Center for Career and Technical Education

Existing for nearly four decades, the National Research Center for Career and Technical Education morphed in to the United States' primary facilitator of research in the area of career and technical education, also referred to as vocational training. The federally funded program was housed at The Ohio State University from inception in 1978 until 1988 when it transitioned to the University of California, Berkeley. In 1999, the center was divided in to too locations. The Research Center transitioned to the University of Minnesota's leadership with the Dissemination Center returning to The Ohio State University. From 2007-2012, the University of Louisville hosted the consortium. Currently, The Ohio State University leads the partnership of leading institutions in providing career and technical education (Lewis and Stone III, 2013).

The Civil Rights Act of 1964

One of the most far-reaching statutes enacted by Congress, the Civil Rights Act of 1964 impacted nearly all facets of American life. The act impacted colleges and universities immensely, prohibiting discrimination against students, employees, and prospective employees on the basis of race, color, national origin, religion, and sex. Though comprised of eleven titles, four most directly impacted higher education (P.L. 88-352, 78 Stat. 241).

Title II regards injunctive relief against discrimination, making it possible for minorities to travel with access to the same accommodations as white individuals. As such, university and college cafeterias had to be made available to all students and staff. Title III addressed the desegregation of public facilities; as a result, minority students could no longer be denied access to live in on-campus or off-campus housing and other facilities. Title VI prohibited against discrimination in distribution of federal financial aid (Bowman, 2014; Davis, 2005)

Title VII covers equal opportunity in employment, forbidding employers from discriminating against employees or prospective employees on the basis of race, color, national origin, religion, and sex. Enforced by the Equal Employment Opportunity Commission (EEOC), the title applies to hiring, firing, transfer, promotion, demotion, compensation, and other conditions of employment. The provision does permit employment of individuals on the basis of national origin, religion, and/or sex if such characteristics are a bona fide occupational qualification (Bowman, 2014; Ishimaru, 2005).

Whether providing funding to non-traditional populations, providing access with protection from discrimination, or changing the focus on workforce preparedness, legislation throughout the 19th century and in to the 20th century altered the direction of higher education institutions. Increased access to higher education resulted in drastic demographic shifts in student populations. Though remediation has been a part of the collegiate environment as long as colleges have existed in the United States, these landmark changes increased and diversified need for remediation.

The Common Core Standards Initiative

Literature suggests a misalignment between secondary and post-secondary curricula, expectations, and requirements impacts remediation rates significantly (Howell, 2011; McKlean, 2012). The Common Core Standards Initiative is an educational initiative taking hold in the United States focusing on career and college readiness. The standards outline the specific skills and content students should be proficient in at the end of each grade level. Sponsored by the National Governors Association and the Council of Chief State School Officers, the push for uniform educational standards across districts and states helps ensure students graduating from a secondary school in the United States is prepared to enter college level curriculum or to enter the workforce (Burris and Garrity, 2012; Common Core Standards, 2014).

Despite fervent push back from many parents and other stakeholders, forty-four states as well as the District of Columbia opted to participate in the initiative. Oklahoma, Texas, Virginia, Alaska, Nebraska, and Indiana did not adopt Common Core standards while Minnesota adopted only the English Language Arts standards. Five states that adopted the standards currently are working towards repealing, replacing, or amending them: Indiana, Missouri, North Carolina, Oklahoma, and South Carolina (Burris and Garrity, 2012; Dickinson, Kimmel, and Doll, 2015).

The standards include two major components, English Language Arts and Mathematics. The English Language Arts standards address reading, writing, media and technology, speaking and listening, and language. The mathematics standards include standards for content and standards for practice (Common Core Standards, 2014; Dickinson, et. al, 2015). While the Common Core Standards do not address social sciences or science, the Next Generation Science Standards were released in 2013 and, while not implicitly related to Common Core Standards, content areas can be cross-aligned.

A consortium of twenty-six states, the National Science Teachers Association, the American Association for the Advancement of Science, the National Research Council, and Achieve, a nonprofit organization, developed the standards and invited the public to review and make recommendations (Lantok, Zhang, and Doughtery, 2015; Pruitt, 2015). The primary purpose of the standards was to "create robust, forward-looking K-12 science standards that all states can use to guide teaching and learning in science for the next decade (Next Generation Science Standards, 2015)." As of August 2015, fourteen states have adopted the standards with a total of forty states having expressed interest in adoption (Next Generation Science Standards, 2015).

To date, a large scale assessment of the Common Core Standards or Next Generation Science Standards has not been conducted. While initial proposals suggested the 2014-2015 would be the first year for assessment, conflicts with assessment tools are likely to delay definitive studies. It will also be several years before the impacts of curriculum alignment on remedial instruction need in colleges and university can be assessed.

Immigration and Non-Domestic Students

In addition to increased access to higher education, the need for remedial education, particularly in English, expanded due to a growing immigrant population. During the 20th century, individuals immigrated to the United States at unprecedented rates. The Migration Policy Institute reports over 40 million immigrants were granted legal status between 1900 and 2000. With the United States Census Bureau documenting a total population growth of 204 million in the same time period, legal immigrants represented approximately twenty percent of growth (2006). This number does not include individuals who immigrant illegally, an estimated

11 million of whom were eligible receive access to attended higher education institutions despite their legal status (Passel, 2006).

Remedial coursework, particularly at community colleges, became instrumental in providing immigrant students with postsecondary education (Almon, 2012; Baily and Weininger, 2002; Bunch and Endris, 2012). With the American economy offering employment in roles increasingly requiring some college education. As such, remedial courses that aid students in building academic English skills to be successful in coursework are integral for the social and economic mobility of the immigrant population (Bunch and Endris, 2012; Gandara and Rumberger, 2009; Rodriguez, 2013).

It is estimated the U.S. population will nearly double by 2050, with immigrants contributing 82 percent of growth (Passell, 2011). Trends suggest approximately 80 to 85 percent of these immigrants will originate from Latin America and Asia (Greico and Trevelyan, 2010). In 2012, nearly 85 percent of immigrants in the United States illegally came from one of ten countries: Mexico, El Salvador, Guatemala, Honduras, Philippines, India, Korea, China, Ecuador, and Vietnam (Baker and Rytina, 2013).

Foundational instruction in English, among other subjects, accommodates individuals with legal immigration status as well as those unauthorized migrants who are otherwise eligible for higher education instruction. Access to education and opportunity for immigrants is fraught with controversy with growing interest emerging as the 2016 Presidential campaigns ramp up (Nienhusser, 2015). Frequently discussed in this debate is the DREAM Act.

An acronym standing for Development, Relief, and Education for Alien Minors, the DREAM act was original introduced in 2001, but has failed to pass despite several reintroductions. The act would provide conditional residency status with a path to permanent

residency for individuals who entered the United States before turning 16 years of age, lived in the United States for five consecutive years, graduated from a U.S. high school or obtained a GED, passes a criminal background check, and demonstrates good moral character. The act encourages individuals to attend college or university or serve in the military as one or the other is required to grant permanent residency (Salas, 2015). While proponents suggest the act offers economic and social benefits and provides a non-amnesty immigration solution (Guzman and Jara, 2012), critics argue it would encourage more illegal immigration (Salas, 2015).

While the DREAM Act failed to pass, the Deferred Action for Childhood Arrivals (DACA) was enacted by the Obama administration in June 2012. The law allows undocumented immigrants who entered the country before their 16th birthday to receive a renewable two-year work permit with exemption from deportation (Adams, 2015; Gonzales, Terriquez, and Ruszczyk, 2014; U.S. Citizenship and Immigration Services, 2015). Though utilizing the same proposed eligibility requirements as the DREAM Act, DACA does not provide opportunity for those on work permits except in those states that have instituted state level policies: Arizona, California, Illinois, Maryland, Michigan, Nebraska, North Carolina, Texas, and Virginia. The policy opened access to employment, increased income, and health care with a path to higher education for some (Adams, 2015; Garcia, 2014).

Other non-native English speakers attend U.S. colleges and universities in droves. There are 1.1 million foreign students in the United States with the large majority enrolled in higher education programs (Department of Homeland Security, 2011). Asia accounts for approximately three quarters of international student enrollment (Jordan, 2015). The majority of these students utilize a language other than English as their first language. Approximately eleven percent

require English language training prior to enrolling in coursework with others receiving remediation concurrently with first semester courses (Jordan, 2015).

Remedial versus Developmental Education

Much attention is given to the name assigned to the instruction of skills and content to students who are academically underprepared. While some scholars differentiate between the two most common terms, remedial and developmental education, there are those who find little or no difference between the two. This debate is not a new one. Nearly five decade ago, Roueche and Hulburt (1968) called "'remedial' and 'developmental' often interchangeable (p. 454)" elaborating that "'remedial' implies the improvement of student skills in order that he might enter a program for which he is currently ineligible [while] 'developmental' implies the improvement of skills or attitudes without reference to his eligibility (p. 454)." While the debate continues, Rouche and Rouche (1999) suggest no differences in student outcomes exist between the usages of terms.

Many scholars indicate a philosophical difference in educational approach behind the two terms. Imploring scholars to ceases utilizing the terms synonymously, Higbee (1993) defined remedial programs as a "'remedy' for academic deficiencies, thus implying a medical model; the student has a weakness that must be cured. (p. 99)" while defining developmental education as a "focus on the process of learning as well as content to be mastered; [fostering] skill development (p. 99)." Higbee, et al. (2005), Boylan (2002), and Breneman and Harlow (1998) suggest developmental education is grounded in principles of student development theory and focus on the whole student. Educating the whole student has been a growing trend in recent decades and encourages educators to celebrate and cultivate all facets of the student including organic,

psychodynamic, cultural, academic, and existential dimensions (Brown, 2011; Mayes and Williams, 2013; Quinlan, 2011).

The National Center for Education Statistics (2013) utilizes Parsad, Lewis, and Green's (2003) definition for remedial education to be "courses for students lacking skills necessary to perform college-level work at the degree of rigor required by the institution (p. 1)." Despite a disconnect among scholar opinion on definitions for these terms, Roueche and Roueche (1999) suggest some use the term remedial because it is generally understood by the public, the media, and policymakers. Recent policy changes across the nation, however, suggest the vernacular used may be changing with more states changing legislation regarding remediation to include developmental education verbiage. The following section will explore these policies.

The Whole Student

Mayes and Williams (2013) present a holistic view of education in their work *Nurturing the Whole Student.* The text addresses student-teacher relationships through the cultivation of five facets: organic, psychodynamic, cultural, academic, and existential. Considered the "antidote to the standardized approaches to education that breed failure, alienation, and discouragement (p. 23)," Mayes and Williams' techniques aim to develop the humane teacher, sentiments echoed by Quinlan (2011).

Some universities have begun implementing a whole student model approach to develop students' drive to succeed, sense of belonging, and learning (Barr & Matsui, 2008; Grinnell College, 2015; Gross, Iverson, Willett, & Manduc, 2015; Maton, Pollard, McDougall Weise, & Hrabowski, 2012; Matsui, Liu, & Kane, 2003). A small, residential liberal arts college, Carleton College, utilized two such programs to support traditionally underrepresented students in STEM

fields: minorities, females, “students from low socioeconomic status backgrounds, students from underresourced high schools (Gross, et. al, 2015, p. 99),” and first generation college attendees. The Focusing on Cultivating Scientists (FOCUS) program connects students with resources on campus to help them develop and explore their interests in STEM fields, support their learning, and develop as individuals.

A study of the FOCUS program suggests the cohort model increased participant’s passion for STEM fields and helped support a sense of belonging. To ensure students felt empowered to capitalize on the opportunity to develop knowledge and advance themselves, the study reviewed four major components of the program implemented to develop the whole student. The first focused on cultivating “trusting relationships between and among peers and faculty through mentorship, social activities, research activities, and shared coursework (Gross, et. al, 2015, p. 102).”

The second provided opportunities to develop time management skills and the third emphasized a combination of mentoring and advising both to build relationships to help students feel more comfortable as well as to guide students through the processes, procedures, and structures of the program. Finally, the study acknowledged participants in the program felt underprepared, lacking “foundational content knowledge that would help them succeed in introductory science courses (Gross, et. al, 2015, p. 102).” The FOCUS program connected students to academic development resources. This final factor, the researchers believe, served as a primary component in the low attrition rate with less than four percent of program participants leaving college prior to graduation (Gross, et. al, 2015).

Three other universities of note utilize the whole student model in implementing programs to retain underprepared and underrepresented students in STEM programs. University

of California, Berkeley touts the success of their Biology Scholars Program (BSP) indicating minority students in the program intending to major in biology graduated with a degree in biology at more than twice the rate of students that did not participate in the program (Matsui, et. al, 2003). Additionally, "from 2004-2011, 85% of BSP medical school applicants who actively and frequently participated in BSP advising and study groups were admitted as compared to a national admissions average of 50% (University of California, Berkeley, 2015)." The program seeks to develop "passion for science, resilience, persistence, authenticity, willingness to seek and give help, and ability to re-strategize and re-group in the face of failure (University of California, Berkeley, 2015)."

Grinnell College's (2015) Science Project included changes not only for program participants but to curriculum and pedagogy, positively impacting all STEM students. The National Science Foundation reports Grinnell ranks eighth on per-capita basis among all other U.S. colleges and universities in producing science graduates who go on to pursue the Ph.D. (National Science Foundation, 2015). Curricular changes addressed the needs of underprepared students by providing an introductory biology course and utilizing workshop based, hands-on learning opportunities. Further, the Science Project provides pre-orientation geared to the specific needs and deficits of incoming students. Mentoring and community building serves as a primary tool to address the emotional and academic needs of students, with particular emphasis on training peer mentors to support and assist students (Grinnell College, 2015).

The University of Baltimore, Maryland's Meyerhoff Scholars Program is a multifaceted program to enhance and support the achievement of minority students. Meyerhoff Scholars receive financial, academic, and social support through collaboration, relationship development with peers and faculty, and immersion in research (Maton, et. al., 2012; The University of

Baltimore, Maryland, 2015). Specifically, students receive a comprehensive financial package including tuition, room and board, and a stipend for books and participate in a recruitment weekend event with their families, a summer bridge program, study groups, summer research internships, community service, and external mentorships. Support for academic achievement is the primary program value with services coming from peers, academic advising staff, faculty, and administrators (The University of Baltimore, Maryland, 2015).

The Meyerhoff Scholars Program has undergone continual formative and summative evaluation since 1990 with some such evaluations receiving funding by various sources including the National Science Foundation, the National Institutes of Health, and Atlantic Philanthropies; studies focused on freshman-year performance, graduation rates, and college grade point average, finding the program successful in supporting these outcomes (Maton, et. al., 2012). Maton, et. al's (2012) study, however, specifically explored post college outcomes. Examining outcomes for students entering the program between 1989 and 2005, the researchers found Meyerhoff students were more likely to enter STEM doctoral programs than those students who were offered admission to the Meyerhoff Scholars Program but declined. African American students were 5.3 times more likely to enter STEM graduate programs than those who declined. Equally qualified students who chose to decline the offer were approximately twice as likely to not attend graduate or professional school after graduation as Meyerhoff students. Among predominately white universities, The University of Maryland, Baltimore has become the leading producer of doctoral students of color in the natural sciences and engineering fields (Maton, et al., 2012; Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, 2010).

These initiatives are examples of the growing focus on the whole student in which universities consider a number of factors that contribute to student outcomes (Mayes & Williams, 2013). While implementation varies from university to university and program to program, key factors include academic and social integration, motivation and support structure development, skill and knowledge development, and advising or mentoring (Barr and Matsui, 2008; Grinnell College, 2015; Gross, et. al., 2015; Maton, et. al, 2012; Matsui, Liu, & Kane, 2003). While mastery of subject material and skill development serve as the heart of institutions and academic programs, these programs suggest a greater sense of the other factors that result in student success, or failure.

State Policies Guiding Remediation

A 2008 report titled "Diploma to Nowhere" published by Strong American Schools indicates states spend approximately $2.3 billion annually providing remedial, no-credit college courses. Legislators in a number of states are forcing higher education institutions to examine this costly practice and implement a range of remedial education reforms. States with legislative changes include Arizona, Colorado, Connecticut, Florida, Indiana, North Carolina, and Texas, with Minnesota considering a proposal to allow corequisite courses (House Bill H.F. No. 647, 2015; Strong American Schools, 2015). California, though not implementing policy changes in higher education developed an Early Assessment Program implemented in student's 11th year of school.

California's Early Assessment Program is a "collaborative effort among the State Board of Education (SBE), the California Department of Education (CDE) and the California State University (CSU)… established to provide opportunities for students to measure their readiness

for college-level English and mathematics in their junior year of high school" (The California State University, 2015). The program undergoes annual evaluation; in a report released by Policy Analysis for California Education (2012), the program was deemed groundbreaking, successful, engaging, and effective in bringing together educational and policy leaders to participate in ongoing discourse about college readiness and remediation. Long term student outcomes and impacts on remedial instruction in the California State University system have not yet been studied due to the short tenure of the program.

Arizona and Indiana legislators ordered college-bound high school seniors to take an additional math course as part of their high school curriculum when it was discovered math was the most frequent form of remedial education (Ross, 2015; Smith, 2015). The 2007 Colorado Commission on Higher Education adopted policies ensuring all undergraduate students "are prepared to succeed in college-level courses,… have accurate information regarding course availability and options to achieve college entry-level competencies, and high schools are informed about the level of college readiness of their recent high school graduates" (Skaggs, 2008, p. 4). In addition to establishing policies to better collect data and evaluate programs and outcomes, Colorado redesigned curriculum to offer corequisite courses (Skaggs, 2008).

The state of Connecticut's college and university system developed a three tiered system of instruction in response to a 2012 policy, Public Act No. 12-40 meant to address the high level of remediation in state universities, particularly in underrepresented populations. The systems include college-level, college-level with embedded support, and intensive college readiness. College-level with embedded support turns traditional remediation in to corequisite coursework and provides additional support to those students who need minimal additional intervention. Intensive college readiness courses utilizes traditional remediation but, unique to Connecticut,

limits the amount of time students may be enrolled in remedial courses to one term (Connecticut Public Act No. 12-40; Ross, 2015).

North Carolina Republican Senators Dave Curtis, Thomas Tucker, and Thomas Apodaca introduced a bill "Avoid Double Billing of State Taxpayers" that would require counties to pay the cost of remedial courses in community college for students who graduated from a high school in said county within two years of enrolling in community college. The bill, S.B. 523, indicates North Carolina high school graduates may not be prepared to complete college-level coursework and taxpayers should not be required to pay, essentially, twice for remediation. The approximate cost of remediation in community colleges alone in 2013-2014 was approximately $24,000,000. The bill does not address remediation in the state university system.

Texas Education Code §61.0761, passed by the 79th Texas Legislature in 2005 and amended in 2007, is a comprehension college readiness plan. Under the statute, the state adopted a P-16 College Readiness and Success Strategic Action Plan requiring the Commissioner of Education and the Coordinating Board to submit an annual report regarding the progress of this plan. Other components of the bill included the development of college readiness standards with sound accountability practices, creating a college-going culture through prekindergarten through high school, the establishment of summer bridge programs offered by state colleges and universities, provides funding to institutions to support the development of research-based, innovative developmental education programs, and provides financial assistance to underprepared students. Like Texas and other states, Florida took a drastic step in improving remediation in 2013 passing Senate Bill 1720.

Florida Statute 1008.30.4a or Senate Bill 1720

With the passage of Senate Bill 1720 in July 2013, remedial instruction took a drastic turn in Florida colleges. Amending several Florida state laws, the bill addressed growing issues of remediation in Florida's state college system, taking aim at turning around the dismal track record of intervention and provide wider access to higher education (Galvano, 2013; Torres & Waddell, 2012). Though the legislation provides specific requirements to public schools in the state of Florida, MSSPU responded to the growing public discussion by developing a task force to explore remedial practices and follow the progress of the Florida College Systems' implementation of Senate Bill 1720 mandates while exploring possible alterations to current remediation practices as suggested in the legislation.

With one third of students nationwide entering colleges and universities ill prepared to perform adequately in math and English, most institutions require students to complete a placement exam prior to enrolling in courses (Bound, Lovenheim, & Turner, 2007). For institutions in the in the Florida College System the Common Placement Exam serves this purpose. The Common Placement testing program "diagnoses basic competencies in the areas of English, reading, and mathematics which are essential for success in meta-majors and to provide test information to students on the specific skills the students need to attain (§ 1008.30.2)."

Students entering the Florida College System are required to take the Common Placement Test unless they meet an exemption, outlined in §1008.30.4a, F.S. Such exemptions include students who earned a Florida standard high school diploma having completed 9th through 12th grades in a Florida public school in 2003-04 and thereafter and active duty military. Florida high school graduates who did not complete all four years of high school in the state, those who have

earned a GED®, those who were home schooled or who graduated from private institutions, or those who plan to dual enroll must complete the common placement testing.

