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STUDENT SUCCESS: DO FIRST-TIME, FULL TIME (FTFT) STUDENTS AT THE UNIVERSITY OF MISSISSIPPI ENROLLED IN INTERMEDIATE MATH (DS 099) EARN HIGHER GRADES IN COLLEGE ALGEBRA (MATH 121) THAN THOSE STUDENTS WHO ENROLLED DIRECTLY IN COLLEGE ALGEBRA?

Martina Brewer-Mister

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A Dissertation
presented in partial fulfillment of requirements
for the degree of Doctor of Education
in the Department of Higher Education
The University of Mississippi

by

Martina Brewer-Mister

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ABSTRACT

Critics of developmental studies suggest that remedial courses may negatively influence a student's program selection, persistence, and completion because remedial classes do not count toward graduation requirements (Long & Boatman, 2013). They have also found that over half of the students referred to remediation do not complete the courses (Clayton, Crosta, & Belfield, 2014; Bailey, Jeong, & Cho, 2010). The number is even lower for minority students (Bailey, 2010).

Using pre-existing data collected from the Office of Institutional Research, Effectiveness, and Planning at the University of Mississippi, an independent sample t-test and correlation analysis were conducted to examine the outcomes for students enrolled in remedial math. The researcher looked at the grades (GPA) of two groups of students who enrolled in college algebra with a Math ACT subscore of 17 or 18. The first group was first-time, full-time students who enrolled directly in college algebra. The second group was first-time, full-time students who enrolled in college algebra after completing developmental math.

The findings for this study included results from the descriptive data and two research questions and hypotheses. The findings for the first research question revealed that there is a significant difference in the grades earned in Math 121 for the students who completed DS 099 compared to the grades earned in DS 099 for the students who did not take college algebra. On the other hand, the findings for the second research question revealed that there is a low

correlation between the grade earned in DS 099 and the grade earned in Math 121 because 0.453 is a low correlation, according to Hinkle et al. (2003, p.109).

DEDICATION

I dedicate this project to my family: Kenny (husband), Malique and Cameron (sons), James and Albirdia (parents), James, Jr., Atlean, Sandra, and Nicholas (siblings), and all my nieces and nephews. I love you all!

"I Can Do All Things Through Christ Who Strengthens Me"

- Philippians 4:13

"With men this is impossible, but with God all things are possible"

-Matthew 19:26

ACKNOWLEDGEMENTS

Born and raised in the Mississippi Delta, I have always been viewed as an underprepared student. Many people thought I would fail in higher education, especially at the University of Mississippi. However, this journey has been an experience that I will cherish forever. I am proud to show my family and friends that we can accomplish anything we put our minds to.

Therefore, I am dedicating this dissertation to everyone who has second-guessed himself or herself about continuing their higher education journey. Using my personal and professional experience, I will continue to encourage underprepared students to never give up on their dreams. This journey has not been easy, and I am thankful for my family and friends who motivated me.

To my amazing husband, Kenny, thank you for loving and supporting me. Thank you for pushing me when I wanted to give up, and thank you for proofreading my writing. I love and appreciate everything you do for the boys and me.

To my guys, Malique and Cameron, you are my world; everything I do is for you. I strive to be great, but I want you all to be greater. Thank you both for being the best young men a mother could ask for. I love you all.

To my parents and siblings, thank you so much for motivating and believing in me. You all are my rocks!

To all of my nieces, nephews, mentors, friends, colleagues, and extended family—thank you for all the words of encouragement.

To the wonderful cohort three, we started as classmates but quickly became friends. I am thankful for you all.

Finally, I would like to thank my chair, Dr. Amy Wells Dolan, and my committee members, Dr. David Rock, Dr. Whitney Webb, and Dr. Macey Edmondson. I appreciate you all, and I am thankful for your guidance throughout this process. Without you all, I would not have reached my goal of completing this dissertation.

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MANUSCRIPT I

INTRODUCTION

Goudas & Boylan (1998) suggested that developmental courses have long been a controversial topic surrounding American education – and are still highly debated (O'Dwyer & Shields, 2017; McCabe & Day, 1998; Stark, 1989). At the center of the debate lies a hotly contested question, what purpose do remedial courses serve (Goudas & Boylan, 2012)? In this Dissertation in Practice (DIP), presented as a three-part study, the researcher explored the effectiveness of remedial math at the University of Mississippi as the central problem of practice. To gather a comprehensive understanding of the problem of practice, the researcher looked at the grades of two large groups of first-time, full-time students enrolled in college algebra at the University of Mississippi at two different points in time. The two different points in time are before and after a change in the policy related to students' required placement in developmental math courses before taking college algebra. A second part of the project sought to determine if there is a correlation between grades earned in developmental math and the subsequent grades earned in college algebra for the two different groups. The goal of this DIP was to determine if remedial math helps students cross the bridge to college-level courses or if it was a "black hole from which students never emerge" (Jimenez, Sargrad, Morales, & Thompson, 2016, p. 1).

Some scholars have believed that developmental classes are practical and necessary components at colleges and universities to enhance democratic access, but others vehemently disagreed and have argued that developmental education should not be a part of the collegiate setting (Goudas & Boylan, 2012; Martorell & MCFarlin, 2011;McCabe & Day, 1998). O'Hear and MacDonald (1996) defined developmental education as a systematized delivery of rules for

students who can engage in learning to help them with the required skills needed to complete collegiate credit-bearing courses. In 1996, O'Hear and MacDonald suggested the classes were tailored to bridge the gap between lessons taught in high school and higher education institutions. However, Casazza (1996) observed that developmental programs were composed of classes that took a more comprehensive look at individual students and sought to promote academic and personal growth (p.31). Casazza also thought colleges and universities could accomplish more by providing support systems that met students where they were by combing educational assistance and individual counseling, rather than solely focusing on their weaker skill areas (p.31). She believed that acknowledging the student's strengths helped the students develop in the underdeveloped learning domains, which set a more positive tone (Casazza, 31). Some college administrators also made an ethical argument for enrolling students who need remediation. They contended that it is the college's job to help unprepared students, not to punish them (Shields & O'Dwyer, 2017). Nevertheless, many scholars and practitioners exist as either advocates or adversaries of developmental education.

While the notion of expanding the market of potential students has long motivated higher education administrators to provide preparatory courses (Thelin, 2004), there was at least one unintended consequence of increasing access to college-level studies. This consequence resulted in a sharp increase in the number of students deemed underprepared and in need of assistance in bridging the gap between secondary and post-secondary education (Stark, 1989; McCabe & Day, 1998). However, critics suggested that the remedial courses may negatively influence a student's program selection, persistence, and completion because remedial classes do not count toward graduation requirements (Long & Boatman, 2013). They have also found that over half of the students referred to remediation do not complete the courses (Clayton, Crosta, & Belfield, 2014;

Bailey, Jeong, & Cho, 2010). The number is even lower for minority students (Bailey, 2010). Other descriptive studies showed that students who are required to enroll in remedial courses persist at a lower rate than students who start college-level courses (Adelman, 2006; Bailey, 2009; Bettinger & Long, 2005; Complete College America, 2018).

Even though developmental courses have been around for centuries (Arendale, 2002), the courses were not called developmental or remedial courses originally. Arendale (2002) noted that the earliest approach to developmental courses was known as tutoring for white male students from privileged socioeconomic backgrounds to prepare them for college entrance exams and the rigor of college-level courses (2002). As cited by McCabe and Day (1998), before historical cases, like the 1954 *Brown v. Board of Education., the Civil Rights Act of 1964,* and the signing of the *Morrill Act of 1862*, several universities were made up of predominantly white young men who learned remedial Latin or Greek on the students' or parents' dime. However, after need-based financial aid became available, doors opened for more students of color who were required to take remedial courses, which emerged as a turning point for how remedial classes were perceived as the classes became negatively critiqued.

Developmental courses were not viewed adversely until after the signing of the Higher Education Act of 1965 (HEA). The HEA's goal was to expand participation in higher education (Hearn, 1993); the expansion allowed more minority students to gain an education. After more colleges and universities became accessible through federal- and state-supported need-based financial aid, the courses' characterization changed from tutoring to preparatory classes, then to remedial and later, developmental courses (Bailey, Cho & Jeong, 2010; Merisotis & Phipps, 2000). As more students entered higher education and the approach evolved to remedial and

developmental, the classes' negative portrayal grew, making people more critical of the courses' availability in colleges and universities in the first place (Arendale, 2002).

Some scholars were very critical of remedial courses and insisted the courses' availability showed some commitment to broadening opportunity by letting a few get in, but they provided a failed opportunity by holding back other students (Boatman & Long, 2013). In particular, for minority students, this system provided access but did not allow them to consistently earn a degree. Even though it was a broken system, colleges and universities were okay with letting students repeat the courses or drop out of school because they were increasing enrollment and ostensibly making money (Boatman & Long, 2013). Still, institutions reasoned that the students were not academically prepared and therefore did not deserve to attend their institution if they were not successful (Harwood, 1997; Marcus, 2000; Trombley, 1998). Deil-Amen & Rosenbaum (2002) described this attack on access to college as a "hoax that perpetrated upon academically weak students who will be unlikely to graduate" (p. 262).

DEVELOPMENTAL AND REMEDIAL EDUCATION

Many colleges and universities offer "refresher" courses for students who lack critical skills for college-level work (Roueche & Roueche, 1999). These courses are referred to as remedial or developmental courses and were designed to prepare students for college-level courses (Casazza, 1996; O'Hear & MacDonald, 1996). However, researchers are still trying to determine what constitutes "college-level work" because the meaning is not clear, primarily because the requirements for remedial courses differ among institutions (Roueche & Roueche, 1999). Colleges and universities use several tools to determine course placement, but the most familiar resource is the college entrance exam or ACT.

The American College Testing, also known as the ACT (2020), is an "entrance exam used by most colleges and universities in conjunction with high school GPAs to make admissions decision" (p.2). In some states, the exam is used to measure college readiness, using benchmark scores in core curriculum areas or subjects (ACT, 2020). According to ACT (2020),

> a benchmark score is the minimum score needed on an ACT subject-area test to indicate 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in the corresponding credit-bearing college courses, which include English Composition, Algebra, Social Science, Biology, and STEM. These scores were empirically derived based on the actual performance of students in college (p. 2).