Historically, students whose scores indicated they were not ready to complete credit bearing college courses required the completion of remedial coursework before enrolling in credit bearing classes for credit; students and colleges alike expressed concerns about costs, time, and persistence to degree completion associated with these required non-credit bearing courses (Torres & Waddell, 2012). Senate Bill 1720 removed a previous limitation of twelve hours of lower division college credit coursework for students who had not completed developmental, or at the time remedial, coursework, and thereby freeing students to enroll in degree earning coursework sooner.

The bill strikes all references to college preparatory and remedial instruction and replaces said references with "developmental education." The legislation still allows schools in the Florida College System to require specific courses as prerequisites presuming they are delivered through one of the modalities indicated in § 1008.02, F.S., definitions. Those modalities include

(a) Modularized instruction that is customized and targeted to address specific skills gaps.
(b) Compressed course structures that accelerate student progression from developmental instruction to college-level coursework.
(c) Contextualized developmental instruction that is related to meta-majors.
(d) Corequisite developmental instruction or tutoring that supplements credit instruction while a student is concurrently enrolled in a credit-bearing course.

The bill amends Florida law defining "meta-major" as a collection of programs of study or academic discipline groupings sharing common foundational skills (§ 1008.02 (3)). The passing of this bill signaled the legislative intent to encourage all incoming Florida College System students to choose a meta-major.

Under the amended laws, schools in the Florida College Systems may charge tuition for developmental education courses, instruction, or additional support initiatives but must offer a minimum of two developmental education options as listed in § 1008.02, F.S., from which students can select one or more option(s). Prior to the passing of Senate Bill 1720, schools in the Florida College System were not required to provide more than one developmental education modality nor were they able to do so utilizing a co-requisite format.

Reducing the total number of underprepared students as well as altering remediation methods is critical for a number of financial reasons. Not only do remedial courses increase the total cost of a degree for the student, taxpayers also pay more, as schools in the Florida College System are publically funded. Further, research suggests students who take remedial courses are less likely to complete their degree (Bound, et al., 2007). As Florida's growing economy needs more workers with college degrees, failure to produce enough graduates has a direct economic impact. Additionally, individuals without college degrees tend to work in positions earning low wages and contributing fewer tax dollars. Fewer tax dollars impact the funding of schools, both K-12 and those in the state university system (Postal, 2013).

Schools in the Florida State College system were mandated to make changes to remedial instruction under Senate Bill 1720 that proved costly if not in finances, in time. Schools ramped up advising, academic support/tutoring, and supplemental instruction in order to meet the new standards and new needs (Fain, 2013). Advising was brought to the forefront of conversations with the passing of this bill as students, when given the decision whether or not to participate in necessary developmental courses, need a stronger guiding hand in making the decision to enroll in courses that are likely vital to their success but for which they may now opt out (Anderson &McGuire, 1997; Creamer & Creamer, 1994; Fain, 2013; Schreiner & Anderson, 2005).

The varying modalities required pursuant to § 1008.02, F.S. provide a unique opportunity for students to select instruction that best fits their needs, skills, and schedules, a true advantage for students but one they may not fully utilize without proper advising (Schreiner & Anderson, 2005; Yarbrough, 2002). Sen. Bill Montford of Tallahassee spoke on the bill in 2013 suggesting the bill would serve as an "encouragement to them… to better see the light at the end of the tunnel (Postal, 2013)." These very benefits pose challenges for colleges as well. Students who need developmental instruction are unlikely to successfully achieve mastery of required subjects without some sort of remediation (Conklin & Sanford, 2007). This is particularly concerning as it is commonly believed that "students don't do optional (Fain, 2013)," meaning they would chose not to enroll in option, but beneficial, coursework.

The overall impact of this legislation cannot yet be determined as data are not yet available regarding student outcomes. However, the passage of the bill sparked conversation among educators, students, and politicians statewide regarding the importance of developmental education, a nationwide challenge few states have attempted to tackle head on. While Senate Bill 1720 changes directly impacted only those schools in the Florida College System, indirect impacts effect all universities across the state. Though MSSPU may not feel the impacts of Senate Bill 1720 now, ancillary changes may be made based on the success or failure of the policy in years to come, utilizing the Florida College System as a pseudo testing ground for developmental instruction practices.

State of Remedial Education

Divergent Perspectives

While it would seem continued and often growing enrollments in remedial or development courses would indicate a clear need, controversy exists as to the value and impacts of remediation. Opponents of remedial or developmental education in university and college systems argue the practice forces taxpayers to pay twice for the education of domestic students. The North Carolina legislation, Senate Bill 528, is one such example of attacking the remediation issue from a solely fiscal standpoint (S.B. 523., 2015). Critics also express concern with factors such as costs, compromised instructional standards, and loss of time in re-teaching skills (Manno, 1996; Phipps, 1998). The excessive cost often typically represents the crux of opposition (Taylor, 2001).

Other factors of concerns expressed by critics, however, include possible negative ramifications for students. Manno (1996) and Carrell, Fullerton, and West (2009) consider the potential for curriculum to become less rigorous, providing a disserve to remedial and non-remedial students alike. Carrell, et. al. (2009) further suggest peer impacts may lower the performance of non-remedial students in some cases.

Students required to take remedial coursework in a traditional format may extend the length of time to graduation making them less likely to graduate and more likely to accrue additional debt, critics argue (Breneman and Harlow, 1998; Manno, 1996; Phipps, 1998). The image and value of the degree is of great concern to Manno (1996) who suggests because underprepared students can eventually earn a college degree, the degree becomes devalued; college acceptance is perceived to be automatic.

Conversely, proponents acknowledge costs associated suggesting the benefits are worth the expense. Research exploring the effectiveness of developmental or remedial education has largely focused on participation rates, costs, and effectiveness. The results of this research demonstrate high participation rates, representing a need for the service (Attewell, et. al., 2006; Fain, 2012; Meriotis and Phipps, 2002), a strong return on invest (Parsad, Lewis, and Green, 2003; Strong American Schools, 2008; Woodham, 1998), and potential effectiveness in many different formats (Carrell, et. al., 2009; Dawson, et. al, 2014; Martorell and McFarlin, 2011; Rodriguez, 2013; Yarbrough, 2002). However, research exploring the most effective formats and implementations is ongoing.

Prevalence

In 2000, the National Center for Education Statistics (NCES) reported approximately thirty percent of first-year students enrolled in one or more remedial courses. Most recently, the National Center for Public Policy and Higher Education with the Southern Regional Education Board (2015) reported nearly sixty percent of first-year college students were unprepared to take college level English or mathematics. In 2003, the NCES reported thirty seven percent of remedial students took less than one year to complete required remedial coursework, approximately fifty percent took one year, while ten percent took more than one year at community colleges. At four year institutions included in the study, over sixty percent completed in less than one year, thirty five percent completed in one year, and three percent took more than one year.

Though research has been done on many facets of the remedial education process, the pervasive nature of remedial or developmental education in the higher education environment suggests a need for ongoing exploration in to the effectiveness and cost was well as best practices for assessment, placement, and instruction. Continued investigation as to the typical characteristics of remedial students is also necessary. This demographic information is vital for colleges and universities to better understand the backgrounds, potential challenges, and trends in the population to best serve students (Hodara, 2015; Roueche and Roueche, 1999).

The Remedial Student

For decades, scholars have debated how to label students who need instruction in basic skills to successfully complete college coursework. Historically, terms included underprepared, at-risk, low-achieving, developmental, remedial, and deficient (Boylan, 2002; Breneman and Harlow, 1998; Higbee, 1993; Roueche and Roueche, 1999; Jones, 2014). Regardless of what they are referred to as, understanding the demographics and characteristics of students in remedial courses proves essential to developing an effective program to address the needs of the individual (Smittle, 2003; Yarbrough, 2002).

Demographics

African American, Hispanic, and low income students are significantly more likely to require remediation. At four-year institutions, thirteen percent of white students require remediation while twenty percent of Hispanic and nearly forty percent of African American students need developmental education. More drastically, at two-year colleges over sixty-seven percent of African American students and fifty-eight percent of Hispanic students need

remediation (Complete College America, 2012). The National Center for Education Statistics reports while the need for remediation among white students declines, need among minority students is on the rise (2013).

Age is also a distinguishing factor. Individuals over the age of twenty-five who attend four-year colleges are nearly twice as likely to require remedial instruction as those who enter between the ages of seventeen and nineteen with over thirty-five percent of students requiring one or more remedial course (Complete College America, 2012; National Center for Education Statistics, 2013). Over thirty percent of students age twenty to twenty four need remediation (Complete College America, 2012).

A student's socioeconomic status can also be an indicator for remedial need (Almon, 2012; Passel, 2011; Barr and Matsui, 2008). Approximately one third of low-income students enrolled at four-year institutions demonstrate a need for developmental education. Nearly sixty-five percent of low-income students enrolled at two-year institutions require the same (Complete College America, 2012). The literature further suggests the majority of remedial students work at least part time, receive financial aid, and live off campus (Saxon and Boylan, 1999).

Seriously Deficient versus Deficient

In his 2000 report, McCabe identifies two unique populations within remedial students. He refers to them as "deficient" and "seriously deficient." Seriously deficient students require remediation in all foundational subjects: mathematics and English with need in areas of both reading and writing. Those students who require remediation in one or the other are considered deficient. His findings indicated approximately forty percent of seriously deficient students are African American, nearly twice as many as non-Hispanic whites. Hispanic students account for

nearly twenty-two percent. Overall, minority students account for over three quarters of students deemed seriously deficient.

McCabe (2000) also explored income level impacts on remediation. The study found over half of students enrolled in remedial courses have an annual family income of less than US$20,000. The U.S. Department of Health and Human Services considers this income at poverty level for a family of three (2015). Because minorities are disproportionately economically disadvantage, these findings are not surprising but are worrisome. The report makes three overarching recommendations to address these issues. Making remedial education a high priority with legislative support tops the list also requiring the assessment and placement of all incoming students at two- and four-year institutions. Additionally, the author recommends developing a national guide to be utilized as a resource for colleges and universities in developing effective remediation programs.

High School Influence on Remedial Needs

Ethnicity and socioeconomic status are not the only factors affecting a student's ability to handle college-level coursework. Other influences include family, teachers, peers, previous academic experience, as well as personality and innate aptitude. Howell (2011) explored those influences specifically under the control of public policymakers, examining secondary school and teacher impact on a student's need for remediation in college. The study explored teacher quality measures as defined under the No Child Left Behind policy: years of experience, educational attainment, and credential status.

The findings suggest mathematics remediation is related to each of these three qualities while English remediation is not correlated to high school teacher experience but is positively

correlated to teacher educational attainment. Less English remediation was required by those students who attended high schools with a greater proportion of teachers with master's degrees. This positive impact was even greater for those students who attended high schools with larger minority student populations. Across both subjects, the results suggest temporary teacher credentials and credential waivers negatively impact student experience and lead to increased levels of remediation in college.

Cost of Remediation

Critics and proponents alike express concerns with the cost of remedial or developmental instruction. Costs impact the individual student, the institution, and often, the state and taxpayers. In some states, significant portions of remediation program costs are covered by the state (Bettinger, Boatman, & Long, 2013; Colorado Commission on Higher Education, 2010; Pitts & White, 1996; Scott-Clayton, Crosta, & Belfield, 2014). States such as North Carolina, Florida, and California have used these high costs as the basis for remedial education legislation changes over the past decade (Calcagno & Long, 2008; McLean, 2012; North Carolina S.B. 523; The California State University, 2015).

Scott-Clayton, et al. (2014) estimate the cost of remediation to be nearly US$7 billion annually, accounting only for the actual cost of remedial coursework, not calculation opportunity costs and impact on future outcomes. This figure represents a nearly US$1.5 billion increase from 2011 estimates posed by the Alliance for Excellent Education (2011). Estimates from the late 20th century suggested a cost of only US$1 to 2 billion (Merisotis and Phiips, 2000; Saxon and Boylan, 2001). These estimates exclude cost to student. Frequently, students must pay out-of-pocket for developmental coursework as it is often non-credit bearing and cannot be covered

by scholarships, grants, or other financial aid (Bettinger & Long, 2007; Calcago & Long, 2008; Dougherty & Reid, 2007).

Calculating the cost of remediation accurately poses challenges for researchers. Many national studies exclude private institutions, most of which provide some sort of remedial instruction while receiving state and federal funding. Other estimates exclude non-direct costs such as missed or reduced earrings (Merisotis and Phipps, 2000) or economic impacts such as decreased labor and productivity as well as global competitiveness (Friedman, 2005; Merisotis and Phipps, 2000).

Profit

Saxon and Boylan (2001) suggest remediation is actually a profitable venture for higher education institutions, not a costly one. The researchers state the cost of providing remediation are fully covered, and sometimes exceeded, by the revenues generated by the service. So, for example, a professor's salary to teach a remedial math course would be fully covered by the revenue from the tuition for those students enrolled. This research, as do other cost estimates, fails to consider cost to student.

Effectiveness of Remediation

Research as to the effectiveness of remediation poses a number of issues. Very few national studies exist and those that do are largely focused on community colleges, with little consideration to universities. Further, those studies that have been completed tend to focus on one specific demographic within remediation, or one specific institution, failing to consider the bigger picture. Some researchers also claim institutions are unwilling to measure the

effectiveness of services perhaps contributing to the gap in the research (Boylan, 2002; Roueche and Roueche, 1999). Though the last several years have seen a marked improvement in research in this area, findings are still limited.

The most recent published, peer-reviewed national study pertaining to the effectiveness of remediation was conducted in 2000. McCabe (2000) utilized national data to conduct a ten year longitudinal study. The report suggested over forty percent of students enrolled in one or more remedial course completed their remedial course of study. Of that forty-three percent of students who successfully completed remediation, ninety-eight percent of participants were employed at the end of the study. Fourteen percent complete an associate's degree. Sixteen percent completed a bachelor's degree. Over one third of participants earned an occupational or vocational degree or certification. Approximately four percent completed graduate degrees.

Another longitudinal study tracked high school graduates from 1982 until 1994 (Phipps, 1998). The study found students who required no remediation were almost twice as likely to complete their degree programs as those who required remedial courses. Of those who completed their degrees, sixty percent required no remediation. Fifty-five percent required one remedial course. Forty-four percent took three or four remedial courses while thirty-five percent took five or more remedial courses. This study suggested that even one third of those students who entered higher education seriously deficient, requiring five or more remedial courses eventually completed a college degree.

McClenney (2006) conducted a study focusing on the Alamo Community College District. The study specifically examine performance in remedial courses impact on persistence. According to the findings, between eight-three and eight-six percent of students who earned a passing grade, of C or better, in their remedial course persisted to the spring term. Interestingly,

the study found a higher rate of persistence among those taking remedial coursework than those students who did not take a remedial course. Bettinger and Long (2005) found similar results. In their study, students enrolled in remedial courses yielded better academic outcomes to those who did not enroll in remedial courses but had similar backgrounds.

More recent studies conducted tend to explore specific remediation methods versus general remedial populations compared to general populations. In 2014, Dawson, Van Der Meer, Skalikcy, and Cowley conducted a study exploring the effectiveness of supplemental instruction, finding it to be a valid instructional method. McClean (2012) explored California's Early Assessment Program, determining it is too soon to understand the long term implications. Additional studies suggest advising plays an integral role in the success and persistence of students (Creamer and Creamer, 1994; Schreiner and Anderson, 2005; Yarborough, 2002).

Successful Remediation Programs

What does a successful remedial program look like? Brothen and Wambach (2012) outline a seven-point framework to be utilized by institutions to develop and understand developmental education initiatives. The framework emphasizes considering students' needs and goals on an individualized and focused basis. The seven components of the framework are: continue and refine literary skill development courses, vary course placement requirements based on student goals and program of study, develop a range of placement testing procedures, integrate alternative teaching/learning approaches, use theory to inform practice, integrate underprepared students into mainstream curriculum, and adjust program delivery according to institutional type. Roueche and Roueche (1999) support the theory of an institution based systematic approach.

Brothen and Wambach (2012) suggest replacing traditional remediation with supplementary instruction and support efforts. Though the need for traditional instructional methods remains, some techniques can link supplemental methods with traditional coursework. One such example is Writing Across the Curriculum, a popular remediation tool to build skills in writing and English (Brown, 2006; Miller, Brother, Hatch, & Moen, 1998).

Exploring an individualized approach for students is urged by the researchers. Brothen and Wambach (2012) consider the need for an art student to take a series of high level mathematics courses. The impracticality and lack of connectedness to the student's field of study of commonly required math courses represents a reoccurring dilemma. The researchers suggest allowing students to take a more applicable mathematical reasoning course is likely to yield in higher success rates and better outcomes for students.

Differentiated instruction utilized in courses in which remedial students enroll in credit bearing coursework with non-remedial students may yield greater student outcomes than remedial instruction (Curtis and Harte, 1991; Leightweis, 2013; Wambach and delMas, 1998). Instructors in this scenario must be adaptable and able to integrate alternative learning and teaching styles in to the classroom. Skill development is more intuitive than overt.

The face of remediation should reflect the institutions focus; a community college remediation program should look different than the developmental education efforts at a research institution. Where a community college is more likely to be preparing vocational learners or those preparing to transfer to public, four-year institutions, research institutions are more likely preparing students focused on science with an emphasis on research and writing. Instructional practices effectively improving the performance of a remedial community college student may

not work for the student at a traditional research institution (Crisp & Delgado, 2014; Quint, Jaggars, Byndloss, & Magazinnik, 2013).

An emphasis on professional development for faculty and other instructors appears in literature beyond Brothen and Wambach's (2012) framework. Roueche and Rouche (1999) and Boylan (2002) also suggest the availability of instructional development of part-time and full-time faculty is key to designing an effective remediation approach. This development should allow faculty to better understand how to provide students with assignments that are meaningful to their long term goals.

The integration of underprepared students in to credit bearing coursework is recommended as an alternative to "skill and drill" practices commonly utilized in regular remedial courses (Grubb, 2001). In order to properly differentiate instruction and incorporate all levels of learners in the classroom, instructors must be prepared. Smittle (2003) outlines six practices for effective developmental education in mainstream courses: commit to teaching underprepared students, demonstrate good command of the subject matter and the ability to teach a diverse student population, address non-cognitive issues that affect learning, provide open and responsive learning environments, communicate high standards, and engage in ongoing evaluation and professional development.

The final component of Brothen and Wambach's (2012) framework recommends refining and broadening placement procedures. The extant literature suggests the impact of being assigned to and/or taking remedial courses can have long term, detrimental effects on a study (Jacobson, 2006). As such, basing a decision on a single test with disregard to other factors, such as performance in high school coursework, is unjustifiable (Brothen & Wambach, 2012;

Burdman, 2012; Scott-Clayton, Crosta, & Belfield, 2014). While most institutions aim to utilize a valid and reliable placement exam, few consider other performance indicators.

In addition to the components outlined in the framework, other researchers have explored the implications of practices such as paired courses, supplemental instruction, and learning communities/living learning communities. Paired courses are those in which students take a mainstream course with a connected skills based course (Kirk and Lerma, 2005; Wilcox, et. al, 1997). Supplemental instruction incorporates advanced students or other instructors conducting and/or re-teaching course content in an alternative setting (Adams and Bush, 2013; Arendale, 2002; Dawson, et. al, 2014).

Learning communities are a cohort of students who enroll in all or some of the same block of courses, increasing the likelihood of interaction and, research suggests, retention (Koski and Levin, 1998). Living learning communities are those in which a group of students are placed on to the same floor or within the same building based on a common major, interest, or program affiliation. These communities aim to increase engagement and promote study groups, peer mentoring, and student-to-student teaching (San Antonio and Ofori-Dwumfuo, 2015).

Measuring Effectiveness – Evaluation of Programs

Successful programs utilize a system of evaluation to guide improvements and development (Bolman and Deal, 2008; Fitzpatrick, Sanders, and Worthen, 2012; Wren, 1995). In an era of accountability and scarcity of financial resources, society is increasingly interested in the ways in which problems are solved. Program evaluation can take on many forms and play many important roles.

Informal evaluations make judgements and observations every day. Remedial students, faculty, and staff form opinions and beliefs about the program at hand. These informal evaluations typically lack depth due to their lack of systematic data collection and formal evidence. Conversely, formal evaluations, which should be conducted regularly, include a plan for data collection, processing, and output (Fitzpatrick, et. al., 2012). Fitzpatrick, Sanders, and Worthen (2012) describe the purpose of evaluation. Ultimately, evaluation informs the user or stakeholder to aid in decision making.

Boylan, Bonham, and Tafari (2005) found those institutions utilizing regular, formal evaluation practices of their remedial education programs had higher retention rates. It is estimated less than fifteen percent of community colleges regularly evaluate their programs (Boylan and Bliss, 1997). More commonly, programs are not evaluated internally or externally unless they become involved in studies; something a small number of institutions participate in overall.

Importance of Remediation

Though states actively attempt to tackle the growing need for remediation in higher education students through the alignment of secondary curriculum to college readiness standards, the need for remediation will not cease. Even with curriculum aligned, some students will leave their high schools needed additional assistance once arriving on their college or university campus. Further, changes in the economy, growth and globalization of the job market, and other social factors encourage adult learners to return to higher education to pursue degrees or certificates. It is likely many of these adults will require remedial coursework to refresh their

basic academic skills. The literature suggests there are benefits to remedial education for institutions, students, and society as whole, demonstrating its important role.