Table 1

ACT Standard Benchmarks

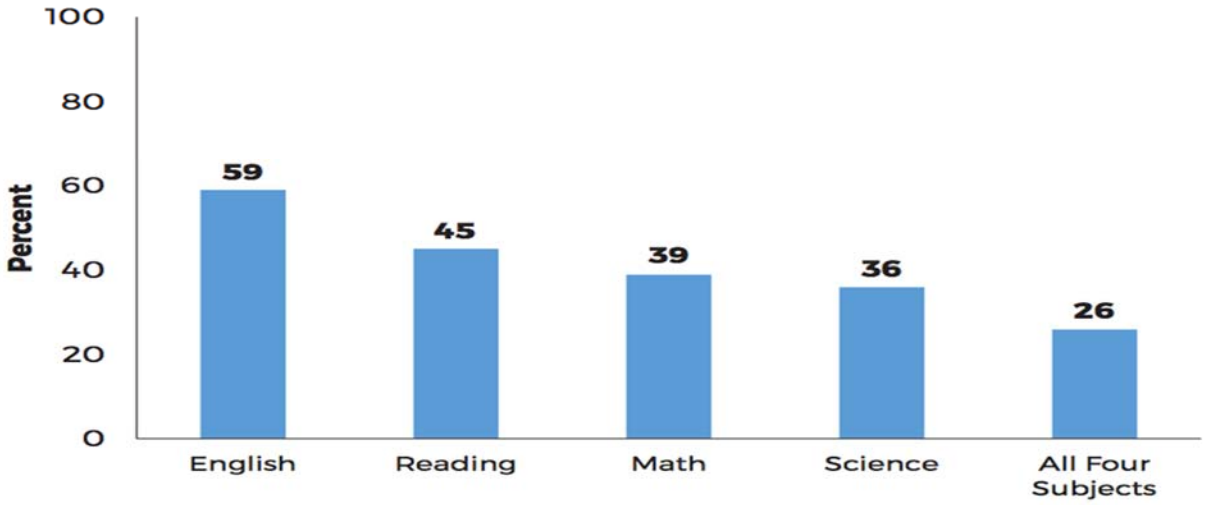
College Course/Course Area	ACT Score	Benchmark Score
English Composition	English	18
Algebra	Mathematics	22
Social Sciences	Reading	22
Biology	Science	23
STEM	STEM	26

Source: Retrieved from act.org

The benchmarks set by ACT are indicators to determine who is ready for college-level coursework and are often used to determine placement for college-level or developmental courses. According to the 2019 National Profile Report, 26% of the 2019 class of high school graduates met all four of the ACT benchmarks; but less than 50% of the class was ready for college-level reading, math, and science. Approximately 59% of these high school graduates were prepared for college-level English.

Table 2

Percent of 2019 ACT-Tested High School Graduates Meeting ACT College Readiness Benchmarks by Subject

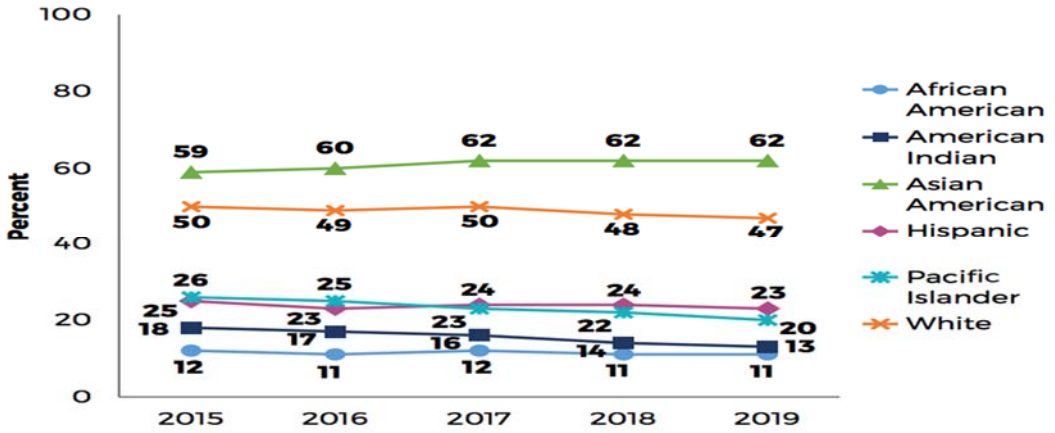


Source: Retrieved from https://www.act.org/content/dam/act/unsecured/documents/National-CCCR-2019.pdf

The Condition and College Readiness report (ACT, 2020) also showed that over the past five years, many African American high school graduates achieved lower college and career readiness levels compared to the students of other race(s)/ethnicity(ties). This graph aligns with Boylan and Bonham's (2005) finding that African American students are the majority of the students enrolling in developmental courses (p.59). Boylan, Bonham, and Tafari (2005) also noted that "developmental education can contribute to campus-wide diversity" (p. 61).

Table 3

Percent of 2015-2019 ACT- Test High School Graduates Meeting Three or More Benchmarks by Race/Ethnicity



Source: Retrieved from https://www.act.org/content/dam/act/unsecured/documents/National-CCCR-2019.pdf

Even though the ACT benchmarks are a national standard, the criteria vary from state to state, and in some cases, from institution to institution; there is no consistency in determining the qualifications for developmental education (King, McIntosh, & Bell-Ellwanger, 2017). For example, in my home state of Mississippi, the Institutions of Higher Learning (IHL) governs public colleges and universities. IHL set an ACT subscore of 17 as the benchmark for English, reading, and math (Atchison, 2018) for the state's eight universities. It also gives each University the authority to require a higher score. As noted in the table below, most Mississippi public universities set a higher math ACT benchmark score.

Table 4

Placement Benchmarks by Mississippi IHL Institution

University	College-Level English	College-Level Mathematics	College-Level Reading
ASU	17	17	17
DSU	17	20	17
JSU	17	17	17
MSU	17	19	17
MUW	17	19	17
MVSU	17	20	17
UM	17	19	17
USM	20	20	17

Source: Retrieved from mississippi.edu

Because the scores differ between institutions, students' scores can place them in remedial classes at one school and credit-bearing courses at another institution (Fields, 2012). For example, students who received a 17 or above on the math section of the ACT at Alcorn or Jackson State University can enroll in College Algebra upon entry. Still, if those same students decided to attend Delta State, Mississippi State, Mississippi University for Women, Mississippi Valley State, University of Mississippi, or the University of Southern Mississippi, remedial math would be their first math course. Even though college entrance exams seem to be the prevalent reason students enroll in a developmental course, they are not the only reason students take developmental courses. In his book "*Who Belongs in College: A Second Look,"* Hardin (1998, pp 3-4) identified other reasons student enroll in developmental courses:

> The poor chooser—those who have made poor academic decisions that have adversely affected their academic future, such as not taking a full battery of college preparatory courses in high school

> The adult student—those over twenty-five years old who have been out of school for several years and must cope with managing adult roles and responsibilities while adjusting to college-level academic expectations
>
> The student with a disability—those who suffer from physical or learning disabilities that prevent them from performing as well in the present as nondisabled students and have often kept them from learning as much as other students in the past
>
> The ignored—those whose physical or psychological disabilities or other learning problems have gone undiagnosed or whose learning needs have consistently been ignored in prior schooling
>
> The limited English proficiency student—those who acquired their early schooling in foreign countries and, as a consequence, have limited English language and verbal skills to apply to college-level settings
>
> The user—those who attend college simply to attain the benefits thereof and who often have no clear academic goals, objectives, or purposes
>
> The extreme case—those who have severe emotional, psychological, or social problems that have prevented them from being successful in academic situations in the past and continue to do so in the present

As Hardin (1998) identified, several reasons other than the ACT/SAT benchmark score account for students taking developmental courses. And occasionally, the reason for taking the courses may not be the student's doing. Because of this, students are not always optimistic when they discover they must enroll in developmental courses. The negative connotation attributed to developmental education courses routinely causes students to ask a variety of questions. I have heard questions such as “Why do I have to take these courses?” “Am I not smart enough to enroll in regular courses?” “My friends do not have to take them, why do I?” “These courses are embarrassing; why do I have to do this?” Conversely, what prospective students fail to realize is that even though developmental courses do not accumulate college credit, they were designed ostensibly to prepare them for the college curriculum (of increasing difficulty and rigor). The courses are imposed with an eye toward bridging the gap between what students learned in high school and what they will learn in college.

My primary concern is this: Some students are trickling out of the system and are not persisting in college or to college graduation after taking developmental courses. If they successfully matriculate through the developmental course requirements (especially in STEM), they can be hit next with gatekeeper or "killer" (Eagan & Jaeger, 2008) courses that are extra tough. Gatekeeper courses are usually the lowest-level college courses students take in subjects like math, reading, writing, or science; these courses are not the developmental courses but are required courses for matriculation into degree programs (Tobias, 1992). Occasionally, gatekeeper courses are designed to weed out students and may be an additional roadblock to student success (Seymour, 2001). These gatekeeper courses sometimes prompt students to change their major or withdraw from school (Eagnar & Jaeger, 2008; Seymour, 2001), especially students majoring in math, science, and engineering (Eagnar & Jaeger, 2008). According to Bryk and Treisman's 2010 article, *Make math a gateway, not a gatekeeper*, math courses are the leading gatekeeper courses. Approximately 70% of students who take math courses are not successful even after repeating it multiple times; other students will avoid taking a math course during college and will never earn a college degree (Bryk & Treisman, 2010).

The task of evaluating students and placing/enrolling them in remedial math usually occurs at the institutional level. As Astin (1998) stated, "although individual institutions may have definitive standards for identifying remedial students, "the line" of demarcation is not consistent throughout higher education" (p.13). Parker, Barrett, and Bustillos (2014) noted further that in addition to institutional practices assessing and placing students in development courses, states may have policies that "influence institutional behaviors" (p. 37). This is the case in Mississippi, where at Mississippi public universities, students required to enroll in

developmental math are not allowed to register for college algebra until after completing remedial math with a D or higher (Atchison, 2018).

Unlike her sister institutions, the University of Mississippi (UM) requires a minimum math subscore of 19 on the ACT to take college algebra. However, this has not always been the case. Before the Fall of 2014, the math subscore needed to take college algebra was a 17. Now all first-time, full-time freshmen who receive less than 19 are required to enroll in remedial math. These students cannot persist in college algebra (Math 121) without receiving a passing score in developmental math (DS 099). Consistent with the other public schools in the state, students cannot persist in college algebra until after completing remedial math with a minimum mark of a "D."

LOCAL CONTEXT OF THE PROBLEM OF PRACTICE

Before progressing in this chapter, the readers must have a clear understanding of the research institution's local context. Therefore, in this section, the researcher provided a brief history of the four-year public institutions.

Located in northern Mississippi, the University of Mississippi (UM) was founded in 1848. It is the oldest and largest institution in the state and is recognized as the flagship institution—the University known for its research activity and is classified as R1: Doctoral University. The institution comprises sixteen academic units and offers over 120 programs of study; it also has a medical center located in Jackson, Mississippi. Across all campuses, the University has approximately 23,000 students (University of Mississippi, 2020). Over the years, several incidents led to the University gaining national attention, but one of the most memorable events in 1962 when James Meredith segregated the campus (University of Mississippi, 2020). Since 1962, the University has taken steps to diversify the student population and has espoused

a more "inclusive environment of intellectual inquiry" (University of Mississippi, 2020).