Research shows us minorities and low socioeconomic students participate in developmental instruction more often than others. As such, remedial programs help to make colleges and universities more accessible to commonly underrepresented populations, diversifying the student body as a whole (Boylan, Bonham, and Tafari, 2005). Increased access by a diverse population enriches all students' learning and eventually increases innovation and competitiveness in the workplace. Institutions may make remedial instruction profitable as well (Saxon and Boylan, 2001).

Remediation gives students a second chance to access higher education. Without it, an estimated one million students would be ineligible to begin their college degrees each year (McCabe, 2000). Remediation contributes to retention and academic outcomes. The literature suggests students who enroll in remedial coursework actually perform better academically than those who do not, suggesting they are an important tool contributing to student success (Bettinger and Long, 2005; McClenney, 2006).

Society relies on higher education institutions for a number of reasons. Individuals with college degrees are more likely than those without to contribute to the community through volunteering, donation to charities and voting. They are more likely to appreciate diversity, important in the increasingly diverse country that is the United States, and adapt more rapidly to emerging technologies (Baum and Payea, 2005).

Further, the more educated the populace, the lower the levels of unemployment and poverty. In addition to contributing more in taxes, adults who have earned a college degree are less likely to need social assistance. College graduates are less likely to smoke, have better

health, and are less likely to be incarcerated (Baum and Payea, 2005). Spann (2000) estimates the production of more than US$87 billion in federal, state, and local taxes annually if just one-third of students enrolled in remedial courses earned a bachelor's degree.

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Factors Impacting Retention and Student Success

A number of factors impact a student's desire and ability to persist to graduation and academic performance. Other factors correlate to the need for remediation and eventual outcomes. Some factors can be controlled, such as institutional programs and characteristics, while others, such as family background, race, and income, cannot be. This section will explore institutional and student characteristics impacting retention and other factors impacting academic achievement, including early theories on student engagement.

Student Characteristics

As discussed in earlier sections, a correlation exists between ethnicity and need for remediation. Similarly, students of color are less likely to persist to graduation. Income is also a contributing factor. Baily (2005) reports approximately two-thirds of low income students do not obtain any college degree or certificate. Kiyama (2010) and Luna de la Rosa (2006) indicate a parent's experience, or lack thereof, in higher education is a more accurate indicator of retention and persistence to graduation, particularly in low income families.

Though a number of resources exist for high school students, college students, and their parents to better understand financial aid, the college environment, transition challenges, and the job market, parents still struggle to educate their children on such issues (Perna, 2006). In addition to this disconnect at home, low income students are more likely to work while in school.

Studies suggest a negative correlation between number of hours worked per week, course outcomes, and persistence to graduation (Boswell and Wilson, 2004; Matus-Grossman and Gooden, 2002).

High School Grade Point Average

The predictive value of high school grade point average cannot go unmentioned. Research suggests this is the strongest predictor of persistence to graduation; the higher the high school grade point average, the more likely the student to persist to graduation and earn a college degree (Astin, 1993). Students who maintained a grade point average of C or lower were less likely to persist in college than those who maintained higher grade point averages in high school. The same is found in reviewing performing in the first year of college (Kahn and Nauta, 2011; Tinto, 1975). Other factors positively correlated to graduation include standardized exam scores, socioeconomic status, and declared major. Those students who major in business or a social science field are more likely to graduate (Pacarella and Terezini, 2005).

College or University Characteristics

Astin (1993) linked the size of an institution to student retention, indicating the larger the institution, the more likely students are to leave the university or college prior to graduation. Astin (1993) further suggests faculty characteristics such as morale and diversity lead to higher retention rates as does having more female students. The National Center for Education Statistics (2014) report female students graduate at a higher rate than male students, suggesting it is not merely having a larger female population the increases retention but rather, that female students are simply more likely to persist to graduation.

The report from the National Center for Education Statistics (2014) further reports approximately fifty-eight percent of students at public institutions persist compared to only thirty-two percent at private for-profit schools. Private non-profit institutions post a graduation rate of sixty-five percent. The more selective an institution, the more likely students are to graduate; presumably, those students only admitting the top twenty-five percent or less of their applicants has a uniquely different population from an institution with open enrollment, or less stringent admissions requirements.

Student Engagement

Theories of student engagement blossomed after the mid-19th century with continually growing interest from institutions. Pace, Astin, Tinto, Chickering, and Gamson conducted much of the earliest research in to this topic beginning as early as the 1970s. The work of these early theorists guides practices and continuing research still today.

Pace

Pace (1979, 1984) examined the student experience beyond test scores, test grades, and job placement. The work explored the quality of effort students put forth in their collegiate environment and looked at the larger picture of the collegiate experience. For one of the first times, education quality was viewed not as a product – not by output – but in terms of a process through which an individual grows, develops, and enhances his or her intellectual capability. Pace (1979, 1984) specifically emphasized the need for students to put forth effort and time to become active participants in their education versus passive consumers.

Astin

Astin (1993) created a theory around student involvement centered around the time and energy invested in the educational process. The theory utilized a model known as I-E-O, standing for Input – Environment – Outcome. Input is identified as those factors and characteristics a student brings to the educational environment with them. Input might include a high school grade point average, rigorous secondary schooling, or innate abilities. Environment refers to those factors the institution contributes: the environment and the experiences the student has in said environment. This is key to Astin's (1993) theory which suggested the amount of learning that occurs is proportional to the quantity and quality of the energy invested in learning. Outcome is the final component of the I-E-O model. Outcome reflects the impact on the student and include factors such as student satisfaction, academic development, career development, and retention.

Tinto

Working backwards, the earliest research pertaining to retention examined student reasons for leaving colleges or universities prior to graduation. Exploring the relationship between the numerous variables that impact student persistence to graduation, Tinto (1975) purported the initial transition to the collegiate environment needed to include assimilation in to the intellectual and social communities within the college or university. Tinto (1975) further argued the success of students is the responsibility of students and schools alike.

Chickering and Gamson

In 1987, Chickering and Gamson espoused a theoretical framework for effective practice in undergraduate education. The framework emphasized good teaching and learning principles. The framework includes: encouraging contact between students and faculty in and out of the classroom, promoting reciprocity and cooperation between students, implementing active learning in the classroom, providing prompt and timely feedback, emphasizing time on task, setting and communicating high expectations, and respecting diversity in skills and ways of learning and teaching.

Engagement in the Twenty-First Century

The works of Pace, Astin, Tinto, and Chickering and Gamson laid the groundwork for research and theories on student engagement well in to the twenty-first century. Kuh (2005) utilized this foundation to guide research regarding the specific factors that provide best support for student development. The research suggests the factors are vast. Some such factors are an explicit organizational mission, high expectations for student and faculty achievement, and exposure to new and diverse experiences and beliefs leading to the emerging dimensions of oneself.

Additionally, Kuh (2005) suggests focusing on the transition from high school to college with the integration of prior learning and experiences plays a positive role in student achievement. Instructional practice takes a front seat in Kuh's (2005) theory. It states lists learning, assessment and feedback, collaborative learning environments, and time on task as key factors. Finally, Kuh, Kinzie, Schuh, and Whitt (2005) note the importance of students spending time out of the classroom connecting with faculty.

National Survey of Student Engagement

In addition to the foundational literature, Kuh (2001) conducted a large scale study to explore levels of student engagement. With a grant from the Pew Charitable Trust, Kuh developed the National Survey of Student Engagement (NSSE) in attempt to improve upon a previously existing instrument, the College Student Experiences Questionnaire. The NSSE attempted to build a more in-depth, multi-dimensional understanding of student engagement using five benchmarks (Kuh, 2001). The benchmarks include: Level of Academic Challenge, Active and Collaborative Learning, Student-Faculty Interactions, Enriching Educational Experiences, and Supportive Campus Environment (National Survey of Student Engagement, 2015).

Specifically, the National Survey of Student Engagement collects data pertaining to two major features of the collegiate environment. The first inquiries a students' time and effort put in to studies and other educational activities. The second is regarding the institutionally deployed resources, curriculum organization, and other learning opportunities. Each year, hundreds of colleges participate in the survey with first-year and senior students responding. In 2015, 587 institutions participated with responses from 323,801 students received. Since 2000, over 1,600 schools have participated with over five million student responses (National Survey of Student Engagement, 2015).

The results of the surveys are presented to the participating institutions in a variety of reports and compare responses with self-selected comparison institutions. Comparisons are made on ten engagement indicators, six high-impact practices, and individual instrument items. The engagement indicators are divided in to four themes: academic challenge, learning with

peers, experiences with faculty, and campus environment. The indicators include higher-order learning, reflective and integrative learning, learning strategies, and quantitative reasoning in the academic challenge category; collaborative learning and discussions with diverse others in learning with peers; student-faculty interactions and effective teaching practices in the experiences with faculty category; and quality of interactions and supportive environment in campus environment (National Survey of Student Engagement, 2015b). High-impact practices are, for the purposes of the survey, (1) learning community or some other formal program where groups of students take two or more classes together, (2) courses that included a community-based project (called service-learning), (3) work with a faculty member on a research project, (4) internship, co-op, field experience, student teaching, or clinical placement, (5) study abroad, and (6) culminating senior experience (such as a capstone, thesis, or portfolio) (National Survey of Student Engagement, 2015c). The annual results are reported each November (National Survey of Student Engagement, 2015).

The findings released in 2014 demonstrate the vast differences in student experiences from institution to institution, regardless of similarities in enrollment and admissions standards (National Survey of Student Engagement, 2014), areas previous studies suggested may be linked to retention rates (National Center for Education Statistics, 2014). Further, the findings suggest institutional culture, policies, and practices can make a significant impact on the quality of student experiences. There were several major noteworthy results (National Survey of Student Engagement, 2014).

As demonstrated in available literature, minority students enroll in remedial courses at higher rates than non-minority students and are often at a disadvantage in accessing higher education. The findings of the 2014 survey suggest the disadvantages do not stop there in some

institutions. Though a considerable number of institutions noted no differences or reserved experiences, African American and Latino students overall reported a lower quality of interactions with students, faculty, advisors, and other staff.

Though twenty percent of first-year students and approximately thirty three percent of seniors indicated social media substantially distracted from their studies, the results of the survey analysis indicate learning-directed uses of social media were positively correlated to all measures of engagement. Reflective and integrative learning, collaborative learning, and student-faculty integration featured the strongest correlations. The emphasis on instruction was further supported by the findings regarding faculty time. Faculty spent more time devoted to teaching activities than to research, service, or advising. Those that did so demonstrated higher student expectations, higher student-faculty interaction, and utilized effective teaching practices more often.

Despite a positive correlation existing between the number of visits a first-year student had with an academic advisor and students' perception of support on campus, nearly one third of first-year students never met with an advisor. Twenty-three percent met only once with an academic advisor while nearly ten percent never had or took the opportunity. The positive correlation exists for all student groups, regardless of racial-ethnicity. The study found commuters, non-traditional, and part-time students were least likely to meet with their advisor; the same populations shown to have higher risk of attrition. Advising plays an integral role in persistence to graduation for remedial and non-remedial students alike.

Advising

Hunter and White (2004) suggest academic advising could be the solution to fixing many of the predominant issues in higher education and, therefore, advising should be at the forefront of university system strategy. The dominant model of advising since the 1970s is the developmental model. While predominating the literature regarding advising practices, research suggests implementation of this, or other effective advising practices falls short (Crookston, 1972; Grites & Gordon, 2000).

Crookston (1972) states this model of academic advising "is concerned not only with a specific personal or vocational decision but also with facilitating the student's rational processes, environmental and interpersonal interactions, behavioral awareness, and problem-solving, decision-making, and evaluation skills (p. 5)." Developmental advising focuses on the development of the whole person, working with the student at their own stage of development and reflects the idea of progression (Crookston, 1972; Fielstein, 1989). The model is grounded in psychological theories such as the cognitive developmental theory, psychosocial theory, and person-environment interaction theory (Creamer, 2000; Creamer & Creamer, 1994; Raushi, 1993).

Developmental advising allows students to develop a plan to achieve specific academic goals with additional consideration to and emphasis on developing the whole person. Those who apply this model focus on student's growth and their ability to lead fulfilling lives after graduation (Crookston, 1972). Comparing prescriptive advising and developmental advising, Crookston (1972) notes prescriptive advising fails to address comprehensive academic concerns. In prescriptive advising, a student seeks answers to questions and advisors provide a single solution.

Developmental advising, conversely, is rooted in "the belief that the relationship itself is one in which the academic advisor and the student differentially engage in a series or developmental tasks, the successful completion of which results in varying degrees of learning by both parties (Crookston, 1972, p. 6)." The relationship is characterized by building student awareness of her or her values, personal characteristics, and individual needs with students learning how to set and achieve goals and problem solve (Gardiner, 1994). Advisor/advisee relationships in developmental models are less hierarchical and authoritarian than prescriptive models that utilize more directive and logistical techniques (Fielstein, 1989).

Though it remains the prevailing archetype, Schreiner and Anderson (2005) suggest an expansion and evolution of the developmental model to refocus on what is called a strengths-based model. The authors suggest this model would further improve academic advising and student outcomes indicating, because of today's diverse learner populations, a model focused on needs assessments, remediation, and problem solving is no longer adequate.

Current models focus on deficit remediation and build their response to these deficits. The abilities of incoming students are assessed to discover these shortfalls. This may include student participation in remedial classes or receiving special services to accommodate the need. The response from advisors is pragmatic and, though developmentally based, focused on the "areas in which the student needs assistance to meet the expectations placed on her or him in the college environment (Schreiner & Anderson, 2005, p. 22). While addressing weaknesses may result in short-term improvement, high levels of excellence may not be achieved (Hodges & Clifton, 2004).

Yarbrough (2002) indicates advising appointments that highlight a student's inadequacies, even if focused on development, may be demoralizing, resulting in reduced

motivation. Reduced motivation can create a cycle that includes withdrawing from the learning community, less interaction and support by faculty, staff, and peers, and dwindled student engagement. The research suggests student engagement in his or her learning is the "most fundamental challenge to producing high academic achievement (Schreiner & Anderson, 2005, p. 23)."

Interdisciplinary Base for Strengths-Based Advising

A study conducted by Schreiner (2000, 2004) discovered a strengths-based model positively impacted the advisor-advisee relationship. Like the developmental model advisors focus on student growth, this approach refocuses from student needs to areas of talent and skill. Schreiner's original study built upon research in the business sector regarding employee motivation and satisfaction (Clifton and Harter, 2003; Harter and Schmidt, 2004), which suggest that employee satisfaction is at least somewhat trait related (Harter, Schmidt, Killham, and Agrawal, 2009) and a relationship exists between engagement and outcomes. In scenarios where employees were able to expand on their talents, they were able to reach levels of excellence (Schreiner & Anderson, 2005). Anderson and McQuire (1997) recommend advisors encourage excellence through motivating students, requiring an understanding of the student's strengths and motivational factors.

In addition to a business model that utilizes feedback and talent building to motivate, the field of social work is rooted in the believe that an individual possesses the talents to be successful (Saleebey, 1996). Saleebey (1996) indicates individuals "must be seen in the light of their capacities, talents, competencies, possibilities, visions, values, and hopes (p. 397)." The growing field of organizational development has also embraced strengths-based practices,

utilizing positive organizational scholarship, or POS. Focusing on "dynamics that are typically described by words such as excellence, thriving, flourishing, abundance, resilience, and virtuousness… [POS] puts an increased emphasis on ideas of 'goodness' and positive human potential (Cameron, Dutton, & Quinn, 2003, p. 4)."

The Psychological Foundation: Self-Efficacy

With an emphasis on positive experiences, individual traits, and institutions, positive psychology provides a foundation for strengths-based advising and underlines the importance of successful advising on student satisfaction and successful outcomes (Cameron, Dutton, & Quinn, 2003). Self-efficacy, the extent of one's belief in one's ability to be successful, is the root of this theory. Bandura (1977) suggests self-efficacy can have an impact on all psychological states including motivation and behavior. Those with a strong sense of self-efficacy are better problem solvers, are more deeply invested in their work and or school, have a stronger sense of commitment, and are more resilient in the face of adversity (Bandura, 1997).

There are four primary ways to develop self-efficacy according to Bandura (1977, 1997), which can be incorporated in the academic advising practices. The most effective means of developing self-efficacy is through successfully completing the task at hand. The more times a task is successfully completed, the more confidence an individual will have to complete the task. Conversely, if an individual repeatedly fails to deal with a task, self-efficacy is weakened.

Social modeling and social persuasion also develop self-efficacy. Modeling, or witnessing the successful completion of a task can motivate and encourage an individual to do the same. For example, a student who has witnessed someone who they relate to, who is like

them, successfully complete a course or graduate finds encouragement in this success (Bandura, 1997). Particularly of interest for advisors is social persuasion. In this, encouragement from others can help to develop an individual's self-efficacy (Bandura, 1977). Finally, physical responses such as nervousness, moods, and stress levels can weaken a sense of self-efficacy. Bandura (1977) suggests individuals learn how to minimize these responses in the face of challenging tasks to improve their sense of self-efficacy.

Strengths-Based Advising

Every student who enters higher education has talents that allow them to contribute uniquely to the learning environment. Strengths-based advising utilizes these talents as the basis for planning and development (Anderson & McGuire, 1997). Clifton & Harter (2003, p. 111) define these talents as "naturally recurring patterns of thought, feeling, or behavior that can be productively applied." This belief that all students have something to contribute to learning is the foundation for reciprocal teaching.

With an emphasis on "enabling students to learn and use cognitive strategies such as summarizing, questioning, clarifying, and predicting (p.204), Hattie (2009) lists reciprocal learning as one of the most effective instructional techniques. With an effect size of d = 0.74, this method requires students to "actively bring meaning" to the information provided by the instructor, or their peers, and "monitor their own learning and thinking (p.204)." In order for reciprocal teaching to be most effective, faculty should first teach, and continue to review, cognitive strategies while providing ample opportunity to practice with familiar content (Hattie, 2009). This method allows students to utilize their personal strengths.

In addition to improve interpersonal communication skills and content knowledge, reciprocal teaching can also keep students on task as they are more cognitively engaged. In an

era where students are often distracted by technological devices, increased external stress factors, and diversions, the cognitive engagement allows participants to disconnect from distractions and focus on the material at hand. This also provides an opportunity for students to share their own personal stories as they relate to the topic. When a learner hears concepts applied in a story or exampled case, they have increased comprehensive and retention. Stories may be similar to a learner's personal experiences or feature characters or plots that the individual finds relatable or memorable (Bower & Clark, 1969).

Reciprocal teaching leads to cognitive flexibility development as well. Cognitive flexibility occurs when multiple perspectives or viewpoints are present. An individual's learning outcome is traditionally influenced by personal biases, assumptions, and experiences, all of which limit the scope of understanding. This is helpful for learners to develop a variety of approaches to solving complex issues (Spiro, Feltovich, Jacobson, & Coulson, 1991). Reciprocal learning and a strengths-based focus can occur in the classroom, in an advising session, or during extracurricular activities.

The advisor, teacher, or mentor can use the model to build a student's self-confidence, motivating them through the identification and encouragement of a student's specific talents. As rooted in the developmental model, the advisor can apply developmental practices to help the student develop skills and knowledge from these talents. This requires advisors to utilize a foundation of student motivation instead of student needs and shift "the focus from problems to possibilities (Schreiner & Anderson, 2005, p. 26)."

In strengths-based advising, advisors guide the student in focusing on approaches that have enabled success versus reasons for failure (Schreiner & Anderson, 2005). The emotional response to strengths-based advising is inherently different than in other advising models.

"Students feel understood and known by their advisors at a deeper level, experience higher motivation levels and a sense of direction and confidence, and report significantly higher satisfaction with advising (Schreiner & Anderson, 2005, p. 27)."

Residence Halls

Research has been conducted to explore the relationship between on campus living and engagement. Astin (1973) found students who live on campus were more likely than commuters to earn their bachelor's degree in four years. They also reported more social interactions, had higher levels of self-confidence, and, overall, were more satisfied with their experience. A positive correlation exists, per Astin (1973), between residential living and retention. Levin and Clowes (1982) support these findings, adding that students who live on campus tended to be those who had higher high school grade point averages and come from higher economic statuses.

Thompson, Samiratedu, and Rafter (1993) found persistence to graduation to be significantly higher for on-campus students regardless of race, gender, or admission type. The study specifically examined remedial students finding remedial students who live on campus perform better than remedial students who do not. While underprepared and other academically at risk students are less likely to live on campus, the study suggests the positive impacts of living on campus may be even greater for this population.

Placement Tools

Assignment to remedial education is largely based on performance on a single placement exam. Some institutions utilize performance on these exams in addition to considering high school coursework and grade point average. Others utilize standardized exam schools, such as the ACT or SAT. While a number of placement tools exist, including institutionally designed

exams such as those utilizes by MSSPU, there are four leading placement programs in the United States: ALEKS, the COMPASS, ACCUPLACER, and MyMathLab. In addition to placing students, the programs provide additional developmental support. They are discussed in this section.

ALEKS

Assessment and Learning in Knowledge Spaces (ALEKS) is an online assessment system that utilizes artificial intelligence and adaptive questioning to determine what a student does or does not know regarding a specific topic. In addition to accurately assessing student strengths and deficits, ALEKS acts as a remedial tool to improve user skill. Developed by a team of software engineers, mathematicians, and cognitive scientists out of New York University and the University of California, Irvine supported by a multi-million dollar grant from the National Science Foundation, ALEKS is based upon Knowledge Space Theory work (ALEKS, 2015).

Essentially, the artificial intelligence framework within the software creates a cognition map outlining what a user knows at each point in time. This allows the student to continually be monitored for understanding of the given topic. The technology makes learning more effective and efficient. ALEKS currently offers courses in over one hundred mathematics topics (ALEKS, 2015; Teaching and Learning, 2014).

Compass

Offered by ACT, the popular vendor for standardized entrance exams, Compass is a popular placement exam. In June 2015, ACT announced plans to phase out the Compass exam. Used primarily by community colleges and non-selective universities, Compass is a low-cost

assessment tool used for accessing reading, writing, and mathematics skills. A statement released by ACT indicated the organization felt it was becoming less effective at placing students as in the past. First developed in 1983, the exam will be eliminated by the end of 2016. Citing limitations in measuring college readiness, the ACT indicated remedial placement should be multidimensional and appropriate for the institution (Fain, 2015).

ACCUPLACER

Like Compass, ACCUPLACER is an online placement assessment in the areas of math, reading, and writing. Offered by the College Board, the software also provides interactive learning tools to prepare students for the exam. The assessment is primarily used by community colleges (ACCUPLACER, 2015). James (2006) examined the effectiveness of ACCUPLACER finding the arithmetic and elementary algebra tests strongly predicted performance in mathematics development courses with weaker but present positive correlation between performance on the reading comprehension and sentence skills ACCUPLACER and performance in English remedial course grades.

MyMathLab

A Pearson product, MyMathLab boasts “personalized, customizable, and always engaging” learning technology (Pearson, 2015). MyMathLab primarily serves as an accompany technology to Pearson textbooks. In addition to assessments for each section of the textbook, other resources are provided. Video lectures, animations, eBooks, and additional activities support classroom learning whether in person or online (Stewart, 2012). While universities and

colleges do not typically use MyMathLab assessments for remedial placement, the technology is often utilized to support remedial instruction.

Bias in Placements

Some studies have been conducting that suggest placement systems and individual instruments accurately predict skills and potential for success for all students equally. A 2002 study explored potential gender biases in mathematics placement tests and found in all examined mathematics courses other than calculus, women were under-placed at a statistically significant level indicating a significant gender bias in the placement systems studied (D'Souza Dorner and Hutton, 2002). These same biases are often cited in ACT and SAT testing outcomes.

A 2014 report demonstrates the racial biases in such examinations with studies consistently showing students of color, Latinos, and Native Americans have lower scores on achievement and placement exams due to the nature of the exams with questions often favoring white students of a certain cultural background. Access to preparatory materials, quality instructors and tutors, internet and text resources, and parental involvement and experiences also impact the outcome of students (Peterson, 2014).

Some institutions have taken steps in response reports of gender, racial, and economic status biases in entrance and placement tools, opting to use university specific tools that have been internally developed. While these biases are likely to exist in the placement tools utilized at MSSPU, race and gender are not examined within the scope of this study. Additional studies may be conducted to explore the potential biases within the MSSPU tools in the future.

Overview of MSSPU

University Profile

Established in 1925, MSSPU began as a training institution eventually growing to be the largest higher education institution specializing in its area of expertise. The institution is independent, nonsectarian, and not-for-profit. The population of this study focuses on the residential campus of MSSPU located in Florida. The university offers over seventy baccalaureate, master and doctoral degrees and is accredited by the Southern Association of Colleges and Schools (Commission on Colleges, 2015).

The National Center for Education Statistics (2015) reports indicate over 95 countries are represented in the student population with the most international students coming from India, Saudi Arabia, and Korea. All 50 states are represented in the student population. Approximately 20 percent of students are female. Forty percent of students reside on campus in residential housing and eight percent receive federal financial aid.

The university utilizes an optional placement examination system for incoming first year students to provide a placement recommendation for mathematics and English composition. These exams were internally developed in 2007 and have not been altered since. The mathematics and English composition placement exams are online exams provided to students prior to enrolling in courses, over the summer before their first term. Scoring for the mathematics placement exam is done via computer and responses are multiple choice. Scoring for the English composition placement exam is subjective as responses are written responses. However, the same two faculty members have completed the scoring process using the same rubric for all cases. Though efforts have been made to ensure equity and efficacy of these exams, it is currently unclear to what extent these placements may be impacted by the biases outlined earlier in this chapter.

Summary

This study is focused on the effectiveness of MSSPU's internally designed placement exams for remedial instruction and the impact of the Free Summer Remedial Program on student outcomes. The literature guiding this research includes a number of topics. Those topics include the history of remedial education in the United States as well as the impact of immigration and non-domestic students on the need for remediation. Also explored is the dynamic controversy between labeling such education as remediation or developmental.

Impacts affecting the nature of remediation were discussed, including state policies, the cost of remediation, and demographics. Though research on these topics and the effectiveness of remediation has occurred since the 1970s, findings are inclusive as to best practices and impacts. The extant literature suggests a number of additional factors contribute to student experience and outcomes; those factors are explored in this chapter. Commonly used placement tools such as ALEKS, Compass, and ACCUPLACER were discussed. Finally, a brief overview of MSSPU is included.

Research as to the effectiveness of placement tools accounts for a very small percentage over the literature. Due to the nature of MSSPU's placement exam development, no literature exists as to its effectiveness. However, studies suggest remediation intervention is vital to the success for a large number of students. As such, properly placing students is of particular interest to universities and students alike.

CHAPTER 3: METHODOLOGY

Introduction

This study sought to answer the research questions previously outlined related to the effectiveness of MSSPU's internally developed mathematics and English placement tools, the predictive value the placement exams as well as other factors including high school grade point average and entrance exam score, and finally, the impacts of participation in the Free Remedial Summer Program on student outcomes. Methods employed to address these research questions are described in this chapter which includes the following sections: statement of the problem, population and sample, data collection, research questions and hypotheses, treatment of the data, and data analysis.

Statement of the Problem

A growing number of individuals entering undergraduate institutions require remediation and existing literature lacks definitive judgments as to the effectiveness of current, traditional remediation interventions. As remediation can be costly, improving the effectiveness of developmental education programs is beneficial for students, institutions, and the country's overall competitiveness. The literature suggests a number of indicators may help identify students at risk of attrition, including placement exam outcomes, high school grade point average, and entrance exam scores. In 2007, remedial education was made an institutional priority through the development and implementation of mathematics and English composition placement exams and a Free Remedial Summer Program at the university at the center of this study, a mid-sized selective private university (MSSPU, herein).

Purpose of the Study

The purpose of this study was to explore the effectiveness MSSPU's internally developed placement exams for mathematics and English composition in placing students into remedial courses and the efficacy of the Free Summer Remedial Program. This study also considered the predictive value of placement exam outcome, high school grade point average, entrance exam scores and a combination thereof on persistence and graduation. The intent was to evaluate the success of the current remedial placement procedures which utilize internally development placement examinations in assigning students to developmental coursework and identify other possible indicators of students most at risk of attrition.

Research Questions and Hypotheses

The relationships between the constructs investigated in the study are given below in the following research questions and null hypotheses:

1. To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement exam, and those who enter a mathematics course above or below their recommended course?

    Hypothesis 1. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course above their recommended course.

    Hypothesis 2. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course below their recommended course.

2. To what extent does student performance vary between those who enter a recommended English composition course, based on the English composition placement exam, and those who enter an English composition course above or below their recommended course?

    Hypothesis 3. No difference exists in student performance between those who enter a recommended English composition course and those who enter an English composition course above their recommended course.

    Hypothesis 4. No difference exists in student performance between those who enter a recommended English composition course and those who enter a course below their recommended English composition course.

3. To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?

    Hypothesis 5. There is no relationship between mathematics placement exam scores and persistence to graduation.

    Hypothesis 6. There is no relationship between mathematics placement exam scores and time to graduation.

    Hypothesis 7. There is no relationship between English composition placement exam scores and persistence to graduation.

    Hypothesis 8. There is no relationship between English composition placement exam scores and time to graduation.

4. To what extent is high school grade point average predictive of persistence and time to graduation?

Hypothesis 9. There is no relationship between high school grade point average and persistence to graduation.

Hypothesis 10. There is no relationship between high school grade point average and time to graduation.

5. To what extent are entrance exam scores predictive of persistence and time to graduation?

Hypothesis 11. There is no relationship between entrance exam scores and persistence to graduation.

Hypothesis 12. There is no relationship between entrance exam scores and time to graduation.

6. To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?

Hypothesis 13. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and persistence to graduation.

Hypothesis 14. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and time to graduation.

7. What differences exist in remedial course and subsequent courses grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?

Hypothesis 15. No difference exists between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework.

Population and Sample

The population consisted of first year students at MSSPU who completed the mathematics placement exam (MP) and English composition placement exam (EP) in between the years of 2007 and 2015. In early years of implementation, approximately 50% of incoming freshman completed the mathematics and English composition placement. In 2015, 73% of incoming freshman completed the mathematics and English composition placement. First year students transferring from another institution were excluded from this study. All members of the population were included in the sample for this study.

Data Collection

In order to answer the research questions, a process for data collection was established. First, the researcher secured permissions and support to conduct the study at MSSPU from appropriate university administrators. Second, the researcher contacted the Office of Institutional Research and the Office of First Year Programs to establish a system of data transfer that would maintain the confidentiality of students. Institutional Review Board permissions from MSSPU were secured. Finally, Institutional Review Board permissions were secured through the University of Central Florida per university procedure.

Treatment of the Data

Descriptive Statistics

To confirm that data are normally distributed, data were checked throughout using descriptive statistics. Missing data was minimal. Missing data bias was eliminated by removal of any case with incomplete results. The data was screened for possible outliers and none were found. Prior to completing the statistical tests, assumptions were tested using summary statistics, Levene's test for homogeneity of variances, scatter plots, and significance levels for interactions between the treatment and the outcome.

Data Analysis

Seven distinct research questions were considered in this study. Fifteen hypotheses were tested. The methodology utilized to address those questions is exposited upon below. Table 1 provides a summary of the variables and the statistical analyses for each research question. The analyses included Pearson's chi squares tests, logistic regression, multiple linear regression, independent samples t-tests, and Pearson's correlation coefficient.

Pearson Chi-Square

Pearson Chi-Square testing was utilized in the analysis of research questions one, "To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement tool, and those who enter a mathematics course above or below their recommended course?", two, "To what extent does student performance vary between those who enter a recommended English composition course, based on the EP placement tool, and those who enter an English composition course above or

below their recommended course?", and seven, "What differences exist in remedial course and subsequent courses grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?"

As described by Fields (2013), the Pearson Chi-Square test is best suited to address these questions as the variables in question include categorical data. The test evaluates how likely any observed difference between sets of data arose by chance. Using the test the null hypothesis, the test states the frequency of distribution of variable events in a particular sample is consistent with a theoretical distribution. To calculate the fit, or total error, of a model, the squared differences between the observed values of the outcome and the predicted values from the model are summed.

When using categorical variables, as in the Pearson Chi-Square test, there is a slight variation. The deviation is standardized for each observation by dividing the model scores as well. When all of the standardized deviations are added together, the resulting statistics is Pearson's chi-square (x^2) as demonstrated in equation 1.

$$X^2 = \sum \frac{(observed_{ij} - model_{ij})*2}{model_{ij}} \qquad (1)$$

Logistic Regression

Logistic regression was utilized to address research questions three, "To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?," four, "To what extent is high school grade point average predictive of persistence and time to graduation?," five, "To what extent are entrance exam scores predictive of persistence and time to graduation?," and six, "To what extent are

mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?"

Logistic regression assumes that each predictor has a linear relationship with the outcome variable in which a categorical variable is labeled in the binary, for example, as (0) remedial and (1) non-remedial. In a simple linear regression, Y is calculated as demonstrated in equation 2. In a logistic regression, the probability of Y occurring given known values of X_1 is predicted, instead of predicting the value of a variable Y from the predictor variable X (or serval Xs) (Fields, 2013), as shown in equation 3.

$$y_i = b_0 + b_1X_{1i} + \varepsilon_i \qquad (2)$$

$$P(1) = \frac{1}{1+ e^{-(b_0+ b_1x_{1i})}} \qquad (3)$$

Multiple Linear Regression

Multiple Linear Regression was utilized to address research question six, "To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?" The test attempts to model the relationship between multiple independent variables and a dependent variable by fitting a linear equation to observed data. Each value of the independent variable is associated with a value of the dependent variable.

In a simple linear regression model, the respond variable is related to a single independent variable. The equation representing this is shown in equation 4, used as the foundation for the equation for multiple regression, in which the dependent variable is related to more than one independent variables is expressed as demonstrated in equation 5 (Fields, 2013).

$$E(Y|X) = \alpha + \beta X \qquad (4)$$

$$E(Y|X) = \alpha + \beta 1X1 + \cdot \cdot \cdot + \beta pXp \qquad (5)$$

Independent Samples T-Tests

To address research questions three, "To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?" independent samples t-tests were run. An independent samples t-test allows a researcher to compare whether two groups have different mean values (Steinberg, 2008).

Pearson's Correlation Coefficient

Finally, research questions four, "To what extent is high school grade point average predictive of persistence and time to graduation?," and five, "To what extent are entrance exam scores predictive of persistence and time to graduation?" utilize Pearson's correlation coefficient. This test is a measure of linear correlation between one dependent variable and one independent variable (Steinberg, 2008).

The following table outlines the variables and method of statistical analysis used to address each research question.

Table 1: Research Questions, Variables, and Methods of Statistical Analysis

Research Question	Variables	Data Source	Statistical Analysis
1. To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement tool, and those who enter a mathematics course above or below their recommended course?	Independent: mathematics placement score, course enrolled Dependent: student grade in first course, student grade in subsequent course	MSSPU IR provided placement level, course enrollments and grade outcomes	Pearson's Chi-Square

Research Question	Variables	Data Source	Statistical Analysis
2. To what extent does student performance vary between those who enter a recommended English composition course, based on the EP placement tool, and those who enter an English composition course above or below their recommended course?	Independent: English composition placement score, course enrolled in Dependent: student grade in first course, student grade in subsequent course	MSSPU IR provided placement level, course enrollments and grade outcomes	Pearson's Chi-Square
3. To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?	Independent: placement score Dependent: semesters to graduation, persistence to graduation	MSSPU IR provided placement level, graduation records, terms to graduation	Logistic regression, independent samples t-test
4. To what extent is high school grade point average predictive of persistence and time to graduation?	Independent: high school GPA Dependent: semesters to graduation, persistence to graduation	MSSPU IR provided high school GPA, graduation records, terms to graduation	Logistic regression, Pearson's correlation coefficient
5. To what extent are entrance exam scores predictive of persistence and time to graduation?	Independent: entrance exam score Dependent: semesters to graduation, persistence to graduation	MSSPU IR provided entrance exam score, graduation records, terms to graduation	Logistic regression, Pearson's correlation coefficient
6. To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?	Independent: placement score, high school GPA, entrance exam score Dependent: semesters to graduation, persistence to graduation	MSSPU IR provided entrance exam score, HS GPA, placement level, graduation records, terms to graduation	Logistic regression, multiple linear regression

Research Question	Variables	Data Source	Statistical Analysis
7. What differences exist in grades in remedial course and subsequent course grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?	Independent: enrollment in Free Remedial Summer Program Dependent: grade in remedial course, grade in subsequent course, persistence to graduation	MSSPU IR provided program enrollment, course outcomes, and graduation records	Pearson's Chi-Square

Summary

This *ex post facto* study utilized quantitative methodologies in order to evaluate the relationships between placement in remedial courses and performance, and persistence to graduation using archival data. The study utilized evaluative research, also referred to as program evaluation or outcome assessment (Babbie, 2013). Dependent variables included grades in remedial and subsequent courses, persistence, and time graduation. Independent variables include placement into developmental mathematics and English composition courses, high school grade point average, entrance exam scores, and participation in the Free Remedial Summer Program. Prior to completing the statistical tests, assumptions were tested using summary statistics, Levene's test for homogeneity of variances, scatter plots, and significance levels for interactions between the treatment and the outcome.

To explore the effectiveness of the placement tools, a Pearson Chi square was utilized to compare the performance (grade) of students who enroll in the course to which they placed against those who enroll in a course a level below their placement; similarly, the population of those who enroll in the course to which they placed will be compared to those who enroll in a

course a level above their placement. This was completed for the mathematics placement exam and English composition placement exam.

Pearson Chi Square tests were also utilized to explore the relationship between mathematics and English composition placement exam scores and persistence to graduation while independent samples t-tests were utilized to explore the same independent variables on time to graduation. Logistic regressions were utilized to explore the relationship between all three independent variables, placement, high school grade point average, and entrance exam score, on persistence to graduation.

Pearson's correlation coefficient testing was utilized to determine the relationships, if any, between placement and time to graduation, high school grade point average and time to graduation, and entrance exam scores on time to graduation. A multiple linear regression was run to determine the covariate impacts of mathematics and English composition placement, high school grade point average, and entrance exam scores on time to graduation.

A Pearson Chi Square was utilized to compare the differences, if any, between student outcomes who complete the Free Summer Remedial Program and those who do not. Using the remedial course grade for both groups, the test was conducted with participation in the program as the independent variable (participation or non-participation) and performance in the remedial course and subsequent course serving as the dependent variables; a relationship between persistence to graduation and participation in the Free Remedial Summer Program was also explored using this test.

CHAPTER 4: FINDINGS

Introduction

The primary purpose of this study was to explore the effectiveness of MSSPU's internally developed mathematics and English composition placement exams and the Free Summer Remedial Program. The study also considered the predictive value of mathematics and English composition placement exam outcomes, high school grade point averages, entrance exam scores, and a combination thereof on persistence and graduation. Contained within this chapter are descriptions of the statistics methods outlined in Chapter 3 and the findings from these analyses. These findings will lead to the conclusions and recommendations for the final chapter, Chapter Five, of this study.

Research Questions and Hypotheses

The relationships between the constructs investigated in the study are given below in the following research questions and null hypotheses:

1. To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement exam, and those who enter a mathematics course above or below their recommended course?

    Hypothesis 1. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course above their recommended course.

Hypothesis 2. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course below their recommended course.

2. To what extent does student performance vary between those who enter a recommended English composition course, based on the English composition placement exam, and those who enter an English composition course above or below their recommended course?

Hypothesis 3. No difference exists in student performance between those who enter a recommended English composition course and those who enter an English composition course above their recommended course.

Hypothesis 4. No difference exists in student performance between those who enter a recommended English composition course and those who enter a course below their recommended English composition course.

3. To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?

Hypothesis 5. There is no relationship between mathematics placement exam scores and persistence to graduation.

Hypothesis 6. There is no relationship between mathematics placement exam scores and time to graduation.

Hypothesis 7. There is no relationship between English composition placement exam scores and persistence to graduation.

Hypothesis 8. There is no relationship between English composition placement exam scores and time to graduation.

4. To what extent is high school grade point average predictive of persistence and time to graduation?

Hypothesis 9. There is no relationship between high school grade point average and persistence to graduation.

Hypothesis 10. There is no relationship between high school grade point average and time to graduation.

5. To what extent are entrance exam scores predictive of persistence and time to graduation?

Hypothesis 11. There is no relationship between entrance exam scores and persistence to graduation.

Hypothesis 12. There is no relationship between entrance exam scores and time to graduation.

6. To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?

Hypothesis 13. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and persistence to graduation.

Hypothesis 14. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and time to graduation.

7. What differences exist in remedial course and subsequent courses grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?

Hypothesis 15. No difference exists between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework.

Analysis of Findings

Research Question 1

To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement tool, and those who enter a mathematics course above or below their recommended course?

Hypothesis 1. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course above their recommended course.

Hypothesis 2. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course below their recommended course.

To answer this question, a Pearson's Chi-Squared test was performed. The analysis explored the performance, labeled Grade Course 1, by the level enrolled (below, at, or above). A total of 8,589 students completed the mathematics placement examination. Of these students, 2,324 had not registered at MSSPU for a mathematics course at the time of the study. Reasons for non-enrollment include completion of mathematics coursework at another institution, attrition, deferral, and postponing of mathematics course sequencing. Of the 6,265 students who completed the placement exam and enrolled in a mathematics course, 515 enrolled at a level

below their recommended placement, 4,178 enrolled at the level of their placement, and 1,384 students enrolled in a course above the level of their placement recommendation. Of the 8,588 students who completed the mathematics placement examination, 4,145 had completed a second mathematics course at the time of this study.