POSITIONALITY

Remedial education is a strategy for student success, and retaining first-time, full- time students who are required to enroll in developmental math is personal to me. This section describes how I share a personal and professional connection with my problem of practice.

Personal Background

Born in Greenwood, Mississippi, I was the middle of five children. My father, an alumnus of Mississippi Valley State University, worked as a correctional officer for Mississippi State Penitentiary and part-time at a local department store to support the family. My mother never completed high school and was a stay-at-home mom. With the majority of my father's time spent at work and my mother lacking an educational background, there was not anyone around to give me much assistance with homework. Despite these circumstances, my parents were adamant that education was the key to better well-being and encouraged us to get a college degree. I was the first child to attend college, and I was academically underprepared. Therefore, I was required to enroll in a developmental course.

As a freshman attending college after high school, I was not allowed to complete a credit-bearing math course until I successfully completed developmental math. Like many others, I did not understand why this course was a requirement for me, primarily because it was not counted towards graduation. I was also very embarrassed and did not tell anyone I was enrolled in the course. Over the semester, I worked hard and completed the course with an "A." The following spring semester, I enrolled in College Algebra. I was surprised to discover that the developmental math course I completed only months prior had not adequately prepared me

for College Algebra. The following semester I enrolled in College Algebra, and because I made an "A" in developmental math, I thought I was ready for the course. To my surprise, I was not. I do not know why, but I struggled in college algebra and was too embarrassed to solicit help from my friends because they did not realize that while they were taking college algebra, I was enrolled in a lower level math course. My instructor was not very helpful, and because of this, I contemplated dropping out of college because I did not think I was capable of succeeding. However, after long conversations with my parents, who asked me not to give up on earning a bachelor's degree, I devoted more time to the course and made a "C" in the class. I was not happy with the "C," but I realized that with hard work, I could do the work, and I kept that attitude through my undergraduate years. On May 10, 2003, I made not just my parents but also my entire family proud because I graduated from the University of Mississippi with a Bachelor of Arts degree. Several years later, the trend continued; after completing Secondary School in the Mississippi Delta, my niece decided to follow in my footsteps and was admitted into the University of Mississippi. She was required to enroll in remedial courses. However, her story did not have a successful conclusion. After repeating the same courses for two semesters; she dropped out of school and returned to the Delta where she is employed at one of the local fast-food restaurants. I broke the cycle and received my bachelor's degree. I wanted the same thing for my niece, but because she could not pass her remedial courses, she did not persist to graduation.

Professional Background

As an admissions officer, I serve as the Associate Director of Undergraduate Admissions at the University of Mississippi. In my role, I oversee the admissions and evaluation

processes for all new incoming transfer and first-time, full- time students. For the past fourteen years, I have had the privilege to work with students who have academic deficiencies. These deficiencies include, but are not limited to, failure to meet the minimum grade point average, the necessary core curriculum, or the required standardized test score. Each year, a significant number of students with academic deficiencies visit the Office of Admissions to complete one of the college preparedness exams (Accuplacer) and to discuss their educational options.

After an exhaustive review of the student's record, they sit scared and nervous as they await their admissions decision. Occasionally, it is a natural process to deliver the good news to the admissible students. However, in some instances, I have had to inform students that they were required to complete one or more developmental courses during their first semester. It is often tough to discuss these options with students, and I feel like a dream crusher after delivering the news. Watching the student's smiles turn into frowns after hearing that they will have to enroll in noncredit-bearing courses is heartbreaking. It is also tear-jerking to wondering how many of them will not persist to graduation because they will not conquer the remedial classes or that the remedial courses will not help them build the necessary skills to succeed in subsequent courses.

Thinking of my own educational experiences, my niece, and other students with lower scores in mind, I cannot help but wonder if the University of Mississippi is helping or hindering students by admitting them in these situations. I understand the institution is accepting the students because administrators believe in providing access to all. Still, I do wonder if it would be better to refer the students with academic deficiencies to a community college before allowing them to enroll at the four-year public institution or develop a better program to assist these students.

Future Plans

Having knowledge of the developmental process, paired with my own experience, and my passion for wanting the best for first-time, full-time students, especially students who are like me- born and educated in a poverty-stricken community- is the reason I chose to conduct this study. The study sought to contribute to the body of existing literature by evaluating the effectiveness of developmental math at the University of Mississippi. Due to conflicting results of other studies, there is a need for more research on these courses at the University of Mississippi. The researcher also provided a descriptive analysis of first-time, full-time students at UM, including their gender, ethnicity, and grades in intermediate and college algebra.

This research is covered in three manuscripts. The first manuscript included the introduction, the problem of practice, a brief history of the research location, and the researcher's personal and professional positionality. It also explored the conceptual framework of the study. Lastly, it introduced the methodology and research. The researcher presented the robust findings of the study in a second manuscript, and recommendations based on the findings were presented in manuscript three.

CARNEGIE PROJECT ON THE EDUCATION DOCTORATE (CPED)

This dissertation in practice (DiP) incorporates three manuscripts. The author is a part of the Ed.D with an emphasis in Higher Education cohort program at the University of Mississippi (UM), a member of the Carnegie Project on the Education Doctorate (CPED). The CPED Professional doctorate in education is centered around equity, ethics, and social justice. CPED was created to enhance professional practice by educating doctoral students to develop solutions to complex problems of practice. It was also designed to teach scholarly practitioners with professional work experience so that they know how to work with others to solve complex

problems (“About Us,” CPED Initiative, n.d.). This study's problem of practice focused on success for students who enroll in developmental math and college algebra at the University of Mississippi. I also looked at the students’ grades, gender, and ethnicity to determine which students are the least successful in the courses. The upcoming literature review section discussed how this problem of practice about developmental education relates to the CPED principles of equity and social justice.

LITERATURE REVIEW

In postsecondary curricula, offering remediation is a controversial issue that has been debated among higher education scholars. One of the significant problems in question is whether remedial courses should be offered at many four-year colleges and universities or if they should be limited to two-year institutions (Ignash 1997; Levin 2001; McCabe 2000; Roueche and Roueche 1999; Shults 2000). According to McCabe and Day (1998), to meet the needs of students, colleges and universities started offering remedial courses, which are intended to bridge the gap between student support services and academic departments (Kozeracki, 2002, 85). However, other researchers contended that developmental courses keep students from persisting in college instead of bridging the gap. Although developmental courses have been identified as positive by some, others proclaimed students are leaving higher education institutions because of them (Ignash 1997; Levin 2001; McCabe 2000; Roueche & Roueche 1999; Shults 2000).

Colleges and universities are admitting students with low mathematical skills (Lewis, 1998). Because these students are not prepared for the transition into college, the decline in mathematics performance is a phenomenon that has continued to be a national concern in the United States (Athuahene & Russell, 2016). Based on recent findings, approximately 46% of

first time, full-time students must enroll in either remedial English, math or both each year. Yet, these students have less than ten percent college completion rates (Jimenez, Sargrad, Morales, & Thompson, 2016). Therefore, retaining students who enroll in developmental courses is difficult for colleges and universities. This issue has become a problem for many public and private institutions and is why numerous students are not successful in college. Jimenez, Sargrad, Morales, and Thompson (2016) showed that approximately sixty percent of incoming first-year students are not academically prepared for college after high school. Authors Attewell, Lavin, Domina, and Levy (2006), found that about 20% of the students who take remedial courses will earn a degree or a certificate within an eight-year time frame. The low percentage for student retention is particularly problematic because it showed that students are occasionally not prepared for college and are unsuccessful. Enrollment in remedial math is a critical issue because the students who usually fall into this category are typically underrepresented minority students who suffer disproportionately due to weak math skills (Thiel, Paterman, & Brown, 2008). The increase in the number of academically underprepared students attending colleges and universities (Department of Education, 1991) with weak math skills has also decreased the number of students earning STEM degrees (Thiel, Paterman, & Brown, 2008).

Given that, my problem of practice focused on the success of the first-time, full-time students in college algebra after they complete developmental math compared to students who go directly into college algebra. Several bodies of literature were used to examine and identify the context in which this study was conducted. The purpose of this section was to frame the problem of practice with relevant bodies of literature to provide the conceptual frameworks by focusing on several elements of the problem of practice: remedial math, college algebra, math

completion, and math performance based on gender and ethnicity. This robust study provided relevant literature to support each of the essential elements.

Remedial math and math completion

Universities offer a range of math courses that cater to first-time, full-time students with various levels of background knowledge and career aspirations (Anthony, 2000). College-level beginner courses are offered under the assumption that students who enroll in them had recently completed a complementary math course in secondary school (Anthony, 2000). However, progressing to higher-level math courses has been an issue for students who begin the math sequence at the lower entry point (remedial math) (Bahr, 2012). Many of these students struggle to progress to the next level math course because some find themselves repeating developmental math semester after semester (Bahr, 2012). In fact, some studies show that students find themselves repeating developmental math more than four times (Attewell, Lavin, Domina, & Levey, 2006).

Repeating a single course several times can be disheartening to students. Primarily, they know they will not ever obtain their degree without completing the entry-level class and advance to at least one higher-level math course, leading to many students giving up or dropping out (Attewell, Lavin, Domina, & Levey, 2006). It is also not a fair, practical use of funds by the institution. Even though a "student's success depends on several factors, including their ability and previous knowledge of the subject, the effectiveness of the instructor, and their motivation to work hard enough to succeed" (Thiel, Paterman, & Brown, 2008, p. 47), I believe there is a flaw in the system. Something should be done to assist students stuck in these predicaments primarily because it affects a significant amount of first time, full-time students. In other words, students

who successfully completed remedial math should exhibit academic outcomes that are compared to those students who did not complete remedial math, all else being equal (Bahr, 2008).

The National Center for Education Statistics (NCES) is a governmental unit for collecting, analyzing, and reporting facts related to high educational data needed in the United States and other countries (2003). In 2003, the NCES conducted a study on remedial education using the Postsecondary Education Quick Information System (PEQIS). The PEQIS provided current national assessments of the prevalence and characteristics of developmental courses and enrollments in 2-year and 4-year postsecondary colleges and universities for first-time, full-time students during fall 2000 compared to remediation in fall 1995 (National Center for Education Statistics, 2003). In this study, NCES (2003) mailed surveys to approximately 1,242 eligible institutions, and 1,186 colleges and universities completed and returned the surveys. In their findings, NCES (2003) discovered that public schools are more likely to offer remedial courses than private two- and four-year institutions. The National Center for Education Statistics (2003) data also showed a significant increase in the overall number of students who needed remedial courses in 2000 compared to the 1995 data at both public and private two- and four-year institutions. However, as noted in the table below, the data also shows the percentage of entering first-year students who enrolled in developmental courses was higher in mathematics than reading and writing courses (National Center for Education Statistics, 2003).