Table 2: *Level of Enrollment and Course Outcomes for First Mathematics Course – Pass/Fail*

			Pass/Fail		
			FAIL	PASS	Total
Level Enrolled	Below	Count	123	392	515
		Expected Count	143.8	371.1	515.0
		% within Level Enrolled	23.8%	76.1%	100.0%
	At	Count	1215	2963	4178
		Expected Count	1167.1	3011	4178.0
		% within Level Enrolled	29.1%	70.9%	100.0%
	Above	Count	357	1027	1384
		Expected Count	386.6	997.4	1384.0
		% within Level Enrolled	25.8%	74.2%	100.0%
Total		Count	1750	4515	6265
		Expected Count	1750	4515	6265.0
		% within Level Enrolled	28%	72.1%	100.0%

Table 3: *Level of Enrollment and Course Outcomes for Second Mathematics Course – Pass/Fail*

			Pass/Fail		
			FAIL	PASS	Total
Level Enrolled	Below	Count	145	219	364
		Expected Count	126.2	237.7	364
		% within Level Enrolled	39.8%	60.2%	100.0%
	At	Count	1006	1752	2758
		Expected Count	956.9	1801.2	2758
		% within Level Enrolled	36.5%	63.5%	100.0%
	Above	Count	196	657	903
		Expected Count	313.3	589.7	903
		% within Level Enrolled	27.3%	72.7%	100.0%
Total		Count	1438	2707	4145
		Expected Count	1438	2707	4145
		% within Level Enrolled	34.7%	65.4%	100.0%

Hypothesis 1

First Mathematics Course

The researcher determined there were no violations of assumptions. The results of the Pearson Chi-Square show X^2 (1) = 41.21, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in first mathematics course. However, Cramer's V is equal to .047, indicating a small relationship though this is likely due to the large sample size. Course outcomes vary by level of enrollment. Students who enroll at the level recommended by their placement exam are more likely to earn an F, W, AU, D, or C than those who enroll at a level above their recommended course.

The odds ratio is calculated to provide an additional analysis of the effect size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their first mathematics course were 1.18

times higher if they enrolled in a course above their recommended level of enrollment per their performance on the mathematics placement exam.

$$\text{Odds}_{\text{ passing enrolled above level}} = \frac{\text{number passed enrolled above level}}{\text{number failed enrolled above level}} = \frac{1027}{357} = 2.879$$

$$\text{Odds}_{\text{ passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{2963}{1215} = 2.439$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled above level}}{\text{Odds of passing enrolled at level}} = \frac{2{,}879}{2.439} = 1.180$$

Second Mathematics Course

The results of the Pearson Chi-Square show X^2 (1) = 81.21, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in second mathematics course. Again, Cramer's V is equal to .081, indicating a small relationship though this is likely due to the large sample size. Course outcomes vary by level of enrollment. Students who enroll at the level recommended by their placement exam are more likely to earn an F, W, AU, D, or C than those who enroll at a level above their recommended course.

The odds ratio is calculated to provide an additional analysis of the effect size. Based on the odds ratio, the odds of a student passing their second mathematics course were 1.926 times higher if they enrolled in a course above their recommended level of enrollment per their performance on the mathematics placement exam for their first course.

$$\text{Odds}_{\text{ passing enrolled above level}} = \frac{\text{number passed enrolled above level}}{\text{number failed enrolled above level}} = \frac{657}{196} = 3.352$$

$$\text{Odds}_{\text{ passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{1752}{1006} = 1.74$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled above level}}{\text{Odds of passing enrolled at level}} = \frac{3.352}{1.74} = 1.926$$

The researcher rejects the null hypothesis that no differences exist in performance between those students who enroll in a course at the recommended level and those who enroll in a course above the recommended level.

Hypothesis 2

First Mathematics Course

The researcher determined there were no violations of assumptions. The results of the Pearson Chi-Square show X^2 (1) = 41.21, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in course. Further, Cramer's V is equal to .047, indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment. Students who enroll at the level recommended by their placement exam are more likely to earn an F, W, AU, D, or C than those who enroll at a level below their recommended course.

The odds ratio is calculated to provide an additional analysis of the effect size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their first mathematics course were 1.307 times higher if they enrolled in a course below their recommended level of enrollment per their performance on the mathematics placement exam.

$$\text{Odds}_{\text{ passing enrolled above level}} = \frac{\text{number passed enrolled below level}}{\text{number failed enrolled below level}} = \frac{392}{123} = 3.187$$

$$\text{Odds}_{\text{ passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{2963}{1215} = 2.439$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled below level}}{\text{Odds of passing enrolled at level}} = \frac{3.187}{2.439} = 1.307$$

Second Mathematics Course

The results of the Pearson Chi-Square show X^2 (1) = 81.21, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in second mathematics course. Further, Cramer's V is equal to .081, indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment. Students who enroll at the

level recommended by their placement exam are more likely to earn an F, W, AU, D, or C than those who enroll at a level above their recommended course.

The odds ratio is calculated to provide an additional analysis of the effect size. Based on the odds ratio, the odds of a student passing their second mathematics course were .869 times higher if they enrolled in a course below their recommended level of enrollment per their performance on the mathematics placement exam for their first course.

$$\text{Odds}_{\text{ passing enrolled above level}} = \frac{\text{number passed enrolled below level}}{\text{number failed enrolled below level}} = \frac{219}{145} = 1.51$$

$$\text{Odds}_{\text{ passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{1752}{1006} = 1.74$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled below level}}{\text{Odds of passing enrolled at level}} = \frac{1.51}{1.74} = .869$$

The researcher rejects the null hypothesis that no differences exist in performance between those students who enroll in a course at the recommended level and those who enroll in a course below the recommended level.

Research Question 2

To what extent does student performance vary between those who enter a recommended English composition course, based on the EP placement tool, and those who enter an English composition course above or below their recommended course?

Hypothesis 3. No difference exists in student performance between those who enter a recommended English composition course and those who enter an English composition course above their recommended course.

Hypothesis 4. No difference exists in student performance between those who enter a recommended English composition course and those who enter a course below their recommended English composition course.

To answer this question, a Pearson's Chi-Squared test was performed. The analysis explored the performance, labeled Grade in Course 1, by the level enrolled (below, at, or above). A total of 4,876 students completed the English placement examination. Of these students, 1,741 had not registered at MSSPU for an English composition course at the time of the study. Reasons for non-enrollment include completion of mathematics coursework at another institution, transfer credit and/or course waivers for Advanced Placement or International Baccalaureate exams, CLEP exams, attrition, deferral, and postponing of English composition course sequencing. Of the 3,135 students who completed the placement exam and enrolled in an English composition course, 31 enrolled at a level below their recommended placement, 2,601 enrolled at the level of their placement, and 503 students enrolled in a course above the level of their placement recommendation. Of the 4,876 students who completed the English composition placement examination, 1,885 had completed a second English composition course at the time of this study.

Table 4: *Level of Enrollment and Course Outcomes for First English Composition Course*

			Pass/Fail in Course 1		
			FAIL	PASS	Total
Level of Enrollment	Below	Count	21	10	31
		Expected Count	5.0	25.9	31.0
		% within Level of Enrollment	67.7%	32.3%	100.0%
	At	Count	441	2160	2617
		Expected Count	419.4	2184.3	2617.0
		% within Level of Enrollment	16.9%	82.5%	100.0%
	Above	Count	43	460	503
		Expected Count	80.6	419.8	503.0
		% within Level of Enrollment	8.5%	91.5%	100.0%
Total		Count	505	2630	3151
		Expected Count	505.0	2630.0	3151.0
		% within Level of Enrollment	16.0%	83.5%	100.0%

Table 5: Level of Enrollment and Course Outcomes for Second English Composition Course

			Pass/Fail in Course 2		
			FAIL	PASS	Total
Level of Enrollment	Below	Count	11	10	31
		Expected Count	3.0	15.5	31.0
		% within Level of Enrollment	35.5%	32.3%	100.0%
	At	Count	270	1297	2617
		Expected Count	254.1	1311.4	2617.0
		% within Level of Enrollment	10.3%	49.6%	100.0%
	Above	Count	25	272	503
		Expected Count	48.8	252.1	503.0
		% within Level of Enrollment	5.0%	54.1%	100.0%
Total		Count	306	1579	3151
		Expected Count	306.0	1579.0	3151.0
		% within Level of Enrollment	9.7%	50.1%	100.0%

Hypothesis 3

First Course

The researcher determined there were no violations of assumptions. The results of the Pearson Chi-Square show X^2 (1) = 311.775, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in first mathematics course. Further, Cramer's V is equal to .223, indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment.

The odds ratio is calculated to provide an additional analysis of the effect size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. When a student enrolls in a course above their recommended level, their odds of passing their first English composition course is 2.184 times higher than if they were to enroll in a course at their level of recommendation.

$$\text{Odds}_{\text{passing enrolled above level}} = \frac{\text{number passed enrolled above level}}{\text{number failed enrolled above level}} = \frac{460}{43} = 10.698$$

$$\text{Odds}_{\text{passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{2160}{441} = 4.898$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled above level}}{\text{Odds of passing enrolled at level}} = \frac{10.698}{4.898} = 2.184$$

Second Course

The researcher determined there were no violations of assumptions. The results of the Pearson Chi-Square show X^2 (1) = 38.104, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in first mathematics course. Further, Cramer's V is equal to .223, indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment.

To further examine the effect size, the odds ratio was calculated. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the

odds ratio, the odds of a student passing their second English composition course were 2.265 times higher if their first course enrolled was above their recommended level of enrollment per their performance on the English Composition placement exam.

$$\text{Odds}_{\text{ passing enrolled above level}} = \frac{\text{number passed enrolled above level}}{\text{number failed enrolled above level}} = \frac{272}{24} = 10.88$$

$$\text{Odds}_{\text{ passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{1297}{270} = 4.804$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled above level}}{\text{Odds of passing enrolled at level}} = \frac{10.88}{4.804} = 2.265$$

The researcher rejects the null hypothesis that no differences exist in performance between those students who enroll in a course at the recommended level and those who enroll in a course above the recommended level.

Hypothesis 4

First Course

The results of the Pearson Chi-Square show X^2 (1) = 311.775, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in first mathematics course. Further, Cramer's V is equal to .169, indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment.

The odds ratio was calculated to further analyze the effect size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their first English composition course were 10.299 times higher if they enrolled in a course at their recommended level of enrollment per their performance on the English Composition placement exam rather than in a course below the recommended level.

$$\text{Odds}_{\text{passing enrolled above level}} = \frac{\text{number passed enrolled below level}}{\text{number failed enrolled below level}} = \frac{10}{21} = .476$$

$$\text{Odds}_{\text{passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{2160}{441} = 4.898$$

$$\text{Odds}_{\text{passing enrolled above level}} = \frac{\text{number passed enrolled below level}}{\text{number failed enrolled below level}} = \frac{10}{21} = .476$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled at level}}{\text{Odds of passing enrolled below level}} = \frac{4.898}{.476} = 10.299$$

Second Course

The researcher determined there were no violations of assumptions. The results of the Pearson Chi-Square show X^2 (1) = 38.104, $p < .001$, indicating there is a statistically significant association between level of enrollment and grade in first mathematics course. Cramer's V is equal to .158 indicating a small association between variables though this is likely due to the large sample size. Course outcomes vary by level of enrollment.

The odds ratio was calculate to further examine the effect size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their second English composition course were 5.285 times higher if their first course enrolled was at their recommended level of enrollment per their performance on the English Composition placement exam versus below.

$$\text{Odds}_{\text{passing enrolled at level}} = \frac{\text{number passed enrolled at level}}{\text{number failed enrolled at level}} = \frac{1297}{270} = 4.804$$

$$\text{Odds}_{\text{passing enrolled above level}} = \frac{\text{number passed enrolled below level}}{\text{number failed enrolled below level}} = \frac{10}{11} = .909$$

$$\text{Odds ratio} = \frac{\text{Odds passing enrolled at level}}{\text{Odds of passing enrolled above level}} = \frac{4.804}{.909} = 5.285$$

The researcher rejects the null hypothesis that no differences exist in performance between those students who enroll in a course at the recommended level and those who enroll in a course below the recommended level.

Research Question 3

To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?

Hypothesis 5. There is no relationship between mathematics placement exam scores and persistence to graduation.

Hypothesis 6. There is no relationship between mathematics placement exam scores and time to graduation.

Hypothesis 7. There is no relationship between English composition placement exam scores and persistence to graduation.

Hypothesis 8. There is no relationship between English composition placement exam scores and time to graduation.

Two statistical tests were utilized to address this research question. Active students were removed from the population sample. The first explored the predictive value of placement exam performance on time to graduation. For this analysis, a Pearson's Chi Square test was utilized. The dependent variable was persistence to graduation. The independent variable placement scores at a remedial or non-remedial level, with separate examinations of mathematics and English composition placement outcomes. This second analysis examined the predictive value of the independent variables on persistence and time graduation. The analysis utilized independent samples t-test.

Hypothesis 5

For this analysis, active students were removed from the population sample. Only those students who completed the mathematics placement examination and either graduated or

dropped out, referred to as "attrited," are included in this sample. A significant association between the mathematics courses recommended by the mathematics placement exam and persistence to graduation exists X^2 (1) = 107.177, $p < .001$ as indicated by the results of the Pearson's Chi Square. Cramer's V is equal to .149, indicating a small association between variables though this is likely due to the large sample size. An odds ratio suggests the odds of graduating are 1.885 times higher if a student places in to a non-remedial mathematics course rather than a remedial mathematics course.

$$\text{Odds}_{\text{graduating placed non-remedial}} = \frac{\text{number graduated placed non-remedial}}{\text{number attrited placed non-remedial}} = \frac{820}{950} = .863$$

$$\text{Odds}_{\text{graduating placed remedial}} = \frac{\text{number graduated placed remedial}}{\text{number attrited placed remedial}} = \frac{966}{2108} = .458$$

$$\text{Odds ratio} = \frac{\text{Odds graduating placed non-remedial}}{\text{Odds graduating placed remedial}} = \frac{.863}{.458} = 1.885$$

The researcher rejects the null hypothesis that no relationship exists between mathematics placement exam scores and persistence to graduation.

Table 6: Mathematics Placement Level and Persistence Status

			Status		
			ATTRIT	GRAD	Total
Placement Level	Remedial	Count	2108	966	3074
		Expected Count	1940.6	1133.4	3074.0
		% within Placement Level	68.6%	31.4%	100.0%
	Non-Remedial	Count	950	820	1770
		Expected Count	1117.4	652.6	1770.0
		% within Placement Level	53.7%	46.3%	100.0%
Total		Count	3058	1786	4844
		Expected Count	3058.0	1786.0	4844.0
		% within Placement Level	63.1%	36.9%	100.0%

Hypothesis 6

This analysis utilized an independent samples t-test to examine the relationship between placement level on the mathematics placement exam and number of terms to graduation. The sample includes only those students who completed the mathematics placement examination and subsequently graduated, with a total sample size of 1786.

The Levene's Test for Equality of Variances tested the null hypothesis that variances were equal; the researcher rejected this null hypothesis as the significance level was equal to .025. As $p < .05$, unequal variances exist and the assumption of homogeneity of variances was violated. The researcher corrected for this violation by not using the pooled estimate for the error term for the t-statistics, also using the Welch-Satterhwaite method making adjustments to the degrees of freedom.

On average, students who place at a non-remedial level on their mathematics placement exam graduate having enrolled in more terms (M=7.58, SE=1.317), than those who placed at a remedial level (M=7.45, SE=1.471). This difference, -.131, was significant $t(1779.941) = -1.989$, $p = .047$. Cohen's d was calculated with $d = -.09$, representing a small effect size. The research rejects the null hypothesis that there is no relationship between mathematics placement exam scores and time to graduation.

Hypothesis 7

For this analysis, active students were removed from the population sample. Only those students who completed the English composition placement examination and either graduated or dropped out, referred to as "attrited," are included in this sample. A significant association between the mathematics courses recommended by the mathematics placement exam and

persistence to graduation exists X^2 (1) = 17.2, $p < .001$ as indicated by the results of the Pearson's Chi Square. An odds ratio suggests the odds of graduating are 1.742 times higher if a student places in to a non-remedial English composition course rather than places in to a remedial English composition course.

$$\text{Odds}_{\text{graduating placed non-remedial}} = \frac{\text{number graduated placed non-remedial}}{\text{number attrited placed non-remedial}} = \frac{260}{839} = .31$$

$$\text{Odds}_{\text{graduating placed remedial}} = \frac{\text{number graduated placed remedial}}{\text{number attrited placed remedial}} = \frac{91}{510} = .178$$

$$\text{Odds ratio} = \frac{\text{Odds graduating placed non-remedial}}{\text{Odds graduating placed remedial}} = \frac{.31}{.178} = 1.742$$

The research rejects the null hypothesis that no relationship exists between English composition placement exam scores and persistence to graduation.

Table 7: *English Composition Placement Level and Persistence Status*

			Persistence Status		
			ATTRIT	GRAD	Total
Placement Level	Remedial	Count	510	91	601
		Expected Count	476.9	124.1	601.0
		% within Placement Level	84.9%	15.1%	100.0%
	Non-Remedial	Count	839	260	1099
		Expected Count	872.1	226.9	1099.0
		% within Placement Level	76.3%	23.7%	100.0%
Total		Count	1349	351	1700
		Expected Count	1349.0	351.0	1700.0
		% within Placement Level	79.4%	20.6%	100.0%

Hypothesis 8

This analysis utilized an independent samples t-test to examine the relationship between placement level on the English composition placement exam and number of terms to graduation. The sample includes only those students who completed the English composition placement examination and subsequently graduated, with a total sample size of 351.

The Levene's Test for Equality of Variances tested the null hypothesis that variances were equal; the researcher accepted this null hypothesis as p = .281. On average, students who place at a non-remedial level on their English composition placement exam graduate having enrolled in more terms (M=6.88, SE=.073), than those who placed at a remedial level (M=6.78, SE=.127). This difference, -.097, was not significant $t(349) = -.672$, p = .502. Cohen's d was calculated with $d = .085$, representing a small effect size. The research does not reject the null hypothesis that there is no relationship between English composition placement exam scores and times to graduation.

Research Question 4

To what extent is high school grade point average predictive of persistence and time graduation?

Hypothesis 9. There is no relationship between high school grade point average and persistence to graduation?

Hypothesis 10. There is no relationship between high school grade point average and time to graduation?

Hypothesis 9

A logistic regression analysis was conducted to predict persistence to graduation using high school grade point average as the predictor. A test of the full model against a constant only model was statistically significant, indicating that the predictor reliably distinguished between graduates and non-

graduates X^2 (8) = 143.111, $p < .001$. Nagelkerke's R of .0547 indicated a moderately weak relationship between prediction and grouping. Prediction success overall was 88.2% for persistence to graduation. The Wald criterion demonstrated that high school grade point average alone made a significant contribution to prediction, $I = .001$. Exp(B) value indicates that when high school grade point average is raised by one unit the odds ratio is .82 times as large and therefore student are .82 more times likely to persist to graduation. The research rejects the null hypothesis that there is no relationship between high school grade point average and persistence to graduation.

Hypothesis 10

To examine the relationship between high school grade point average and time to graduation, a Pearson's correlation coefficient was calculated. Normal distribution was tested. The findings were statistically significant, $p = .03$; However, there was a negligible, negative correlation between the two variables, $r = -.05$, $n = 1850$. The researcher rejects the null hypothesis that no relationship exists between high school grade point average and time to graduation.

Research Question 5

To what extent are entrance exam scores predictive of persistence and graduation?

Hypothesis 11. There is no relationship between entrance exam scores and persistence to graduation.

Hypothesis 12. There is no relationship between entrance exam scores and time to graduation.

Hypothesis 11

A logistic regression analysis was conducted to predict persistence to graduation using college entrance exam scores composites as the predictor. A test of the full model against a constant only model

was not statistically significant, indicating that the predictor did not reliably distinguish between graduates and non-graduates X^2 (8) = 11.236, p = .189. Nagelkerke's R of .0316 indicated a weak relationship between prediction and grouping. Prediction success overall was 87.7% for persistence to graduation. The Wald criterion demonstrated that college entrance exam scores alone did not make a significant contribution to prediction, I = 3.653. Exp(B) value indicates that when college entrance exams are raised by one unit the odds ratio is 1.000 times as large and therefore student are no more likely to persist to graduation. The research accepts the null hypothesis that no relationship exists between entrance exam scores and persistence to graduation.

Hypothesis 12

To examine the relationship between entrance exam scores and time to graduation, a Pearson's correlation coefficient was calculated. Normal distribution was tested. These tests were run independently for each format of the entrance exam, both SAT and ACT. Only those students who completed the SAT entrance exam or ACT entrance exam and graduated were included in this sample.

For the SAT, the findings were statistically significant, $p < .001$; however, there was a negligible, negative correlation between the two variables, r = -.166, n = 857. For the ACT, the findings were statistically significant, p = .010; however, there was a negligible, negative correlation between the two variables, r = -.087, n = 869. The research rejects the null hypothesis that no relationship exists between entrance exam scores and persistence to graduation.

Research Question 6

To what extent are mathematics and English composition placement exam scores, high school grade point averages, and entrance exam scores combined predictive of persistence and graduation?

Hypothesis 13. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and persistence to graduation.

Hypothesis 14. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and time to graduation.

Hypothesis 13

A logistic regression analysis was conducted to predict persistence to graduation using math placement exam scores, English composition placement exam scores, high school grade point averages, and college entrance exam scores as the predictors. A test of the full model against a constant only model was statistically significant, indicating that the predictors reliably distinguished between graduates and non-graduates X^2 (4) = 74.358, $p < .001$. Nagelkerke's R of .32 indicated a moderate relationship between prediction and grouping. Prediction success overall was 97.3% for persistence to graduation. The Wald criterion demonstrated that math placement exam scores I = 57.775, college entrance exam scores I = 4.056, and high school grade point averages I = 11.988, made significant contributions to prediction. The research rejects the null hypothesis that no relationship exists between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and persistence to graduation.

Hypothesis 14

A multiple linear regression was calculated to predict time to graduation based on mathematics placement exam score, English composition placement exam score, high school grade point average, and entrance exam scores. A significant regression equation was found ($F(5, 1844) = 25.595$, $p < .001$), with an R^2 of 76.2%. The calculation predicted time to

graduation is equal to 7.332 + .008 (mathematics placement score) + .001 (English composition placement score) + -.095 (high school grade point average) + -.008 (entrance exam score), where English composition and mathematics placement is coded as 0 = remedial placement, 1 = non-remedial placement, high school grade point average is measured on a 0-6 point scale, and entrance exam score is measured on a 0-36 with SAT scores converted to ACT scoring using the composite table Concordance between ACT Composite Score and Sum of SAT Critical Reading and Mathematics scores published by ACT (ACT, 2015).

Time to graduation increased .008 terms for indicators of remedial mathematics placement and .001 for indicators of remedial mathematics placement and decreased -.095 terms for higher high school grade point averages and -.008 for higher entrance exam scores. Mathematics placement ($p < .001$), high school grade point average ($p = .012$), entrance exam scores ($p < .001$) were significant predictors of time to graduation. English composition placement ($p=.576$) was not a significant predictor of time to graduation. The research rejects the null hypothesis that no relationship exists between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and time to graduation.

Research Question 7

What differences exist in remedial course and subsequent course outcomes and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not participate in the Free Remedial Summer Program to complete remedial coursework?

Hypothesis 15. No difference exists between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework.

Hypothesis 15

To address this question, a Pearson's Chi Squared test was completed. The independent variable in this analysis was participation or non-participation in the Free Remedial Summer Program. Dependent variables included the student's grade in the remedial course, grade in subsequent course, and persistence to graduation. The Free Remedial Summer Program was only offered to students requiring remedial mathematics so first and subsequent course grades in mathematics only were analyzed.

First Mathematics Course

The results of the Pearson Chi-Square show X^2 (1) = 41.134, $p < .001$, indicating there is a statistically significant association between participation in the Free Remedial Summer Program and grade in first mathematics course. Cramer's V is equal to .081, indicating a small relationship though this is likely due to the large sample size. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their first mathematics course, the remedial mathematics, were 2.065 times higher they did not enroll in the Free Remedial Summer Program.

$$\text{Odds}_{\text{passing not enrolled in Free Remedial Summer Program}} = \frac{\text{number passed not enrolled}}{\text{number failed not enrolled}} = \frac{4330}{1608} = 2.693$$

$$\text{Odds}_{\text{passing enrolled in Free Remedial Summer Program}} = \frac{\text{number passed enrolled}}{\text{number failed enrolled}} = \frac{185}{142} = 1.303$$

$$\text{Odds ratio} = \frac{\text{Odds passing not enrolled in Free Remedial Summer Program}}{\text{Odds of passing enrolled in Free Remedial Summer Program}} = \frac{2.693}{1.303} = 2.065$$

The research rejects the null hypothesis that no differences exist between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework, when considering grade outcomes in first mathematics course.

Table 8: Free Remedial Summer Program Enrollment and Grades in First Mathematics Course

			Grade in First Course		
			FAIL	PASS	Total
Free Remedial Summer Program Enrollment	N	Count	1608	4330	5938
		Expected Count	1658.7	4279.3	5938.0
		% within Free Remedial Summer Program Enrollment	27.1%	72.9%	100.0%
	Y	Count	142	185	327
		Expected Count	91.3	235.7	327.0
		% within Free Remedial Summer Program Enrollment	43.4%	56.6%	100.0%
Total		Count	1750	4515	6265
		Expected Count	1750.0	4515.0	6265.0
		% within Free Remedial Summer Program Enrollment	27.9%	72.1%	100.0%

Subsequent Mathematics Course

The results of the Pearson Chi-Square show X^2 (1) = 15.706, $p < .001$, indicating there is a statistically significant association between participation in the Free Remedial Summer Program and grade in subsequent mathematics course. At MSSPU, a grade of F, W, AU, or D is considered failing. Grades of A, B, or C are considered passing. Based on the odds ratio, the odds of a student passing their subsequent mathematics course, the remedial mathematics, were 1.706 times higher they did not enroll in the Free Remedial Summer Program.

$$\text{Odds}_{\text{ passing not enrolled in Free Remedial Summer Program}} = \frac{\text{number passed not enrolled}}{\text{number failed not enrolled}} = \frac{2584}{1330} = 1.943$$

$$\text{Odds}_{\text{ passing enrolled in Free Remedial Summer Program}} = \frac{\text{number passed enrolled}}{\text{number failed enrolled}} = \frac{123}{108} = 1.139$$

$$\text{Odds ratio} = \frac{\text{Odds passing not enrolled in Free Remedial Summer Program}}{\text{Odds of passing enrolled in Free Remedial Summer Program}} = \frac{1.943}{1.139} = 1.706$$

The research rejects the null hypothesis that no differences exist between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework, when considering grade outcomes in the student's second mathematics course.

Table 9: Free Remedial Summer Program Enrollment and Grades in Second Mathematics Course

			Grade in Second Course		
			FAIL	PASS	Total
Free Remedial Summer Program Enrollment	N	Count	1330	2584	3914
		Expected Count	1357.9	2556.1	3914.0
		% within Free Remedial Summer Program Enrollment	34.0%	66.0%	100.0%
	Y	Count	108	123	231
		Expected Count	80.1	150.9	231.0
		% within Free Remedial Summer Program Enrollment	46.8%	53.2%	100.0%
Total		Count	1438	2707	4145
		Expected Count	1438.0	2707.0	4145.0
		% within Free Remedial Summer Program Enrollment	34.7%	65.3%	100.0%

Persistence to Graduation

To determine the relationship between enrollment in the Free Remedial Summer Program and persistence to graduation, a Pearson Chi-Square was completed. The sample included only those students who completed the mathematics placement exam and either graduated or dropped

out, referred to as "attrited," excluding active students. The results of the Pearson Chi-Square show X^2 (1) = 012, p = .913, indicating there is not a statistically significant association between participation in the Free Remedial Summer Program and persistence to graduation. Based on the odds ratio, the odds of a student persisting to graduation were .987 times higher when they did not enroll in the Free Remedial Summer Program.

$$\text{Odds}_{\text{persisting not enrolled in Free Remedial Summer Program}} = \frac{\text{number persisted not enrolled}}{\text{number attrited not enrolled}} = \frac{1739}{3030} = .574$$

$$\text{Odds}_{\text{persisting enrolled in Free Remedial Summer Program}} = \frac{\text{number persisted enrolled}}{\text{number attrited enrolled}} = \frac{111}{196} = .566$$

$$\text{Odds ratio} = \frac{\text{Odds persisting not enrolled in Free Remedial Summer Program}}{\text{Odds of persisting enrolled in Free Remedial Summer Program}} = \frac{.574}{.566} = .987$$

The research accepts the null hypothesis that no differences exist between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework, when considering persistence to graduation as an outcome.

Table 10: Free Remedial Summer Program Enrollment and Persistence to Graduation

			Enrollment Status		
			ATTRIT	GRAD	Total
Enrollment in Free Remedial Summer Program	N	Count	3030	1739	4769
		Expected Count	3030.9	1738.1	4769.0
		% within Enrollment in Free Remedial Summer Program	63.5%	36.5%	100.0%
	Y	Count	196	111	307
		Expected Count	195.1	111.9	307.0
		% within Enrollment in Free Remedial Summer Program	63.8%	36.2%	100.0%
Total		Count	3226	1850	5076
		Expected Count	3226.0	1850.0	5076.0
		% within Enrollment in Free Remedial Summer Program	63.6%	36.4%	100.0%

Summary

This chapter provided an in-depth description of the approaches to examine the stated research questions and hypothesis including the statistical analysis results and findings for each. The following table, **Table 11**, outlines the results and findings of those analyses. The next chapter, chapter 5, will present conclusions and recommendations based on these findings.

Table 11: Summary of Findings

Research Question/Hypothesis	Statistical Analysis	Results
Research Question 1. To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement tool, and those who enter a mathematics course above or below their recommended course?		
Hypothesis 1. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course above their recommended course.	Pearson's Chi-square	Reject the null hypothesis, $p < .001$
Hypothesis 2. No difference exists in student performance between those who enter a recommended mathematics course and those who enter a mathematics course below their recommended course.	Pearson's Chi-square	Reject the null hypothesis, $p < .001$
Research Question 2. To what extent does student performance vary between those who enter a recommended English		
Hypothesis 3. No difference exists in student performance between those who enter a recommended English composition course and those who enter an English composition course above their recommended course.	Pearson's Chi-Square	Reject the null hypothesis, $p < .001$
Hypothesis 4. No difference exists in student performance between those who enter a recommended English composition course and those who enter a course below their recommended English composition course.	Pearson's Chi-Square	Reject the null hypothesis, $p < .001$
3. To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?		

Research Question/Hypothesis	Statistical Analysis	Results
Hypothesis 5. There is no relationship between mathematics placement exam scores and persistence to graduation.	Pearson's Chi-Square	Reject the null hypothesis, $p < .001$
Hypothesis 6. There is no relationship between mathematics placement exam scores and time to graduation.	Independent samples t-test	Reject the null hypothesis, $P = .047$
Hypothesis 7. There is no relationship between English composition placement exam scores and persistence to graduation.	Pearson's Chi-Square	Reject the null hypothesis, $p < .001$
Hypothesis 8. There is no relationship between English composition placement exam scores and time to graduation.	Independent samples t-test	Fail to reject the null hypothesis, $p = .502$
4. To what extent is high school grade point average predictive of persistence and time to graduation?		
Hypothesis 9. There is no relationship between high school grade point average and persistence to graduation.	Logistic regression	Reject the null hypothesis, $p < .001$
Hypothesis 10. There is no relationship between high school grade point average and time to graduation.	Pearson's correlation coefficient	Reject the null hypothesis, $p = .03$
5. To what extent are entrance exam scores predictive of persistence and time to graduation?		
Hypothesis 11. There is no relationship between entrance exam scores and persistence to graduation.	Logistic regression	Fail to reject the null hypothesis, $p = .189$

Research Question/Hypothesis	Statistical Analysis	Results
Hypothesis 12. There is no relationship between entrance exam scores and time to graduation.	Pearson's correlation coefficient	Reject the null hypothesis, $p < .001$ & $p = .01$
6. To what extent are mathematics and English composition placement exams, high school grade point average, entrance exam scores combined predictive of persistence and time to graduation?		
Hypothesis 13. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and persistence to graduation.	Logistic regression	Reject the null hypothesis, $p < .001$
Hypothesis 14. There is no relationship between mathematics and English composition placement exam score, high school grade point averages, and entrance exam scores and time to graduation.	Multiple linear regression	Reject the null hypothesis, $p < .001$
7. What differences exist in remedial course and subsequent courses grades and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not?		
Hypothesis 15. No difference exists between outcomes for students who complete the Free Remedial Summer Program and those who do not participate in the Free Remedial Summer Program to complete remedial coursework	Pearson Chi-square	Reject the null hypothesis, $p < .001$ (first and subsequent course); Fail to reject the null hypothesis, $p = .913$ (persistence)

CHAPTER 5: CONCLUSIONS AND RECOMMENDATOINS

Introduction

The primary purpose of this study was to examine the research questions previously outlined related to the effectiveness of MSSPU's internally developed mathematics and English placement tools, the predictive value the placement exams as well as other factors including high school grade point average and entrance exam score, and finally, the impacts of participation in the Free Remedial Summer Program on student outcomes. The previous chapters provided an introduction of the study, a review of the literature, outlined the methodology utilized, and provided findings as a result of the statistical analyses performed on the data associated with the 2007 through 2015 first-time, freshman students who completed the mathematics and English composition exams and placed in to remedial level coursework. This chapter will explore the findings outlined in Chapter 4 providing discussion on conclusions and recommendations.

The following sections will include a brief summary of the study followed by a report of major findings and the conclusions yielded from these findings, organized by research question. Implications on further research and practice will follow. The final section of this chapter will include general conclusions and discussions of best practices recommendations that may be instituted by MSSPU and similar institutions to improve placement practices and student success.

Study Summary

In order to explore the effectiveness of MSSPU's remedial placement practices and the impacts of participation in the Free Remedial Summer Program on student outcomes, this study

examined performance in remedial courses, persistence to graduation, and time to graduation as it relates to mathematics and English composition placement level, high school grade point averages, entrance exam scores, and participation in the Free Remedial Summer Program. Five unique statistical tests were utilized to address fifteen hypothesis related to seven research questions. The results of those statistical tests are outlined in Chapter 4, Findings. The following section will discuss the major findings and conclusions by research question.

Statement of the Problem

A growing number of individuals entering undergraduate institutions require remediation and existing literature lacks definitive judgments as to the effectiveness of current, traditional remediation interventions. As remediation can be costly, improving the effectiveness of developmental education programs is beneficial for students, institutions, and the country's overall competitiveness. The literature suggests a number of indicators may help identify students at risk of attrition, including placement exam outcomes, high school grade point average, and entrance exam scores. In 2007, remedial education was made an institutional priority through the development and implementation of mathematics and English composition placement exams and a Free Remedial Summer Program at the university at the center of this study, a mid-sized selective private university (MSSPU, herein).

Purpose of the Study

The purpose of this study was to explore the effectiveness MSSPU's internally developed placement exams for mathematics and English composition in placing students into remedial courses and the efficacy of the Free Summer Remedial Program. This study also considered the

predictive value of placement exam outcome, high school grade point average, entrance exam scores and a combination thereof on persistence and graduation. The intent was to evaluate the success of the current remedial placement procedures which utilize internally development placement examinations in assigning students to developmental coursework and identify other possible indicators of students most at risk of attrition.

Research Question 1

To what extent does student performance vary between those who enter a recommended mathematics course, based on the mathematics placement exam, and those who enter a mathematics course above or below their recommended course?

The purpose of this question was to determine whether the mathematics placement exam effectively placed students in to a mathematics course. It did so by examining the performance of students who enroll in a course either above or below their placement level. Once performance outcomes were identified, MSSPU could use this information to adjust the mathematics placement exam to better align with course requirements or consider further exploration in to the reasons for variances in performance at all levels: below, at, or above.

Major Findings

Of interest, twenty-seven percent of first year admitted students who completed the mathematics placement exam did not register for a mathematics course at the time of the study. Several possibilities exist for this and include completion of mathematics coursework at another institution for transfer credit, attrition, deferral, and postponing of mathematics course sequencing. Of those students who completed the mathematics placement exam and enrolled in

a mathematics course, eight percent enrolled at a level below their recommended placement, sixty seven percent enrolled at the level of their placement, and twenty two percent enrolled at a level above their placement. Forty eight percent of admitted students who completed the mathematics placement exam had enrolled in a second mathematics course at the time of this study. It is recommended MSSPU explore the reasons for non-enrollment further.

The analysis of the first mathematics course enrollment indicated students who enroll in a course below or above their placement level are more likely to pass the course then those who enroll at their recommended level. Students who enroll above their recommended level were 1.18 times more likely and those who enroll below their recommendation level 1.307 times more likely to pass their first mathematics course than those who enroll as recommended per their performance on the mathematics placement exam. Seventy four percent of students who enrolled above their recommended level, seventy six percent who enrolled below their level, and seventy one percent of those who enrolled at their recommended level passed their first mathematics course.

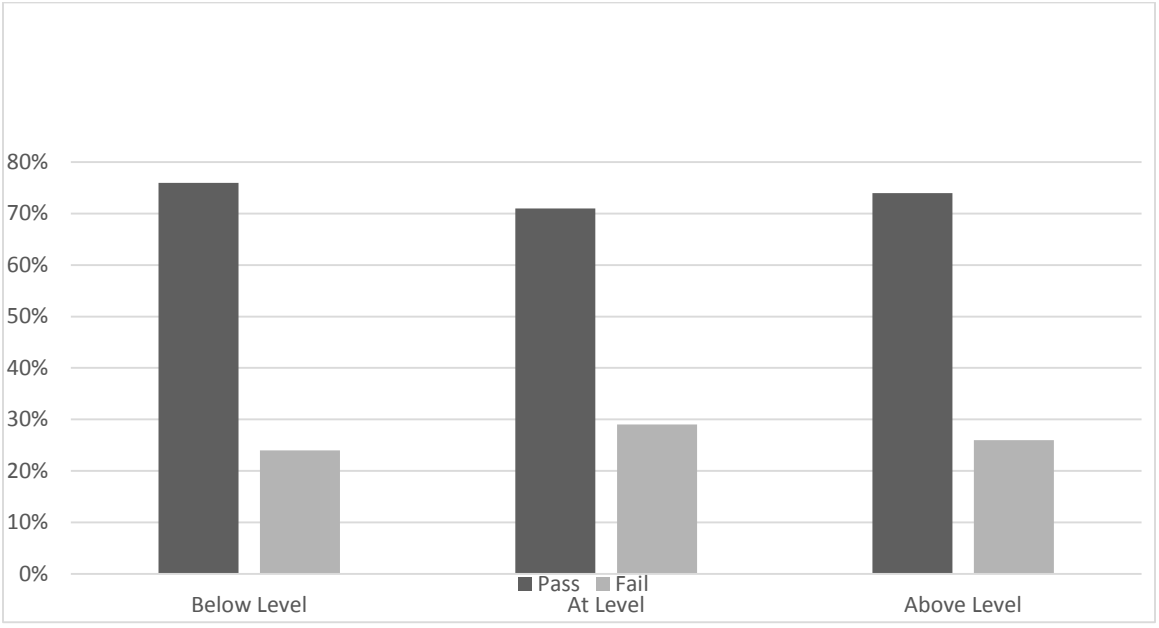

Figure 1: Pass/Fail Rates by Level of Enrollment – First Mathematics Course

Similarly, students who enroll above their recommended level for their first mathematics course were 1.926 times more likely to pass their second mathematics course than those who enrolled at their recommended level for their first mathematics course. Those who enroll below their recommended level for their first mathematics course are .869 times less likely to pass their second mathematics course than those who enroll at the recommended level. Seventy three percent of students who enrolled above their recommended level, sixty percent who enrolled below their level, and sixty three percent of those who enrolled at their recommended level passed their second mathematics course.

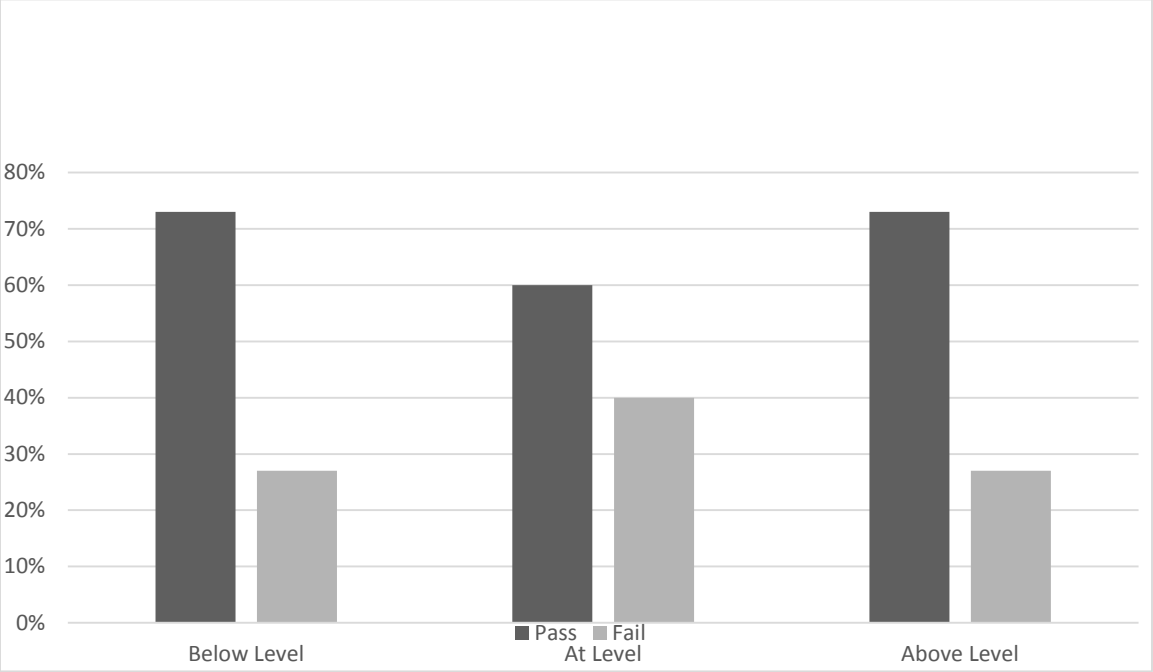

Figure 2: Pass/Fail Rates by Level of Enrollment – Second Mathematics Course

These findings suggest the mathematics placement exam is ineffectively providing placement recommendations for a statistically significant number of students. As previously mentioned in Chapter Two, the university utilizes internally developed placement examinations

that have not been altered since their implementation in 2007. There exists a strong possibility that course content has altered in the eight years since implementation and the placement examinations recommendations no longer align with the courses. Therefore, the need to review and recalibrate placement questions, rubrics, and assignments may be necessary.