Table 5

Number of degree-granting institutions that enrolled freshman, and the percent of those institutions that offered remedial reading, writing, or mathematics courses, by institutional type: Fall 1995 and 2000

Year and institutional type	Number of degree-granting institutions with freshmen	Percent of institutions that offered remedial courses in:			
		Reading, writing, or mathematics	Reading	Writing	Mathematics
2000					
All institutions	3,230	76	56	68	71
Public 2-year	1,080	98	96	96	97
Private 2-year	270	63	37	56	62
Public 4-year	580	80	49	67	78
Private 4-year	1,300	59	30	46	49
1995					
All institutions	2,990	77	57	71	72
Public 2-year	940	100	99	99	99
Private 2-year	330	64	30	62	62
Public 4-year	540	80	52	71	78
Private 4-year	1,180	62	33	52	50

NOTE: Data reported for fall 2000 are based on Title IV degree-granting institutions that enrolled freshmen in fall 2000. Data reported for fall 1995 are based on degree-granting institutions that enrolled freshmen in fall 1995. The numbers of institutions have been rounded to the nearest 10.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Postsecondary Education Quick Information System, "Survey on Remedial Education in Higher Education Institutions: Fall 1995," 1995; and "Survey on Remedial Education in Higher Education Institutions: Fall 2000," 2001.

Source: Retrieved from
** https://pdfs.semanticscholar.org/3916/8aa66a06e4fc20efc4f0a4b3aa32e6457366.pdf

In his study, Bahr (2008) tested the effectiveness of postsecondary remedial math courses, using the population of 85,894 first-time, full-time students who were enrolled in one of the 107 community colleges. He found that students who attained college-level math skills established long-term academic attainment compared to students who achieved college-level math skills who did not complete a remedial math course. He also found that students who did not complete remedial classes constitute most students who enrolled in remedial math coursework. The majority of students who enrolled in higher-level math courses experience outcomes that were considerably less favorable. Bahr (2008) insisted that developmental math is beneficial for students to pass the course. While some scholars have argued that students can benefit from

developmental courses (Bettinger &Long, 2009), others suggested that it will take students who are enrolled in developmental classes longer to complete college (Atewell, Lavin, Domina, & Levy, 2006).

Bettinger and Long (2009) studied the effects of developmental courses in Ohio. They compared academically similar students from different institutions who had different experiences with remedial classes. They found that remedial students at four-year institutions in Ohio were more likely to persist in college and earn a degree than students who had similar scores but did not enroll in developmental courses (p. 6).

Using a regression discontinuity (RD) technique, Boatman & Long (2010) conducted a quantitative methodology research study to measure the effectiveness of remedial and developmental courses. Their study was conducted using 12,200 students who enrolled in a public institution in Tennessee during the fall of 2010 (Boatman & Long, 2010). They discovered their results depended upon the subject areas and how the students prepared for class (Boatman & Long, 2010). Boatman and Long (2010) concluded with two hypotheses. They found that enrolling in developmental courses could provide students with the necessary skills needed to achieve academically. They also determined that courses can slow down the students' progress because they do not count toward graduation. Students in developmental classes are less likely to complete their degree in six years or complete fewer courses in their first three years than students enrolled in college-level courses (Boatman & Long, 2010).

Thiel, Peterman, and Brown (2008) found that there was about a 55 percent success rate of earning C- grade in college algebra in 2002 at the University of Missouri-St. Louis. They believed the low percentage was not only confined to the University of Missouri but other institutions, too, due to the barriers associated with college algebra. Therefore, using a

curriculum approach, they used their findings to develop the Roadmap to Redesign (R2R) of college algebra. The R2R program was a model for high-enrollment courses that outlined the use of technology to lessen lecture time and encourage active learning, a constant review of student development, and the skills to keep students motivated on the work they needed to succeed (Thiel, Peterman, & Brown, 2008). Using this model, they saw significant results. After three years, they found that twenty percent of the students received higher grades in the course (Thiel, Peterman, & Brown, 2008).

Several other researchers have published literature about remedial courses and the impact these courses have on students. One common reason researchers have continued to look into this issue is that students who enroll in developmental courses are not performing better than the students who do not enroll in the classes (Goudas & Boylan, 2012). Therefore, they, too, are wondering if the courses are beneficial to the students.

Gender/ethnicity and math performance

Extensive research has conclusively demonstrated that children's social class is one of the most significant predictors—if not the single most significant predictor—of their educational success (Garcia & Weiss, 2017). And other studies have shown that students of color are significantly more likely to enroll in college remedial courses than white students with the same academic skills, preparation, and social background (Attewell, Lavin, Domina, & Levey, 2006; Knopp 1996). However, researchers (Clayton, Crosta, & Belfield, 2014; Boylan, Bonham, and Bliss, 1994) found whites are the majority enrolled in developmental courses. Based on their findings, approximately two-thirds of students enrolled in developmental education were white. One-third were minorities, with the largest minority groups in remedial education being Hispanic and African Americans (Scott- Clayton, Crosta, & Belfield, 2014;

Boylan, Bonham, and Bliss, 1994). These authors also found that women and men are equally represented in these courses at two and four-year institutions (Clayton, Crosta, & Belfield, 2014; Boylan, Bonham, & Bliss, 1994).

Authors McCabe and Day (1998) believed that the makeup of the traditional American family is tied to their socioeconomic status and the children's educational challenges. Based on their findings, over 60% of American children will grow up in a single-parent home, and approximately 77% of white children, 65 % of Hispanic children, and 36% of African American children live in a two-parent household (McCabe & Day,1998, p. 13; Mitchell 1996). They also discovered that most students needing remediation are from lower socioeconomic backgrounds (Boylan & Saxon, 1998). Such a refusal to offer developmental courses at colleges and universities could severely impact educational opportunities for students from poverty, especially since minorities are amongst the poor (Lavin & Hyllegard, 1996; Dalaker, 1999; McCabe & Day, 1998).

Detailed in table 1.5 and table 1.6, McKenney and Ruben (as cited in McCabe & Day, 1998) provided the percentage of first-time, degree-seeking student's success rate for remedial and non-remedial students and the fall-to-fall retention rates by ethnicity and student classification based on data from Community College of Denver during the fall 1996-1997 academic year. These numbers showed that there was little difference between the student enrolled in remedial courses and the students enrolled in non-remedial courses. The fall-to-fall retention was excellent for the students who started in the developmental courses. However, the numbers from Denver Community College also showed that more students of color enrolled in remedial classes compared to their white peers and that there was not a significant difference between the ethnicities of the student who took non-remedial courses.

Table 6

First-Time, Degree-Seeking student success states for remedial and non-remedial students

Student Classification	First Semester Completion	Fall to Spring Retention	Fall to Fall Retention
Remedial	**84%**	**79%**	**53%**
Non-Remedial	**83%**	**69%**	**42%**

Source: Retrieved from McCabe & Day 1998

Table 7

Fall- to –Fall Retention Rates by Ethnicity and Student Classification

Student Classification	Remedial	Non-Remedial
People of Color	**55%**	**42%**
White	**49%**	**43%**

Source: Retrieved from McCabe & Day 1998

While Denver community colleges represented a different kind of institution, the review of McKenney and Ruben's research is essential to this literature review. The study showed that in 1996/1997 when this study was conducted, there was a more even distribution amongst students who took more non-remedial courses in terms of race. It also showed that previously the enrollment at this community college was more rationally equal (more equality) in the percentage of the students enrolled. The study highlights there was a significant number of students of color enrolled at the community college of Denver, which could also have an impact on the number of students enrolled in developmental courses.

Looking at first-year, full-time students from fall 2009 and fall 2010, Atuahene and Russell (2016) conducted a study on students' readiness for college-level math courses at a four-year public institution. Like other universities, the University of California used the student's college entrance exam to determine math placement. There were 1,315 students used in the

study who were enrolled in at least one math course, which ranged from developmental math and higher-level mathematics courses (Atuahene & Russell, 2016). Of the 1,315 students, approximately 80% were white, and the remaining 20% were underrepresented minorities (URM) - fifty-five percent were females, and 45% were males (Atuahene & Russell, 2016). Atuahene and Russell found that even though minorities made up a small sample of the study, most of the group was required to take developmental math (Table 1.7). While only about 8.5% of the white students were placed in developmental math, the remainder of the white students enrolled in college-level math courses (Atuahene & Russell, 2016).

Table 8

Results of t-Test and Descriptive Statistics Comparing Mean Performance in Select Math Courses by Ethnicity

	Majority				URM								
Course	*N*	*M*	*SD*	*SEM*	*N*	*M*	*SD*	*SEM*	*T*	*p*	*df*	CI	Cohen's *d*
Algebra and Trig.	349	2.47	1.22	0.07	61	1.76	1.34	0.17	4.11	0.00	408	0.37, 1.05	0.55
Calculus-based	168	1.90	1.39	0.11	20	1.82	1.56	0.35	0.25	0.80	186	0.57, 0.74	0.06
Developmental	95	2.58	1.25	0.13	126	2.48	1.15	0.1	0.66	0.51	219	0.21, 0.43	0.09
Statistics	323	2.76	1.10	0.06	42	2.45	1.01	0.16	1.73	0.08	363	0.42, 0.66	0.29

Source: Retrieved from Atuahene and Russell, 2016

Atuahene and Russell also determined that high schools equipped with qualified math instructors prepared students for college-level mathematics than students who were faced with socioeconomic disadvantages. They also found that there was a considerable disparity in math preparation between white and ethnic minority students.

According to NELS:88, researchers cannot determine from the NELS:88 data to what extent African American students are required to take remedial courses, or are advised to take such courses, or whether they choose to enroll in the classes (Attewell, Lavin, Domina, &

Levey, 2006). In reality, remedial/developmental education encompasses a much broader group of students and many ability levels. Therefore, even though about 50% of students from families in the lowest quartile of socioeconomic status (SES) are likely to enroll in remedial coursework, about 25% of the students from the highest quartile SES families also registered for remedial courses in college (Bahr, 2008). In this way, taking remedial or developmental courses in college is not limited to economically disadvantaged students. However, other studies suggested that non-white females with low high school GPAs and college entrance exams, which most likely came from a low socioeconomic background, are the students who typically enroll in remedial courses (Merisotis & Phipps, 2001; NCES, 2003, 2008).