Further, the nature of the placement examinations themselves may be reconsidered. As the exam is optional to complete, without time limit, and online, students are unlikely to perform accurately. Students may have distractions in their testing locations, utilize outside resources, or simply not take the examination process seriously. All of these factors impact student outcomes on the placement examination.

Also explored in Chapter Two were the peer impacts on remedial students who enroll in courses where they may have skill deficiencies. Carrell, et. al, (2009) suggest peer effects are unclear in the extant literature though some studies suggest moderately remedial students report higher grade outcomes when they enroll in non-remedial coursework. This may be one reason students who enroll in a course above their level of recommendation are more likely to pass their first and subsequent mathematics course.

Conclusions for Research Question 1

The purpose of this question was to determine whether the mathematics placement exam effectively placed students in to a mathematics course. Based on the findings, the researcher concludes the mathematics placement exam ineffectively places a statistically significant portion of students as demonstrated by better student outcomes by those students who enroll outside of their recommended placement level. While it may be expected students who enroll in a course below the level of their placement recommendation would perform as well or better than those

who enroll at the level of their placement recommendation, increased student performance among those who enroll above the level of the recommendation suggests the mathematics placement exam may need to be reviewed. Further, exploration in to the reasons for enrolling against placement recommendations should be considered.

Research Question 2

To what extent does student performance vary between those who enter a recommended English composition course, based on the English composition placement exam, and those who enter an English composition course above or below their recommended course?

The purpose of this question was to determine whether the English composition placement exam effectively placed students in to an English composition course. It did so by examining the performance of students who enroll in a course either above or below their placement level. Once performance outcomes were identified, MSSPU could use this information to adjust the English composition placement exam to better align with course requirements or consider further exploration in to the reasons for variances in performance at all levels: below, at, or above.

Major Findings

Of interest, thirty six percent of first year admitted students who completed the English composition placement exam did not register for an English composition course at the time of the study. Several possibilities exist for this and include completion of English composition coursework at another institution for transfer credit, attrition, deferral, and postponing of English composition course sequencing. Of those students who completed the English composition

placement exam and enrolled in an English composition course, only one percent enrolled at a level below their recommended placement, eight three percent enrolled at the level of their placement, and sixteen percent enrolled at a level above their placement. Thirty eight percent of admitted students who completed the English composition placement exam had enrolled in a second English composition course at the time of this study. It is worth noting only three levels of courses are offered for English composition for incoming freshman.

The analysis of the first English composition course enrollment indicated students who enroll in a course above their placement level are more likely to pass the course then those who enroll at their recommended level. Such students are 2.184 times more likely to pass their first English composition course than those who enroll at the level of their recommendation. However, students who enroll in a course below their recommended English composition course are 10.299 more likely not to pass their first English composition course. Ninety two percent of students who enrolled above their recommended level, thirty two percent who enrolled below their level, and eighty three percent of those who enrolled at their recommended level passed their first English composition course.

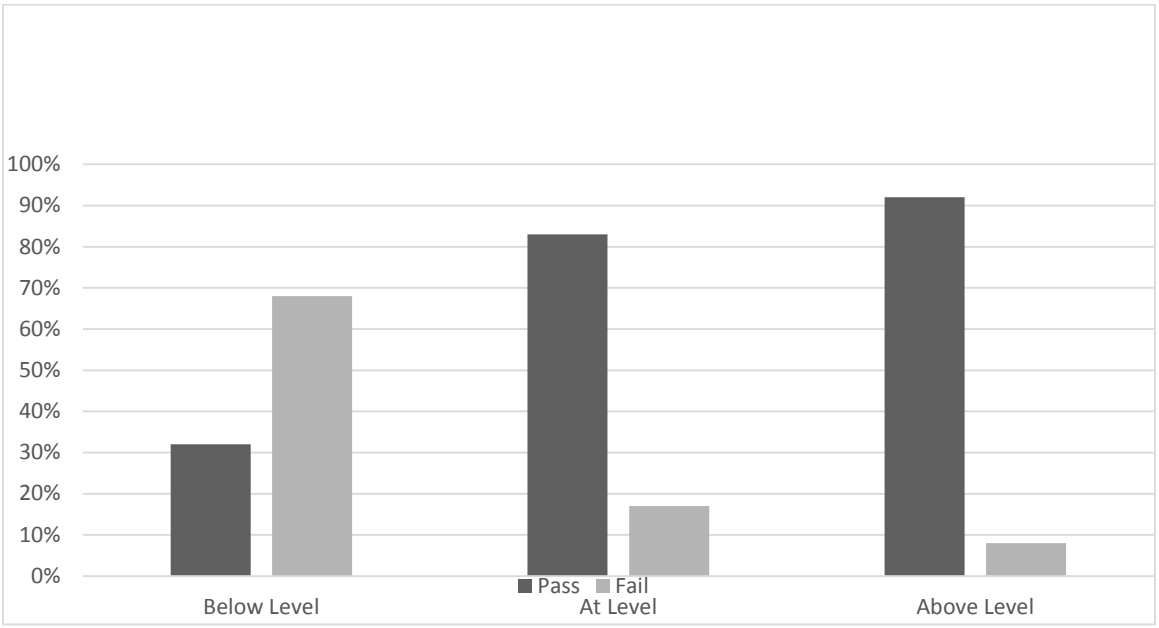

Figure 3: *Pass/Fail Rates by Level of Enrollment – First English Composition Course*

Similarly, students who enroll above their recommended level for their first English composition course were 2.265 times more likely to pass their second English composition course than those who enrolled at their recommended level for their first English composition course. However, those who enroll below their recommended level for their first English composition course, are 5.285 times less likely to pass their second English composition course. Eighty four percent of students who enrolled above their recommended level, thirty three who enrolled below their level, and eighty three percent of those who enrolled at their recommended level passed their second English composition course.

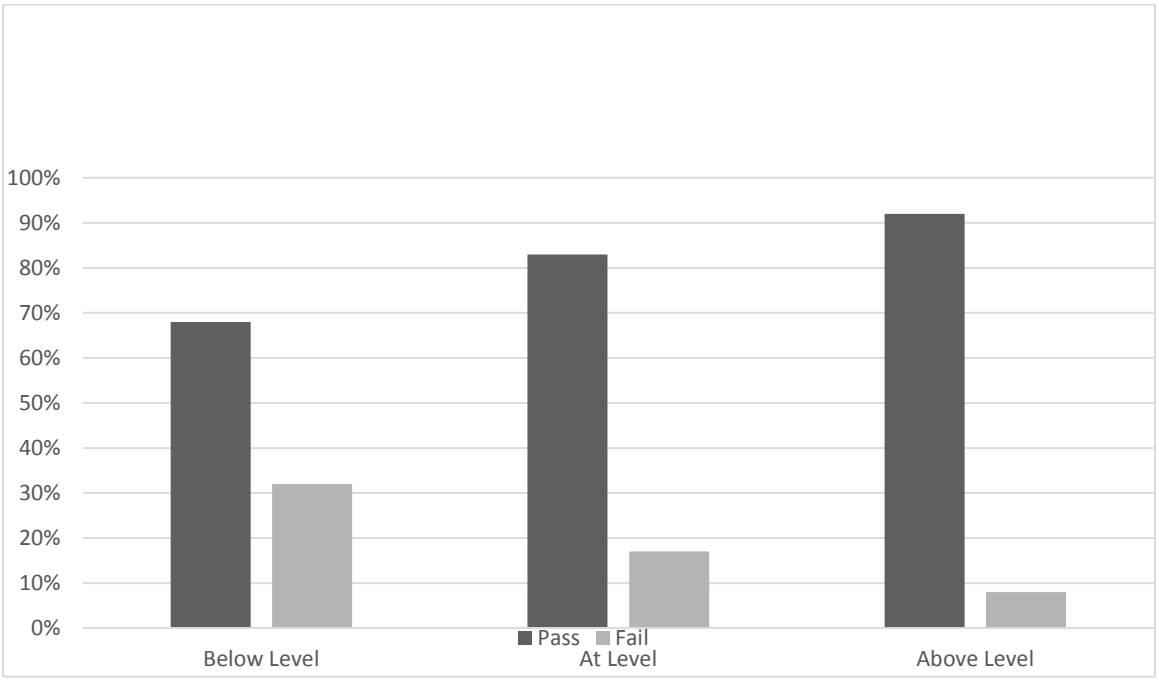

Figure 4: Pass/Fail Rates by Level of Enrollment – Second English Composition Course

These findings suggest the English composition placement exam is ineffectively providing placement recommendations for a statistically significant number of students. As previously mentioned in Chapter Two, the university utilizes internally developed placement examinations that have not been altered since their implementation in 2007. There exists a strong possibility that course content has altered in the eight years since implementation and the placement examinations recommendations no longer align with the courses. Therefore, the need to review and recalibrate placement questions, rubrics, and assignments may be necessary.

Further, the nature of the placement examinations themselves may be reconsidered. As the exam is optional to complete, without time limit, and online, students are unlikely to perform accurately. Students may have distractions in their testing locations, utilize outside resources, or

simply not take the examination process seriously. All of these factors impact student outcomes on the placement examination.

Also explored in Chapter Two were the peer impacts on remedial students who enroll in courses where they may have skill deficiencies. Carrell, et. al, (2009) suggest peer effects are unclear in the extant literature though some studies suggest moderately remedial students report higher grade outcomes when they enroll in non-remedial coursework. This may be one reason students who enroll in a course above their level of recommendation are more likely to pass their first and subsequent English composition course.

Conclusions for Research Question 2

The purpose of this question was to determine whether the English composition placement exam effectively placed students in to an English composition course. Based on the findings, the researcher concludes the English composition placement exam ineffectively places a statistically significant portion of students as demonstrated by better student outcomes by those students who enroll outside of their recommended placement level. Better student outcomes, as indicated by passing courses, among those who enroll above the level of the recommendation suggests the mathematics placement exam may need to be reviewed. Further, exploration in to the reasons for enrolling against placement recommendations should be considered.

While it may be expected students who enroll in a course below the level of their placement recommendation would perform as well or better than those who enroll at the level of their placement recommendation, this was not the case for English composition at MSSPU. It is worth noting the number of students who enrolled in a course below their level of recommendation constituted only one percent of the sample. External factors outside of the

control of the university may have impacted the student outcomes for this population. However, a review of remedial instruction practices may provide insight in to the factors impacting student outcomes.

Research Question 3

To what extent is performance on the mathematics and English composition placement exams predictive of persistence and time to graduation?

The purpose of this research question was to determine if the level of placement on the mathematics and/or English composition placement exams could be an indicator of long-term persistence to graduation. This question also aimed to identify if, among those students who completed the placement exams and graduated, the level of placement was correlated to the number of terms of enrollment needed to graduate. If a correlation was found, the university could utilize this information to identify students at higher risk of attrition to provide additional support and access to programs and initiatives to increase their likelihood of persistence to graduation. Additionally, as the cost of tuition per semester is approximately US$16,000, addressing the need to extent enrollment may be beneficial to MSSPU and the students alike.

Major Findings

Students who place in to a non-remedial mathematics course are 1.885 times more likely to persist to graduation than those who place in to a remedial mathematics course. Similarly, students who place in to a non-remedial English course are 1.742 times more likely to persist to graduation. From this, the researcher can assume students who place at a remedial level on the

English composition or mathematics placement exam are more likely to drop out, or "attrit," than those who do not.

Interestingly, students who place at a non-remedial level on their mathematics placement exam enroll, on average, in more terms (M=7.58, SE=1.317) than those who place at a remedial level (M=7.45, SE=1.471). Though statistically significant, the difference between average enrollments was small. A similar pattern was found for those students who placed at a non-remedial level on their English composition placement exam (M=6.88, SE=.073), who enrolled in more terms than those you placed at a remedial level (M=6.78, SE=.127). However, the difference between non-remedially placed and remedially placed English composition students' terms of enrollment was not significant.

To better understand these findings, additional analysis was conducted. A review of declared majors and minors of the students in this sample indicate students who place at a non-remedial level are thirty four percent more likely to complete a minor in addition to their major course of study. Non-remedially place students are twenty nine percent more likely to graduate from an engineering program, which requires three to six additional credit hours than other programs, depending on specific engineering field. These factors may contribute to the overall difference in number of enrolled terms.

Conclusions for Research Question 3

Perhaps the most important finding from this question demonstrated students who place at a remedial level on either the mathematics or English composition placement exam are less likely to persist to graduation. Conversely, those remedially placed students who do persist to graduation do so in less terms, on average, than those who are placed at a non-remedial level.

This dynamic is of particular interest; MSSPU could use placement level on the mathematics and/or English composition placement exams to identify students at higher risk of dropping out. However, those remedially placed students who do persist may be receiving a less rigorous educational experience or opting out of pursuing a desired minor or major. Exploration in to student perceptions that may impact their degree selection as impacted by their level of placement may be beneficial.

Research Question 4

To what extent is high school grade point average predictive of persistence and time to graduation?

The primary purpose for this research question was to understand how high school grade point average may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of factors including placement exam scores, high school grade point average, and entrance exam scores may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

Major Findings

The analysis found high school grade point average alone made a significant contribution to prediction of persistence to graduation. The logistic regression model was statistically

significant, X^2 (8) = 143.111, $p < .001$. The model explained three percent of the variance in persistence to graduation. Specifically, raising a high school grade point average by one point increased a student's likelihood of persisting to graduation by .82 times.

A negative, negligible correlation was found between high school grade point average an terms to graduation. This suggests high school grade point average is not a strong predictor of terms to graduation. This varies from the findings in other major studies that suggest high school grade point average is one of the strongest predictive indicators of student outcomes (Astin, 1993).

Conclusions for Research Question 4

One or more reasons may explain why high school grade point average is not a strong predictive indicator of student outcomes, by measure of terms of enrollment to graduation. First, there is no way to control for the variation in rigor associated with a high school grade point average. With sixteen percent of the student population consisting of international students and only thirty percent of students from the state of Florida, the differences in what a particular grade point average represent are vast. Not only do high schools weight grades differently, courses may also use different grading scales. For example, in one school district a ninety percent may earn a student an A grade while in another the minimum A grade will be a ninety four. Simply, MSSPU cannot account for these variances. However, the relationship between high school grade point average and persistence to graduation, and time to graduation, though weak, is present and allows MSSPU to utilize the indicator as one component of the larger picture of placement.

Research Question 5

To what extent are entrance exam scores predictive of persistence and graduation?

The primary purpose for this research question was to understand how entrance exam scores may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of factors including placement exam scores, high school grade point average, and entrance exam scores may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

Major Findings

A logistic regression analysis determined entrance exam scores alone did not serve as a statistically significant predictor of persistence to graduation. The predictor model did not reliably distinguish between graduates and non-graduates, X^2 (8) = 11.236, p = .189. When examining the correlation between entrance exam scores and time to graduation, the researcher looked at both the SAT and ACT individually. Neither form of the entrance exam demonstrated a strong association with time to graduation. Both demonstrated a negligible, negative correlation. This suggests entrance exam scores are not a strong predictor of persistence or time to graduation.

This supports the findings of MSSPU's Office of Enrollment. The office conducted an informal study in 2013, determining entrance exam scores were not a strong indicator of student outcomes. Since the late 1990s, major studies found this lack of correlation to be true across public and private, four and two year institutions (Geiser and Studley, 2010; Rooney and Schaeffer, 1998; Walton and Spencer, 2009). Increasingly, institutions across the United States

have eliminated an entrance exam score requirement. Referring to them as test optional, the National Center for Fair and Open Testing published a report of one hundred and ninety five top tier institutions that no longer require an SAT or ACT score from applicants with nearly four hundred total institutions falling in to the test optional category. MSSPU is now one such top tier university. This was part of an initiative to reform the admissions process to become more accessible to diverse populations.

Conclusions for Research Question 5

Based on trends in current research and practices among top tier institutions, it is unsurprising entrance exam scores did not correlate strongly with student persistence or time to graduation. Emerging studies find the format of entrance exams to be disadvantaging to specific groups such as females and English as a Second Language (ESL) learners. The exam formats are highly coachable and scores tend to improve with each taking of the exam, given students who can afford multiple retakes or coaching an advantage. Both the SAT and ACT show large gaps in scores between students of different racial groups, making racial bias in admissions formulas commonplace in institutions which require them (Davis, 2014; FairTest, 2015; Noble and Camara, 2003). The university, MSSPU, has already taken steps to eradicate issues of potential profiling bias in the admissions process. However, further investigation is required to determine precisely how or if entrance exam scores should be utilized in determining remedial or non-remedial placement or in identifying students at risk of dropping out.

Research Question 6

To what extent are mathematics and English composition placement exam scores, high school grade point averages, and entrance exam scores combined predictive of persistence and time to graduation?

The primary purpose for this research question was to understand how mathematics and English composition placement exam scores, high school grade point average, and entrance exam scores may be used as a predictive indicator of a student's likelihood to persist to graduation and, among those who do persist, number of terms of enrollment to do so. The extant literature suggests remedial placement procedures which include a combination of these factors may better identify those students in need of remediation, as reported in Chapter Two. This question aimed to determine if major studies' findings aligned with the student population at MSSPU.

Major Findings

A logistic regression analysis determined mathematics and English composition placement exam scores, high school grade point averages, and entrance exam scores combined serve as a statistically significant predictor of persistence to graduation. The predictor model reliably distinguish between graduates and non-graduates, X^2 (4) = 74.358, $p < .001$. The prediction success overall was ninety seven percent. This suggests while the individual variables are moderate or weak predictors of persistence to graduation, combined their predictive value is increased.

A multiple linear regression was also calculated to predict time to graduation based on the composite of factors: mathematics and English composition placement exam scores, high school grade point averages, and entrance exam scores. A significant regression equation was found (F(5, 1844) =

25.595, $p < .001$), with an R^2 of .067. As found in the analysis of research question three, hypothesis eight, there is no relationship between English composition placement exam scores and time to graduation. However, the other variables found a moderate statistically significant predictability on time to graduation.

Conclusions for Research Question 6

The existing literature finds few institutions consider multiple performance indicators when identifying students in need of developmental education. However, studies, such as this, find the combined predictive value of multiple indicators on student outcomes is more accurate than a single placement tool (Brothen & Wambach, 2012; Burdman, 2012; Scott-Clayton, Crosta, & Belfield, 2014). One byproduct of this statistical analysis was the generation of a model that accurately discriminated between students who persisted to graduation and those who did not. Using such an algorithm with consideration to multiple factors to both place students in to remedial coursework and identify students in need of additional support, advising, and/or access to programs and initiatives in conjunction with other mechanisms to predict likelihood for success can be used throughout the admissions and enrollment process in to a student's first years of study.

Research Question 7

What differences exist in remedial course and subsequent course outcomes and persistence to graduation between students who complete the Free Remedial Summer Program versus those who do not participate in the Free Remedial Summer Program to complete remedial coursework?

The primary purpose of this research question was to explore the efficacy of the Free Remedial Summer Program. The program, offered to students who complete the mathematics placement exam and are identified as requiring remediation are able to enroll in their remedial mathematics course at no cost to the student during the summer term prior to enrolling in credit bearing coursework. Specifically, the researcher aimed to determine if students who complete their remedial coursework as a participant in the Free Remedial Summer Program perform better in their first mathematics course and second mathematics course. The researcher also sought to determine the impacts of participation on persistence to graduation.

Major Findings

First, an analysis of the first mathematics course outcome was conducted. It was found that there is a statistically significant association between participation in the Free Remedial Summer Program and passing the first mathematics course. However, the findings indicate the likelihood of passing the first mathematics course was higher for students who did not enroll in the Free Remedial Summer Program. Students who did not enroll were 2.065 times more likely to pass their first mathematics course. A number of possibilities for this result exist including limited out of class supports during summer hours, non-full time faculty instructing during summer sessions, or attractiveness of the program to lower achieving students.