Barry and Dannenberg (2016) reported in 2011 that more than half a million high school graduates enrolled in remedial courses during their freshman year of college. These students were from every social class and attended public and private k-12 institutions (Barry & Dannenberg, 2016). Single household families were forced to pay over three thousand dollars towards their child's developmental courses. Some families had to borrow money for these courses because they were the same price as any other college course (Barry & Dannenberg, 2016). Due to this, Barry and Dannenberg (2016) wondered if the families were investing in their child's future or losing money.

Furthermore, they found that after one year, more than a million students were required to take remedial courses (Barry & Dannenberg, 2016). Their data showed that seventy-four percent of the full-time freshman who enrolled in remedial classes at a four-year college were more likely to drop out of college. Twelve percent of those who attended community college did the same (Barry & Dannenberg, 2016). Barry and Dannenberg (2016) concluded that

students are not prepared for college because the K-12 system is failing them by not preparing them.

In a five-year study, Attewell, Lavin, Domina, and Levey (2006) used the National Educational Longitudinal Survey (NELS:88) to determine the effect, either positive or negative, that developmental courses have on students. They found that some students had a positive outcome and graduated from colleges, while other students did not experience the same outcome of completion (Attewell, Lavin, Domina, & Levey 2006). Furthermore, these scholars discovered that students' success in school was not solely based on enrollment in remedial courses, but also on their high school education and the demographics of the area they lived in or their family background (2006). Their analysis found that students from all geographical regions could be required to complete developmental courses. Still, the students who fall in the lowest quartile of the social, economic status were more likely to enroll in developmental classes but were less likely to graduate in four to five years.

Critics of remedial education have contended students who enroll in developmental courses will not graduate. Still, supporters of developmental courses have seized on the fact that African American students from poverty-stricken families and students whose primary language is something other than English are significantly overrepresented in developmental courses (Bahr, 2008; Attewell, Lavin, Domina, & Levey, 2006). Subsequently, some policies blocking students who need remedial/developmental classes from attending a four-year college or university could significantly decrease the probability that these students would ever obtain bachelor's degrees (Lavin & Weininger, 1998). Supporters of remediation, therefore, have insisted that the conversation about remediation is an attack on access to college.

Based on Athuahene's and Russell's (2016) findings, the majority of high school students, especially underprepared minorities from low socioeconomic backgrounds, are academically underprepared for college-level math (ACT, 2016) at four-year public institutions in the United States. In their 2005 study, authors Green and Winter's discovered that approximately 34% of high school graduates obtained the required skills to complete college-level math. They also found that during the same year, about 23% of African American students and approximately 20% of African Americans were college-ready when they left high school.

Authors Brothen and Wambach (2012) found that participating states created a developmental studies program centered around remedial courses for unprepared African Americans in hopes that minority students would have the opportunity to attend colleges and universities. With additional research showing that few Black males enroll in college, it is safe to assume more Black females enroll in developmental courses than their male counterparts (Davis & Palmer, 2010). Davis and Palmer (2010) conducted a study on the effects of postsecondary remediation for African-American students. During this study, it was found that Black students were more likely to rely on postsecondary remediation as a means for obtaining access to higher education and that they are nearly twice as likely as white students to enroll in a remedial program (Davis & Palmer, 2010). They also found that many Americans leave high school underprepared for college-level coursework, with African-Americans accounting for 8% of that total (Davis & Palmer, 2010).

According to Aldeman's (1999) analyses of the "High School and Beyond," which followed a cohort of students who graduated high school in 1992, students who took remedial courses in college are less likely to graduate (p.74). His study showed that 39% of the students who enrolled in remedial classes earned their bachelor's degree compared to the 69% of students

who did not take a remedial course. However, he ceased to predict graduation after adding secondary school academic performance and preparation to the equation (1999, p.75); his finding implied that poor high school preparation rather than taking remedial coursework prevents students from completing college. Researchers Shields and O'Dweyer (2017) also provided detail about the complicated relationships among students and courses. They insisted that remedial courses "hold a crucial position at the intersection of individual and institutional factors affecting college completion" (p. 86).

Methodology

Researchers Lavin and Weininger's (1998) analyses determined that remedial placement is far from an academic death sentence and that after completing remedial courses, many students do graduate (p. 4). However, historical data showed that many students do not persist in college because they are not successful in the gateway courses, like college algebra (Bettinger & Long, 2009).

Using the Statisttical Package for the Social Sciences (SPSS), this quantitative study analyzed archived data of first-year, full-time, academically underprepared students who received low math subscores on the college entrance exam. I examined student success outcomes for students enrolled in developmental education, particularly developmental math, to determine if the course was "a hole that students' never emerge" from (Jimenez, Sargrad, Morales, & Thompson, 2016). I proposed to look at the grades (GPA) of two groups of students enrolled in college algebra with a math ACT subscore of 17 or 18 to determine if UM should revise their developmental policy again to determine student readiness for college algebra. To be in alignment with other institutions in the state, the University changed the developmental policy during fall 2014.

The first group enrolled directly in college algebra at UM between the 2011 and 2013 academic years which was before the policy changed for remedial math changed from a 17 to a 19 math ACT subscore. The second group enrolled in college algebra after completing developmental math either in 2016, 2017, or 2018 academic year. I compared multiple groups using the following research questions:

Research Questions and Hypotheses

1. Is the average grade (on a 4 point scale) in college algebra of students with an ACT math subscore of 17 or 18 who did not take remedial math significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math first?
2. Is there a correlation between the grade earned in remedial math and the grade earned in college algebra by students that scored a 17 or 18 math subscore and took remedial math first?

The University of Mississippi accepts ACT and SAT scores to determine placement. For this study, all SAT scores were converted to ACT.

Currently, all enrolled students must have a minimum ACT math sub-score of 19 before they can enroll in a credit bearing math course. If the students have not met the math benchmark set by the institution, they are required to enroll in developmental math first. According to historical data collected from the Office of Institutional Research, Effectiveness, and Planning at the University of Mississippi, 7.8% of students dropped out of college algebra between the academic years of 2011-2013 (before policy change), and 21.4% dropped out after the math-subscore was raised from 17 to 19. When reviewing the table, it is essential to note that the students dropped out of the course before the census date, which was at midnight on the last day to add or drop classes for the fall term.

Table 9

UM Math 121 Fall Enrollment Statuses

Year	Number of Students Enrolled in Math 121	Number of students Dropped Math 121 before the end of the fall semester	Overall Percentage Dropped Math 121 before the end of the fall semester
2011	1063	86	8%
2012	1117	85	7.6%
2013	1027	78	7.6%
Total	**3207**	**249**	**7.8%**
2016	725	174	24%
2017	708	128	18.1%
2018	636	141	22.2%
Total	**2069**	**443**	**21.4%**

*For Math 121, Enrollment Status for each year and term at Official Census (initial census before complementation of Official Census) for each student was established. Outcome Status includes those students that were included at Outcomes. Those students that were included in the Outcomes but had an Earned and Graded Credit hours of 0/0 were not counted. These students include withdrawals, audits and incomplete grades.

In attempt to answer the research questions, the following conceptual hypotheses were written:

R1. Is the average grade (on a 4 point scale) in college algebra of students with an ACT math subscore of 17 or 18 who did not take remedial math significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math first?

H1. The average grade (on a 4-point scale) in college algebra of students with an ACT of 17 or 18 who did not take remedial math is significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math before enrolling in college algebra.

R2. Is there a correlation between the grade earned in remedial math and the grade earned in college algebra by students that took remedial math first?

H2. There is a correlation between the grades earned in remedial math and the grade earned in college algebra by the students that took remedial math first.

SUMMARY AND NEXT STEPS

Authors Boylan and Saxon (1999a) argued, "the essential purpose of remedial courses was to prepare students to be successful in the college curriculum" (p. 6). Authors McCabe & Day (1998) insisted that students are overlooked because they were not equipped with the necessary skills to obtain their goals. As outlined throughout this study, many scholars are advocates, and others are adversaries or opponents (Boylan & Saxon, 1996a; and McCabe & Day, 1998) of remedial courses (Goudas & Boylan, 2012).

Accordingly, with this DIP, I compared the average grade (on a 4-point scale) in college algebra of two groups of first-time, full-time students at the University of Mississippi before and after a change in policy for students' placement in development math. Specifically, this study looked at two groups of students' grades over three years, comparing two large cohorts of students who enrolled in college algebra with a math ACT subscore of 17 or 18 before and after a policy change.

In this manuscript, I provided an introduction, discussed the problem of practice, and revealed the research questions that guided my study. In manuscript two, data gathered from the University of Mississippi's Office of Institutional Research, Effectiveness, and Planning is presented and interpreted. In manuscript three, the findings are discussed along with implications for policy and practice.

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MANUSCRIPT II: DATA INTERPRETATION

INTRODUCTION OF THE PROBLEM OF PRACTICE

Each year, students graduate high school with the hopes of attending college. However, because of a single assessment, usually either the student's score on the ACT or SAT, many of those students are informed that they are not adequately prepared for some college-level courses (Schak, Metzger, Bass, McCann & English, 2017, p. 1). As a result, they are placed in remedial or developmental classes. According to Schak et al. (2017), between the academic years 2011 to 2012 about one-third of first-time, full-time students were enrolled in at least one developmental course. Fifty-nine percent of those students were enrolled in developmental math (pp 3-5). In addition, based on their research, these authors also believed that the developmental courses could be a barrier to college completion or offer an opportunity for academic enrichment (Schak et al., 2017).

While some authors have argued that developmental education still serves its original purpose, which is to provide access to all students and assist with closing the achievement gap by preparing students for college-level courses, other researchers are pushing for a reevaluation of developmental education because of low levels of course and degree completion (Bailey, Bashford, Boatman, Squires, & Weiss, 2016). Therefore, to support this study and ensure that first-time, full-time students are prepared for college-level courses, my problem of practice sought to determine the effectiveness of required enrollment in remedial math courses and if those courses were preparing students for college algebra at the University of Mississippi. Using pre-existing data collected from the Office of Institutional Research, Effectiveness, and Planning, an independent sample t-test, and correlation analysis were conducted to examine the outcomes

for students enrolled in remedial math. The researcher looked at the grades (GPA) of two groups of students who enrolled in college algebra with a Math ACT subscore of 17 or 18. The first group was first-time, full-time students who enrolled directly in college algebra. The second group was first-time, full-time students who enrolled in college algebra after completing developmental math. The research questions and hypothesis used in the study were:

Research Questions and Hypotheses

R1. Is the average grade (on a 4-point scale) in college algebra of students with an ACT math subscore of 17 or 18 who did not take remedial math significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math first?

H1. The average grade (on a 4-point scale) in college algebra of students with an ACT of 17 or 18 who did not take remedial math is significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math before enrolling in college algebra.

R2. Is there a correlation between the grade earned in remedial math and the grade earned in college algebra by students that took remedial math first?

H2. There is a correlation between the grades earned in remedial math and the grade earned in college algebra by the students that took remedial math first.

Throughout this manuscript, the researcher provided the reader with an overview of the research institution, the student's population, description of courses and grading scale, data collection, the research design, and statistical analysis, limitation of the study, the findings, and a summary of the manuscript.

Research Institution and Student Population

The University of Mississippi is a four-year public institution located in Oxford, Mississippi. The institution is known for its research and is classified as an R1: Doctoral University. It comprises sixteen academic units and offers over 120-degree programs and certifications (Mississippi, 2020). The current total enrollment for fall 2021 for the main and regional campuses is 18,668. Three thousand, five hindered, and eighty-fours of the total enrolled were first-time, full-time students for the fall, and according to Lisa Stone (2021), this is the largest freshman class in the university's history. UM is a predominantly white institution (PWI). Therefore, there are currently only 12.4% African American students and 12.4% Hispanic/Latino or unknown students attending the university.

The population for this study included students enrolled at the university from fall 2011 to fall 2013 and fall 2016 to 2018. The years are divided into two different periods to allow time before and after the developmental math policy change. In 2011, the developmental policy required all students with less than a 17 math subscore to enroll in developmental math. However, in 2014, the policy changed, and the minimum math requirement was changed from a 17 to 19. The entire policy can be found in Appendix A and B. This way, the researcher could use data that would compare students with similar academic credentials. The following chart shows the total enrollment for the study period.

Table 10

Fall 2011-1013: 2016-2018 Enrollment

Year	Total Enrollment (All Campuses)	Total Undergraduate	First-Time, Full-Time Freshman
2011	17,085	14,159	3,095
2012	18,224	15,346	3,569
2013	18,794	16,060	3,373
2016	20,827	18,084	3,969

2017	21,260	18,517	3,984
2018	20,890	18,121	3,697

Source: Retrieve from https://irep.olemiss.edu/fall-2020-2021-enrollment/

Instrumentation and Placement Process

At the University of Mississippi, the ACT and SAT are the main exams used to determine placement. However, all SAT scores were converted into ACT scores for this study. The American College Testing, also known as the ACT (2020), is an "entrance exam used by most colleges and universities in conjunction with high school GPAs to make admission decisions in some states. The exam measures college readiness using benchmark scores in core curriculum areas or subjects" (ACT, 2020). Over 225 higher education institutions accept this exam. The exams cover four primary areas: English, mathematics, reading, and science reasoning (ACT, 2020). The score in each subject area ranges from 1 – 36 and is divided by four to calculate an overall score or composite (ACT, 2020).

The students in this study were considered underprepared for college algebra because they received a 17 or 18 in the math subarea of the ACT between 2016 to 2018 and were required to enroll in remedial math. However, from 2011 to 2013, students with an ACT math subscore of 17 or 18 were not required to take remedial math and enrolled directly into college algebra. This was possible because, from 2011 to 2013, students with a 17 or 18 ACT math subscore could enroll directly in college algebra. However, in 2014, the policy changed, and the required ACT math subscore increased from 17 to 19 (see Appendices A & B).

Description of the courses and Grading Scale

At the University of Mississippi, the remedial math course is coded as Intermediate Algebra (DS 099). Students who do not meet the minimum math requirement to enroll in the credit-bearing course are required to register in the class during their first semester of enrollment

and must continue in the class until they receive a passing grade of a "D" or higher. While enrolled in intermediate algebra, the students cannot enroll in other math classes (Mississippi, 2021).

After passing intermediate algebra, students could enroll in credit-bearing math courses, and the majority of them choose to take college algebra. College algebra is coded as Math 121 at UM. While enrolled in college algebra, students are taught how to solve different types of equations like linear, quadratic, and exponential (Mississippi, 2021). They are also introduced to other algebra functions, graphing, and variables (Mississippi, 2021). In addition to completing the three-hour course, the students must enroll in a mathematics lab designed to provide additional assistance to the students enrolled in the classes.

The variables used in this study to determine if the mean GPAs are significantly different and if a correlation exists between the courses are the grades earned in intermediate and college algebra are the students' ACT math subscore. As mentioned above, the ACT scores range from 1-36. The University of Mississippi uses a 4.0 grading scale to determine letter grades. The grade-point average (GPA) is computed by dividing the number of A, B+, B, B-, C+, C, C-, D, and F-graded hours attempted at The University of Mississippi into the total number of grade points earned at the university. Grade points per credit hour are assigned as follows: A = 4.0, A- = 3.7, B+ = 3.3, B = 3.0, B- = 2.7, C+ = 2.3, C = 2.0, C- = 1.7, D = 1.0, and F = 0 (Mississippi, 2021).

DATA COLLECTION

The data used for this study was received from the University of Mississippi's Office of Institutional Research, Effectiveness, and Planning. The anonymized data set included random identifiers for each student, the year the student enrolled in DS 099 and Math 121, and the

student's grades in the course(s), gender, and ethnicity. There were 3,375 students included in the data set. However, of the 3,375, only 981 of the students completed both intermediate and college algebra.

The data was stored on a password-protective drive and was only shared with the dissertation chair and methodologist for the research study.

Research Design and Statistical Analysis

Using the Statistical Package for the Social Sciences (SPSS) version 28, this quantitative study analyzed archived data of first-year, full-time, academically underprepared students who received low math subscores on the college entrance exam. The researcher examined student success outcomes for students enrolled in developmental education, particularly intermediate math, to determine if the course is "a hole that students' never emerge" from (Jimenez, Sargrad, Morales, and Thompson, 2016). Finally, the researcher looked at the grades (GPA) of two groups of students enrolled in college algebra with a Math ACT subscore of 17 or 18 to determine if UM should revise their developmental policy to assess student readiness for college algebra.

The study utilized an independent sample t-test for the first research question. For the second research question, a correlational analysis was used to measure a relationship between students' math ACT scores and their grades received in intermediate and college algebra.

An independent sample t-test was used to compare the means of the two separate groups to determine if there is statistical evidence that the associated population means are significantly different. The independent samples t-test is a parametric test. The variable used in the test is known as the dependent variable, test variable, and independent variable, or grouping variable (Hinkle, Wiersma, & Jurs, 2003). However, before interpreting the data of the t-test, the researcher had to determine if equal variances were assumed or not assumed by using Levene's

Test for Equality of variances. This was determined by using the significant value (sig. value). If the sig value was greater than 0.05, we assumed the variances were equal, but equal variances were not assumed if the sig value was less than 0.05 (Hinkle, Wiersma, & Jurs, 2003).

According to authors Hinkle, Wiersma, & Jurs (2003), correlation analysis in research is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. In addition, it calculates the level of change in one variable due to the difference in the other (Hinkle, Wiersma, & Jurs, 2003).

The most common correlation coefficient used in behavioral science is the Pearson production-moment correlation coefficient symbolized by the letter "*r.*" The correlation between the variables can be either positive, negative, or no correlation (Hinkle, Wiersma, & Jurs, 2003). A positive correlation between the two variables means both variables are moving in the same direction. A negative correlation means the variables are moving in opposite directions, and no correlation exists when the variables do not affect one another (Hinkle et al., 2003). The correlation coefficient ("*r*") was determined by the covariance between two variables divided by the product of the standard deviations of two variables.

$$r = \frac{S_{sy}}{S_x S_y}$$

The S_{sy} is the covariance, and S_x and S_y are the standard deviations of each variable (Hinkle et al., 2003). The correlation coefficient ("*r*") ranges from -1.0 to +1.0. The closer r is to +1 or -1, and the more closely the two variables are related. If "r" is close to 0, it means there is no relationship between the variables (Hinkle et al., 2003). The coefficient of determination, r^2, is the square of the correlation coefficient and equals the proportion of the total variance in Y associated with the variance X. According to Hinkle et al., the term "associated" is used and not "due to" because "due to" implies causation (2003). Yet, causality implies correlation, but

correlation does not imply causality and should be based on logic and not mathematics (Hinkle et al., 2003). The statistical significance of "r "when testing the null hypothesis is listed below (Hinkle et al., 2003, p. 109).

Table 11

Rule of Thumb of Interpreting the Size of Correlation Coefficient

Size of Correlation	Interpretation
.90 to 1.00 (-.90 to -1.00)	Very high positive (negative) correlation
.70 to .90 (-.70 to -.90)	High positive (negative) correlation
.50 to .70 (-.50 to -.70)	Moderate positive (negative) correlation
.30 to .50 (-.30 to -.50)	Low positive (negative) correlation
.00 to .30 (.00 to -.30)	Little if any correlation

Adopted from "Applied Statistics for the Behavioral Sciences, 5th ed, by Hinkle, D.E. Wiersma, W., and Jurs, S.G, 2003. Copyright 2003 by the American Psychological Association.

Limitation of Study

The primary focus for the study was on first-time, full-time students who progressed from intermediate algebra and later enrolled in college algebra. Therefore, some students were removed from the data set because they withdrew from intermediate or college algebra. Other limitations included not knowing how many of the students referenced in the study repeated the courses, the number of days the students missed class or if the students needed accommodations due to a learning disability, and not knowing the students' financial situations. Another limitation was that the students enrolled in the courses during different years. Due to the students taking the courses during different times of their college careers, they were also registered in different sections of the classes and had different instructors. For example, the instructors for college algebra could have been either a full professor or a graduate student. In addition to the student having different instructors, the grade point averages (GPAs) could also be another limitation.

The University of Mississippi gives the instructors the ability to use either the standard grading scale or the +/- scales. Therefore, because the students were assigned different instructors, the same grading scale was not used for all the students in the data set.

PRESENTATION OF FINDINGS

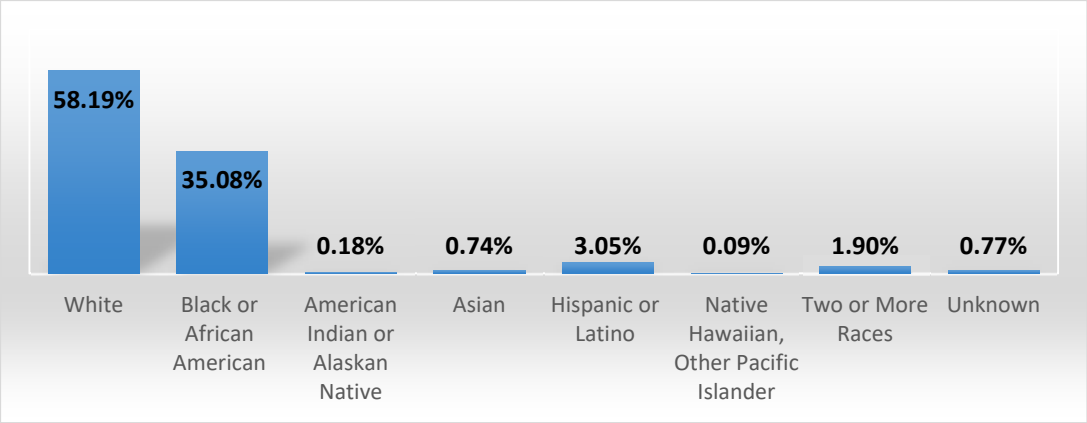
The study was conducted to determine if there was a significant difference between the grades for the student who enrolled in developmental math compared to those who enrolled directly in college algebra. The study also determined if there was a correlation between the students' grades who took both intermediate and college algebra. The data set was composed of students who took the course between fall 2011 to fall 2013 and fall 2016 to fall 2018. The study looked at two different points in time to include students before and after the policy change. Descriptive statistics and two research questions were collected for this study. An analysis of the findings are presented within the following sections of this manuscript.