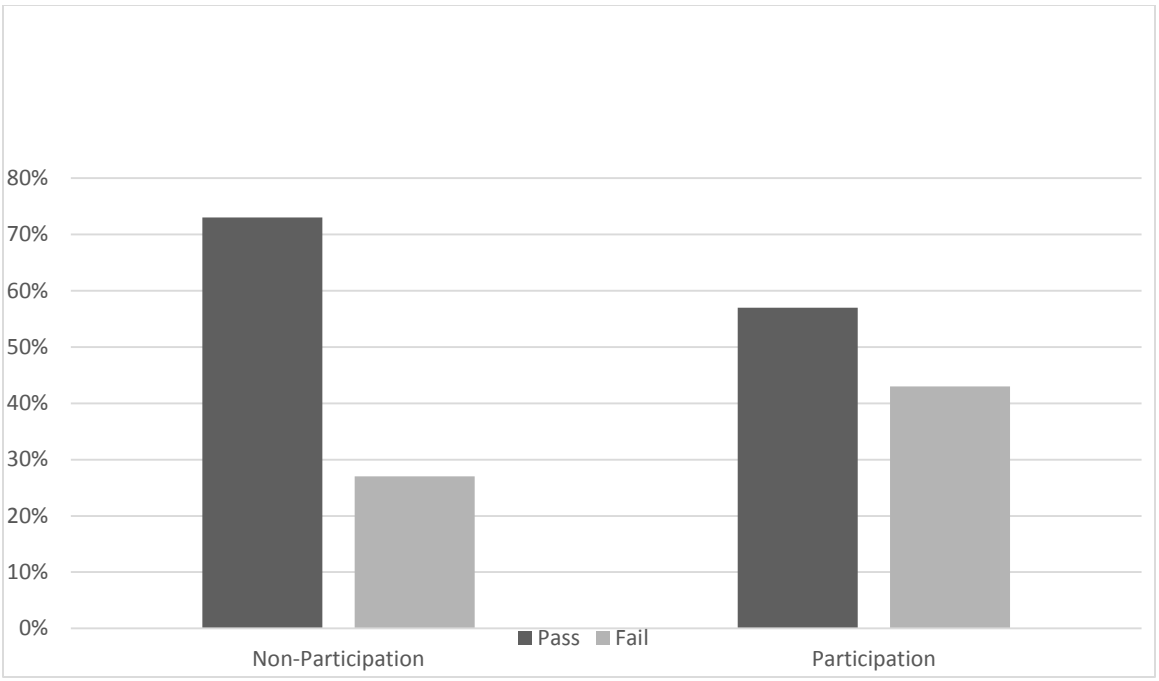

Figure 5: Free Remedial Summer Program Enrollment and First Mathematics Course

Second, an analysis of the second mathematics course outcome was conducted. It was found that there is a statistically significant association between participation in the Free Remedial Summer Program and passing the second mathematics course. As with the first course, the findings indicate the likelihood of passing the first mathematics course was higher for students who did not enroll in the Free Remedial Summer Program. Students who did not enroll were 1.706 times more likely to pass their first mathematics course.

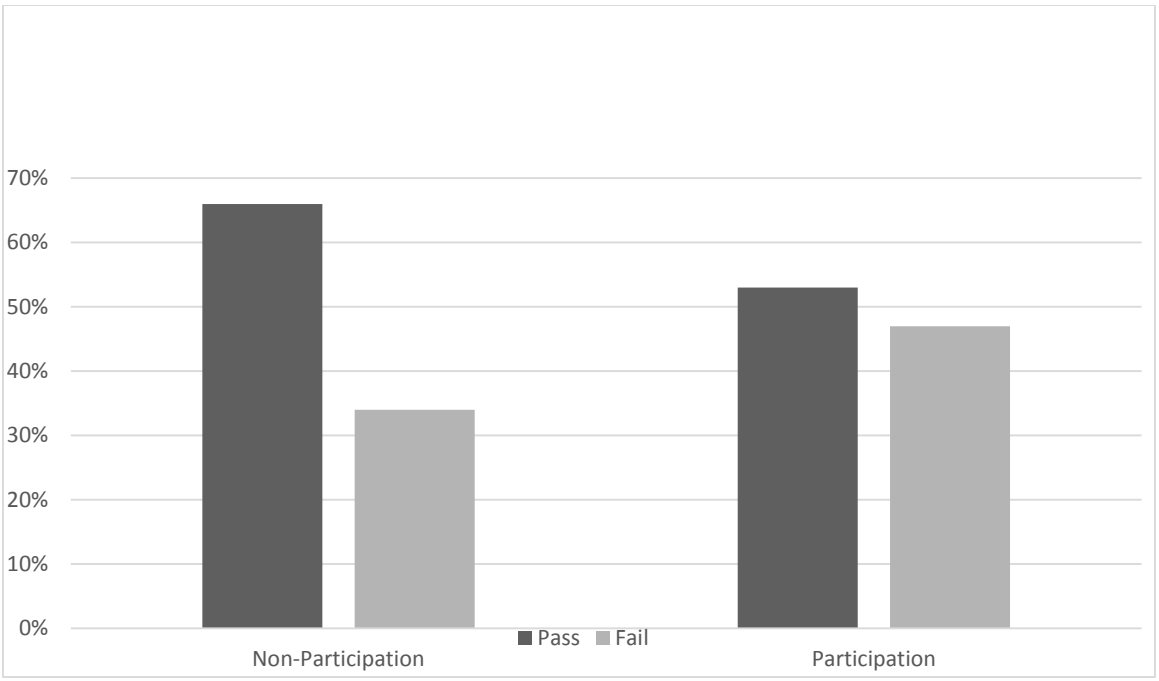

Figure 6: Free Remedial Summer Program Enrollment and Second Mathematics Course

Finally, the relationship between enrollment in the Free Remedial Summer Program and persistence to graduation was examined. The results of this analysis indicate there is not a statistically significant association between participation in the Free Remedial Summer Program and persistence to graduation. Based on the odds ratio, the odds of a student persisting to graduation were .987 higher when they did not enroll in the Free Remedial Summer Program.

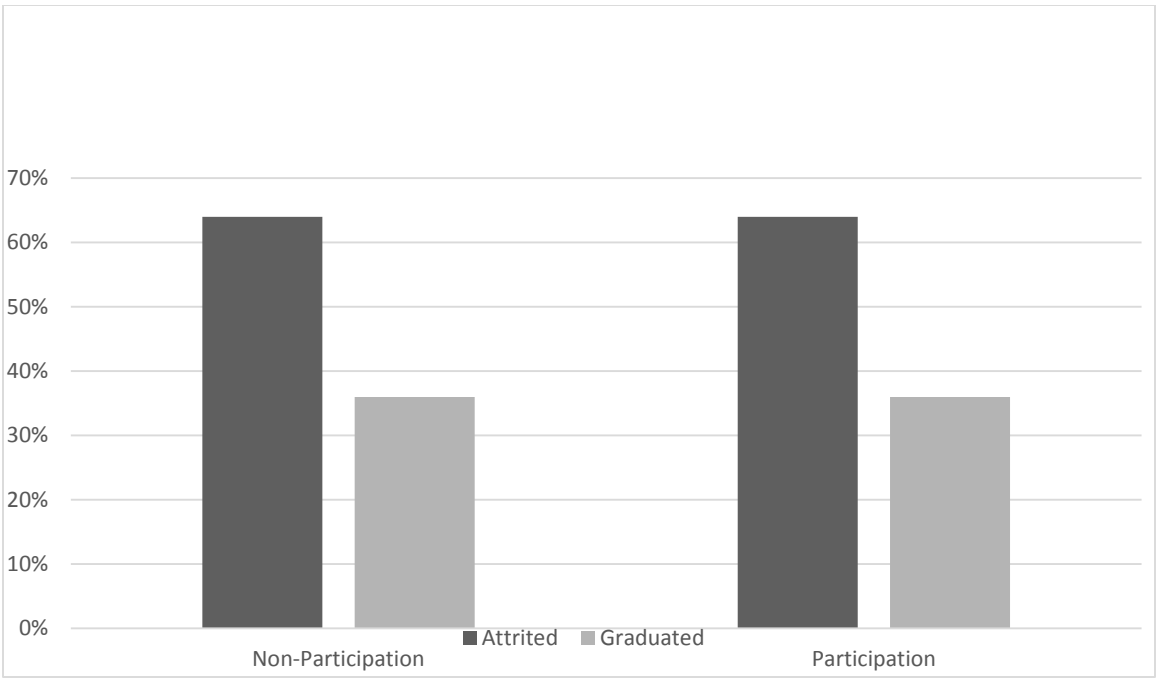

Figure 7: Free Remedial Summer Program Enrollment and Persistence to Graduation

Conclusions for Research Question 7

In general, the findings for this research question suggest the Free Remedial Summer Program is not effective in its current form. A number of factors may contribute to this finding. First, outside of the control of MSSPU, is the type of student the Free Remedial Summer Program may attract. While it is likely the motivation level of these students is higher than those students who do not participate, their deficit levels may also be higher. An exploration of the specific skill levels of those who participate in the program versus those who do not will provide insight in to this possibility.

Second, the Free Remedial Summer Program remedial courses are taught by adjunct faculty. These faculty members are not full-time and do not have access to or the responsibility to complete faculty development training and workshops. A growing body of research suggests adjunct faculty are less engaged with the university, the students, and student outcomes and

demonstrate more instructional deficiencies than full-time faculty (Bettinger and Long, 2005b; Mueller, Mandernach, and Sanderson, 2013). These studies suggest students are adversely affected by adjunct faculty performance. The university has the opportunity to study the effectiveness of the Free Remedial Summer Program when the courses are taught by full-time faculty versus adjunct faculty or may provide development resources to adjunct faculty.

Third, support programs on campus are limited during the summer months. The academic advancement center, peer mentors, supplemental instruction, and one on one peer tutoring services are primarily facilitated by high achieving, junior, senior, and graduate students. During the summer terms only a small percentage of these individuals are available to provide support to students enrolled in the Free Remedial Summer Program. Growing these support programs and initiatives to include more student facilitators during the summer months may increase the effectiveness of the Free Remedial Summer Program.

Implications for Practice

In order to explore the effectiveness of MSSPU's remedial placement practices and the impacts of participation in the Free Remedial Summer Program on student outcomes, this study examined performance in remedial courses, persistence to graduation, and time to graduation as it relates to mathematics and English composition placement level, high school grade point averages, entrance exam scores, and participation in the Free Remedial Summer Program. The results of this study demonstrated current practices at MSSPU are negligibly to moderately effective, with opportunities for additional research, which will be explored in the next section, and for change in practices, which will be explored in the section following.

Similar to trends within the extant literature, remedial placement played a role in predicting student outcomes including grades in mathematics and English composition and persistence and time to graduation. However, remedial placement is just one factor to be considered in identifying students at-risk of attriting. As recommended in studies by Brothen and Wambach (2012), Burdman (2012), and Scott-Clayton, Crosta, and Belfield (2014), the findings from this study indicate a combination of factors including performance on mathematics and English composition placement exams, high school grade point average, and entrance exam scores may provide better insight in to student potential. Due to the high cost of remediation and attrition, growing diversity in the MSSPU population, and ramifications of poor student outcomes on the students, their peers, and the institution as a whole, numerous implications exist.

As explored in Chapter Two, divergent perspectives exist as to the efficacy of remediation. While some studies show there is little to no effectiveness for remediation (Calcagno and Long, 2008; Martorell and McFarlin, 2007), others demonstrate remedial course performance to be the best predictor of college success (Bettinger and Long, 2005). This study finds similar effect sizes to be weak to moderate, with some variables having no correlation to student outcomes at all, reflecting this divergence in the literature. It is proposed a number of factors unable to be studied for this analysis can strongly impact the effectiveness of remediation and meaningfulness of placement procedures. Determining these critical factors is of important to MSSPU, and other institutions, should there be an intention to improve student outcomes and decrease attrition.

As found in previous studies, the first semester of coursework is crucial for student outcomes regardless of remedial need (McClenney, 2006; Pascerella and Terrenzini, 2005). Given students requiring remediation are at higher risk for attrition, based on the findings of this

study, MSSPU should both increase efforts to improve retention for all students during their first term but also investigate why so many remedial and non-remedial students do not persist to graduation. Of students who completed the mathematics placement exam, for example, approximately sixty four percent did not graduate, dropping out before completing their degree. While this number is not representative of the entire university population, the reported graduation rate is actually lower among all students than among those in the population for this study. Sixty nine percent of all students, as reported by MSSPU, drop out prior to graduation.

Finally, the dynamics of the enrollment and admissions process is likely to change drastically with the new test optional policy and an increased emphasis on recruiting more diverse students. Additionally, MSSPU has reported steadily increasing number of incoming freshman each fall indicating a statistically likelihood that more students will require remediation on a whole. A new or improved process to properly identify skill deficiencies among incoming students and indicate those at highest risk for attrition is of importance. Also of consideration should be improving remediation strategies to best meet these student needs.

Recommendations for Further Research

In the conclusions and major findings section of this chapter, some recommendations for further research were mentioned. This section will discussion these areas in more detail. Additionally, further recommendations based on the extant literature are considered. These recommendations are made with specific consideration to MSSPU but may be applicable to other, similar institutions.

Recommendation 1: Non-Enrollment

With over one quarter of students completing the mathematics and English composition placement exams but not enrolling in a mathematics or English composition course, further exploration in to non-enrollment would be beneficial. Even fewer students enroll for their second course in the sequence. The objective of the research would be to identify the reasons students opt not to enroll in a mathematics or English composition sequence at MSSPU.

Recommendation 2: Registration Outside of Recommended Level by Placement

Though students who enroll outside of their recommended level of placement perform better overall, the need to understand why students opt not to follow the recommendation exists. As this occurs consistently with each term of enrollment and for both mathematics and English composition, the understanding provides an opportunity to improve practice. The objective of this analysis would be to identify specific factors impacting student registration decisions.

Recommendation 3: Review and Adjust Placement Tools and Procedures

As students who enroll outside of their recommended level of placement perform better overall than those students who enroll in a course at their level of recommendation, it is recommended MSSPU review both the mathematics and English composition placement tools to better align with course content. The objective of this analysis is to improve the accuracy and effectiveness of the mathematics and English composition placement tools. It is also recommended alternative placement procedures be explored and piloted. The objective of this pilot study to determine which best practices provides the best student outcomes at MSSPU.

Recommendation 4: Analysis of Instructional Practices

An in-depth analysis of the effectiveness of various instructional practices, including out of class supports such as the academic advancement center, peer mentors, and supplemental instruction, is recommended. The objective of this analysis is to identify strategies that effectively improve student outcomes and persistence to graduation. The results of this study can be utilized to guide faculty development, promote increased funding for support services, and better align programs and initiatives with actual student outcomes.

Recommendation 5: Impact of Advising

The important role of advising was explored extensively in chapter two. It is recommended an analysis of advising impacts for first year and continuing students on course selection as well as degree and/or minor selection be conducted. The objective of this analysis would be to determine the ways in which advising is impacting student decision making.

Recommendation 6: Student Perceptions Impact on Degree Selection

The analysis of remedial placement impacts on terms to graduation suggest students who place in to remedial mathematics or English composition are less likely to declare a minor course of study or to pursue a degree in engineering. It is recommended a study be conducted to examine student perceptions of the impact of remediation on decision making. The objective of this study would be to understand the implications of a remedial placement on student self-perception and how that self-perception may impact academic goals.

Recommendation 7: In-depth Analysis of Free Remedial Summer Program

The analysis of the efficacy of the Free Remedial Summer Program for this study did not delve in to the specific factors that may impact student outcomes. As such, it is recommended an in-depth analysis of student perceptions, faculty impacts, access to out of class support services, and other factors be conducted to better understand the impact of the program. The objective of this analysis would be to identify areas of improvement for the program or determine if the program should be continued as there is a high cost associated for MSSPU.

Recommendation 8: Longitudinal Study of Non-Academic Factors for Success

As outlined in Chapter Two, a number of non-academic factors impact student success. To better understand these factors, it is recommended a longitudinal study be conducted in which a cohort of both remedial and non-remedial placing students are assessed on performance, engagement, and self-perception over the course of their time at MSSPU. The objective of this study would be to develop a better understanding of the impact of academic and non-academic factors on student success.

Recommendation 9: A Meta-Analysis of College and University Remedial Practices

The findings of this study suggest the current practices utilized by MSSPU to identify students' skill and knowledge deficits and those most at risk for attrition are ineffective. A meta-analysis of outcomes from the extant literature on the effectiveness of various college and university placement practices, remedial and development education interventions, and other retention factors will provide insight in to possible opportunities for change within MSSPU.

Best Practices for Consideration

In completing this study, the researcher has identify best practices and strategies established in the extant literature. While these best practices are explored at length in Chapter Two, this section will briefly explore these as they relate to the topic of this study. Institutional structure, placement procedures, and instructional practices and supports will briefly be revisited.

Institutional Structure

Currently, MSSPU provides developmental education intervention in a decentralized model. This model provides little opportunity to coordinate between departments and offices that play a role in remediation. Boylan (2002) suggests decentralized programs are less effective than centralized programs as they lack a designated individual to oversee program practices, uphold high expectations, and identify gaps in services. McCabe (2000) and Rouche and Rouche (1999) suggest a complete restructuring may not be necessary. While centralized systems function more effectively, providing a designated coordinator of developmental education initiatives and courses provides and effective linkage between departments and offices.

This individual would also be responsible for overseeing evaluation measures. While MSSPU programs must undergo regular accreditation review, the institution does not conduct ongoing evaluation of developmental education programs. The National Association for Developmental Education (2015) suggests self-evaluation to examine goals, strengths, and weaknesses is vital to program, and in turn, student success. Successful programs utilize a system of evaluation to guide improvements and development (Bolman and Deal, 2008; Fitzpatrick, Sanders, and Worthen, 2012; Wren, 1995).

Placement Procedures

Brothen and Wambach's (2012) framework recommends refining and broadening placement procedures. This study supports that assertion. The extant literature suggests the impact of being assigned to and/or taking remedial courses can have long term, detrimental effects on a study (Jacobson, 2006). As such, basing a decision on a single test with disregard to other factors, such as performance in high school coursework, is unjustifiable (Brothen & Wambach, 2012; Burdman, 2012; Scott-Clayton, Crosta, & Belfield, 2014). While most institutions aim to utilize a valid and reliable placement exam, few consider other performance indicators.

Instructional Practices and Supports

Though currently offered in some form at MSSPU, the effects of supplemental instruction, peer mentors, academic advancement center, and one on one tutoring have not been examined. However, the importance of learning supports on campus is readily supported in literature (Boylan, 2002; Brothen and Wambach, 2012; Rouche and Rouche, 1999). Expanding the accessibility and funding for these initiatives is an important factor in improving the success of all MSSPU students, not just those who enter the institution underprepared.

Highly effective institutions not only provide out of classroom learning supports. The literature suggests an emphasis on faculty development in the area of pedagogy is a vital component in improving student outcomes. This includes the refinement and redevelopment of remedial and non-developmental coursework alike (Brothen and Wambach, 2012; Levine and Calgano, 2007).

Conclusion of Study

The attempt to improve current remedial placement processes and increase student grades and likelihood of persistence to graduation is a complicated one. To improve, the university must first evaluate ongoing practices and understand areas of opportunity. This study attempted to highlight those areas while providing insight in to current practice. The findings in this study demonstrate the weak to moderate relationships between remedial placement, student grades in mathematics and English composition sequences, and persistence and time to graduation. Additionally, the study found the Free Remedial Summer Program to be associated with lower student grades and higher attrition. Fortunately, the study as outlined best practices and opportunities for change and development for MSSPU. With the rapidly changing demographics and growing need for remedial intervention, MSSPU has an obligation to adapt to the new dynamics and provide opportunities for student success.

APPENDIX: IRB APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

From : **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To : **Kadie J. H. Mullins**

Date : **June 09, 2015**

Dear Researcher:

On 06/09/2015 the IRB determined that the following proposed activity is not human research as defined by DHHS regulations at 45 CFR 46 or FDA regulations at 21 CFR 50/56:

Type of Review:	Not Human Research Determination
Project Title:	THE EFFECTIVENESS OF PLACEMENT EXAMS AND A FREE SUMMER REMEDIAL PROGRAM AT A MIDSIZED SELECTIVE PRIVATE UNIVERSITY
Investigator:	Kadie JH Mullins
IRB ID:	SBE-15-11348
Funding Agency:	
Grant Title:	
Research ID:	N/A

University of Central Florida IRB review and approval is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are to be made and there are questions about whether these activities are research involving human subjects, please contact the IRB office to discuss the proposed changes.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Joanne Muratori

Signature applied by Joanne Muratori on 06/09/2015 03:27:58 PM EDT

IRB manager

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