Descriptive Statistics

To provide a greater understanding of the data set provided in the study, the following descriptive data was collected. The total population of the students used in the study was 3375 students. 58.19% White, 35.08% Black or African American, 0.18% American Indian or Alaskan Native, 0.74% Asian, 3.05% Hispanic or Latino, 0.09% Native Hawaiian, Other Pacific Islander, 1.9% Two or More Races, and 0.77% Unknown as shown in figure 1.

Figure 1

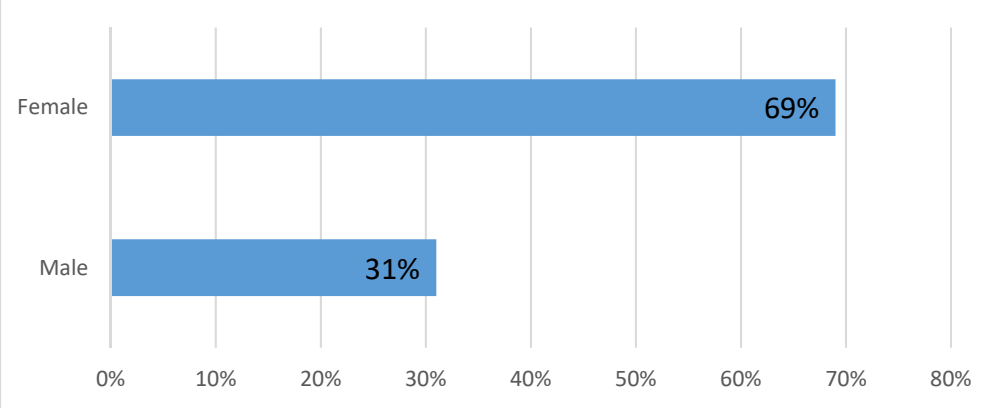
Percentage of Students by Ethnicity for the entire data set



The gender included 31% male and 69% female as shown in figure 2.

Figure 2

Percentage of Students by Gender for the entire data set



The grades for the students who enrolled in College Algebra are 13.84% A, 2.52% A-, 3.79% B+, 14.96% B, 3.20% B-, 3.70% C+, 16.21 C, 0.89% C-, 14.34% D, and 28.55% F as shown in Table 12.

Table 12

Grades for students who took College Algebra for the entire data set

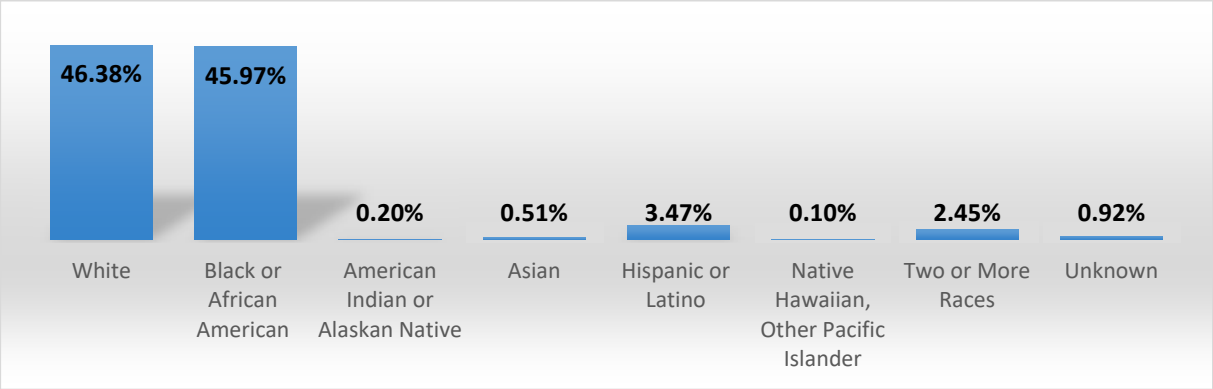
Letter Grades	# of students	Percentage
A	467	13.84%
A-	85	2.52%
B+	128	3.79%

B	505	14.96%
B-	108	3.20%
C+	125	3.70%
C	547	16.21%
C-	30	0.89%
D	484	14.34%
F	896	26.55%

Of the data collected, 981 students enrolled in college algebra after completing intermediate algebra. The ethnicity for this population of students was 46.38% White, 45.97% Black or African American, 0.20% American Indian or Alaskan Native, 0.51% Asian, 3.47% Hispanic or Latino, 0.10% Native Hawaiian, Other Pacific Islander, 2.45% Two or More Races, and 0.92% Unknown as shown in figure 3.

Figure 3

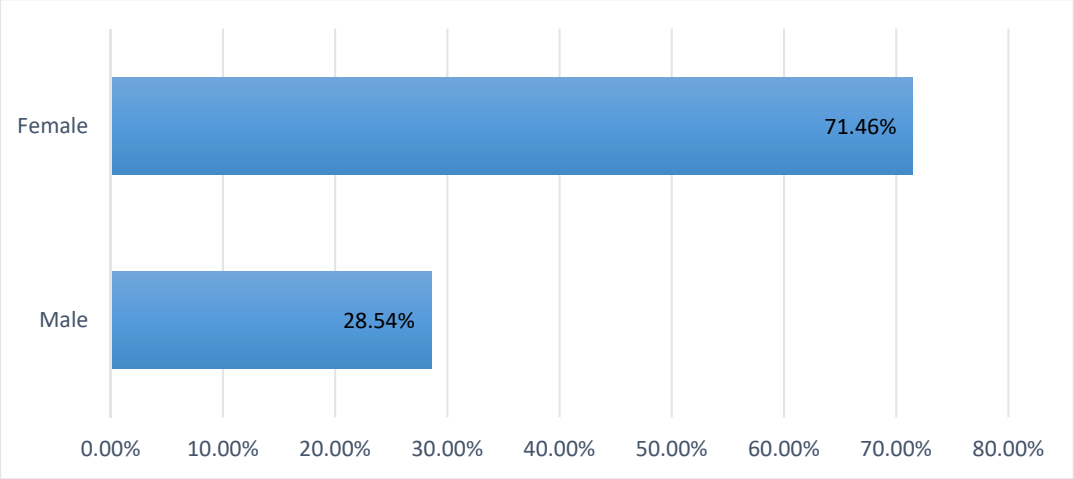
Percentage of Students by Ethnicity for the student who took Intermediate and College Algebra



The gender for this population of students included 28.5% male and 71.46% female, as shown in figure 4.

Figure 4

Percentage of Students by Gender for the student who took Intermediate and College Algebra



The grades for the students who enrolled in the class were 35.27% A, 0.61% A-, 0.31% B+, 28.54% B, 0.61% B-, 0.10% C+, 23.04 C, 0.41% C-, 4.79% D, and 6.32% F as shown in Table 13.

Table 13

Grades for students who took Intermediate Algebra as first-time, full-time student

Letter Grades	# of students	Percentage
A	346	35.27%
A-	6	0.61%
B+	3	0.31%
B	280	28.54%
B-	6	0.61%
C+	1	0.10%
C	226	23.04%
C-	4	0.41%
D	47	4.79%
F	62	6.32%

The grades for the students who started in college algebra as first-time, full-time students were 16.83 % A, 2.92 % A-, 4.18% B+, 17.04% B, 3.63% B-, 3.97% C+, 16.25% C, 0.71% C-, 13.99% D, and 20.47% F as shown in Table 14.

Table 14

Grades for students who took College Algebra as first-time, full-time student

Letter Grades	# of students	Percentage
A	403	16.83%
A-	70	2.92%
B+	100	4.18%
B	408	17.04%
B-	87	3.63%
C+	95	3.97%
C	389	16.25%
C-	17	0.71%
D	335	13.99%
F	490	20.47%

The grades for the students who enrolled in the college algebra after taking intermediate algebra were 6.52 % A, 1.53 % A-, 2.85% B+, 9.89% B, 2.14% B-, 3.06% C+, 16.11% C, 1.33% C-, 15.19% D, and 49.39% F as shown in Table 15.

Table 15

Grades for students who took College Algebra after enrolling in Intermediate Algebra

Letter Grades	# of students	Percentage
A	64	6.52%
A-	15	1.53%
B+	28	2.85%
B	97	9.89%
B-	21	2.14%
C+	30	3.06%
C	158	16.11%
C-	13	1.33%
D	149	15.19%
F	406	41.39%

The results from the descriptive data showed that 46.38% White, 45.97% Black or African American, 0.20% American Indian or Alaskan Native, 0.51% Asian, 3.47% Hispanic or Latino, 0.10% Native Hawaiian, Other Pacific Islander, 2.45% Two or More Races, and 0.92%

Unknown. Nine hundred eighty-one students completed both intermediate algebra and college algebra. This population of students was made up of 71.46% more females than males. The data also showed that 93.68% of the students who took intermediate algebra passed the course with at least a "D" or higher. However, 41.49% of the students failed college algebra.

Because 41.49% of the students who took intermediate algebra failed college algebra, this data aligned with researchers' Bettinger & Long (2005) study. They insisted that remedial math is not preparing students for credit-bearing math courses and that minority students are most likely to enroll in a developmental course after high school. The data listed in this manuscript also showed that more minority students at UM were required to take developmental math before college algebra.

Analysis of the Findings

This study's first research question (R1) asked is the average grade (on a 4-point scale) in college algebra of students with an ACT math subscore of 17 or 18 who did not take remedial math significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math first? To answer the questions, the conceptual hypothesis (H1) was formulated. Next, the conceptual hypothesis was tested by running an independent sample t-test on the grades earned in DS 099 and Math 121, based on a 4.0 grading scale. In this analysis, Math 121 was the dependent variable, and the independent variable was the students "who took DS 099." Equal variances were assumed using Lavene's Test for Equality. The results of the conceptual hypothesis are presented in Table 16.

Table 16

Group Statistics

Took DS099	N	Mean	Std. Deviation	Std. Error Mean

Math 121 Grade	Yes	981	1.333	1.3532	.0432
	No	2394	2.097	1.4039	.0287

Independent Sample Test

		Lavene's Test for Equality of variance		t-test for Equality of Means					95% Confidence Interval of the Difference	
		f	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference	lower	upper
Model 121 Grade	Equal Variances assumed	.005	.942	-14.506	3373	<.001	-.7640	.0527	-.8673	-.6607
	Equal Variances not assumed			-14.731	1884.995	<.001	-.7640	.0519	.8657	-.6623

The analysis results showed a significant difference in the grades earned in Math 121 for the students who completed DS 099 compared to the grades earned in DS 099 for the students who did not take college algebra. An independent sample t-test was conducted to compare the grade students earned in Math 121 for those who took remedial math to the grades earned in Math 121 for those who did not take DS 099. There were significant differences (t (3373) =-14.506 $p < .001$) in the mean grades earned in math 121 for the students who completed DS 099 and those who did not. The mean grades for the students who took math 121 after completing DS 099 (M=1.33 SD= 1.3532) was significantly lower than the average grade for the students who only took math 121 (M=2.097, SD=1.4039). The magnitude of the differences in the means is -.7640, and a 95% CI: -.8673 to -.6607 was significant. Therefore, we rejected the null hypothesis because there was a significant difference in the grades earned in Math 121 for the students who completed DS 099.

The second research question (R2) asked, is there a correlation between the grade earned in Intermediate algebra (DS 099) and the grade earned in college algebra (Math 121) by students

that took remedial math first? To answer the questions, the conceptual hypothesis (H1) was formulated. The hypothesis stated that there is a correlation between the grades earned in remedial math and the grade earned in college algebra by the students that took remedial math first. The conceptual hypothesis was tested using a correlation analysis on the grades earned in DS 099 and Math 121, based on a 4.0 grading scale. The results of the conceptual hypothesis are presented in Table 17.

Table 17

Model Summary, ANOVA, and Coefficients for DS 099 and Math 121

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.453[a]	.205	.204	1.2069

a. Predictors: (Constant), DS099 Grade

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Stg.
1	Regression	368.352	1	368.352	252.873	<.001[b]
	Residual	1426.078	979	1.457		
	Total	1794.430	980			

a. Dependent Variable: Math 121 Grade

b. Predictors: (Constant), DS099 Grade

Coefficients[a]

Model		Unstandardized Coefficient		Standardized Coefficients Beta		
1		B	Std. Error		t	Sig.
	(Constant)	-.174	.102		-1.705	.089
	DS099 Grade	.532	.033	.453	15.902	<.001

a. Dependent Variable: Math 121 Grade

Interpreting the size of the correlation coefficient *r* is done by looking at the statistical significance of *r*. The statistical value of *r*, *r* =.453, indicated a low correlation between the grades earned in Math 121 for the student who took DS 099 and Math 121 compared to the grades for the students who enrolled directly in the course. The results of the correlation analysis showed that while there was a relationship between grades earned in DS 099 and Math 121, the correlation between the grades was low because according to Hinkle et al. (2003, p. 109), 0.453 is a low correlation as shown above in Table 11. The coefficient of determination (r^2), r^2 =.205, indicated about 21 percent of the variances in the letter grades earned in DS 099 can be attributed to the variance in the letter grade earned in Math 121. Therefore, the findings for R2 showed a low correlation between the letter grade earned in DS 099 and the grade earned in Math 121. The sig value for DS math (.001) was less than the alpha of .05. Therefore, we rejected the null hypothesis and determined that the model was statistically significant because there was a low correlation between the grades earned in Math 121 for the students who took DS 099 and Math 121 compared to the grades for the students who enrolled directly in the course.

SUMMARY OF THE MANUSCRIPT

In this manuscript, I researched first-time, full-time students to see if they benefited from enrolling in developmental math before taking college algebra during their first semester of college. This was done by determining 1) if the average grade in college algebra for students who did not take remedial math was significantly greater for the students who took remedial math during their first semester of college; and 2) if there is a correlation between the grade earned in remedial math and the grade earned in college algebra by students that took remedial math?

To achieve this goal, student data was obtained (with the approval of the university's IRB committee) for students who enrolled in fall 2011 to 2013 and fal1 2016 to 2018. The data was

selected for fall terms only to minimize the influence of variables. First, the descriptive data compiled of students' grades, gender, and ethnicity were analyzed. The descriptive data indicated that minority students and females made of the majority population of the students who enrolled in the math courses. It also showed that only 6.32% of the students who started with intermediate algebra failed the course. Approximately 41% of the students failed college algebra after taking remedial math, indicating that it did not prepare them for college algebra. However, the college algebra grades for the students who were not required to take intermediate algebra were better than the grades were for the students who took intermediate algebra; only 20.77% of the students who started with college algebra failed the course.

Second, an independent sample t-test was performed to compare the grades students earned in Math 121 for the student who took remedial math compared to the grades earned in Math 121 for the students who did not take DS 099. The t-test showed that there was a significant difference in the grades. Furthermore, the grades for the students who completed DS 099 were lower than Math 121 grades for the students who did not take DS 099. Therefore, the null hypothesis was rejected.

Lastly, a correlation analysis was performed in the study, and the results showed a correlation between the grades earned in DS 099 and Math 121. The analysis revealed a low correlation between the letter grade earned in DS 099 and the grade earned in Math 121. Therefore, the null hypothesis was rejected, and it was determined that the model is statistically significant.

The third and final manuscript for this study summarized the problem of practice; provided a description of the findings, a brief overview of enhancements, and a summary of the manuscript.

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MANUSCRIPT III: IMPLEMENTATION AND DISSEMINATION PLAN

SUMMARY OF THE PROBLEM OF PRACTICE

For years, students have been required to take one of the college entrance exams before being accepted into the college of their choice. These exams are essential because colleges have assessed students and placed those who do not achieve the required cut score into remedial courses during their first semester of college.

Research showed that about forty percent of prospective students who attend a public 4-year institution are referred to a developmental course (Martin, 2019; Jimenez, Morales, Sargrad, & Thompson, 2016). However, only about twenty percent of the students who take the classes will earn a degree or a certificate within an eight-year time frame (Edgecombe 2011; Attewell, Lavin, D., Domina, & Levey, T., 2006). Because so many students are required to enroll in developmental courses, higher education scholars have begun to wonder if high school students are college-ready by the time they complete high school (Conforti, 2010). In his book, *Completing college: Rethinking institutional action*, Vincent Tinto noted that in the year 2000, about twenty-eight percent of entering first-year students were required to enroll in remedial courses (2012, p.25), and many public decision-makers were very aggravated by the significant increase of underprepared students entering higher education institutions (Chingos, 2016; McCabe & Philip, 1998).

Conducting a quantitative study, my problem of practice sought to determine if first-time, full-time students benefited from enrolling in developmental math before taking college algebra during their first semester of college. Using an independent t-test and a correlation analysis, the

researcher compared the grades earned in intermediate math to the grades earned in college algebra for two groups of first-time, full-time students at two different points in time.

SUMMARY OF DATA COLLECTION

The University of Mississippi's Office of Institutional Research, Effectiveness, and Planning provided the data used for this study. The anonymized data set included random identifiers for each student, their grades in either developmental math, college algebra, or both, and the year the student enrolled in the course(s), gender, and ethnicity.

The goal of this DIP was to research to determine if intermediate algebra prepared first-time, full-time students for college algebra. Therefore, because some students withdrew from intermediate or college algebra, they were removed from the data set. It is also important to note that the University of Mississippi is a predominately white institution with a minority student population of about 24%.

SUMMARY OF THE FINDINGS

The findings for this study included results from the descriptive data and two research questions and hypotheses. In addition, an independent sample t-test and a correlation analysis were used to conduct the research. In this manuscript, the researcher summarized the descriptive data, detailed the findings, discussed the dissemination of the results, made recommendations, and provided a conclusion.

Descriptive Findings

The descriptive data collected and examined included grades, ethnicity, and gender for the math courses' students. The data were distributed into two parts: the entire data set (students only took one of the math courses) and the students who took developmental math and college algebra. For the whole data set, there were a total of 3375 students. The ethnicity for this

population of students was 58.19% White, compared to 35.08% Black or African American, compared to only 6.73% Hispanic/Latino or Unknown. The gender was 31% male compared to 69% female. The mean grade point average for the DS 099 was 2.83, and the mean GPA for Math 121 was 1.875.

Looking at the overall data set, more white students enrolled in the math courses than minority students. However, this was expected because the University of Mississippi is a predominately white institution. It also showed that more females than males enrolled in school during the selected timeframe than males. This descriptive date was not a good comparison of the student's grades because all the students in this data set did not take both courses. Therefore, the mean GPA gives the readers a good overview of the student's performance in the classes. Based on the research questions, the researchers sought to determine if there was a significant difference between the grades earned for the students who took both courses. Two thousand three hundred ninety-four students took college algebra only, and 781 students took both classes.

The descriptive data for the students who took intermediate and college algebra showed 71.46% females enrolled in the courses compared to only 28.5% males. The ethnicity of this population of students was 46.38% white compared to 45.97% Black or African American, and only 7.65% of Hispanic/Latino or Unknown. The grades for the students who took Intermediate algebra were 35.27% A, 0.61% A-, 0.31% B+, 28.54% B, 0.61% B-, 0.10% C+, 23.04 C, 0.41% C-, 4.79% D, and 6.32% F. The grades for the students who enrolled in the college algebra after taking intermediate algebra were 6.52 % A, 1.53 % A-, 2.85% B+, 9.89% B, 2.14% B-, 3.06% C+, 16.11% C, 1.33% C-, 15.19% D, and a shocking 49.39% F. The college algebra grades for students who did not take intermediate algebra were 6.83% A, 2.92% A-, 4.18% B+, 17.04% B, 3.63% B-, 3.97% C+, 16.25% C, 0.71% C-, 13.99% D, and 20.47% F.

The findings from the descriptive data revealed that while there were a significant number of white students enrolled in the courses, there were approximately 7% more minority students who were required to take intermediate and college algebra than Caucasian students. The findings also revealed significantly more females than males enrolled in the classes. This descriptive data also showed that developmental math did not prepare the students for college algebra. The first-time, full-time students who started with college algebra had better grades than those who began with intermediate algebra.

Research Questions Findings

This study focused on two research questions and their accompanying hypothesis. The first question was answered using an independent sample t-test, and a correlation analysis was used to answer the second question.

The first research question asked Is the average grade (on a 4-point scale) in college algebra of students with an ACT math subscore of 17 or 18 who did not take remedial math significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math first? The findings revealed that there is a significant difference in the grades earned in Math 121 for the students who completed DS 099 compared to the grades earned in DS 099 for the students who did not take college algebra. An independent sample t-test was conducted to compare the 95% Confidence Interval of the Difference grade students earned in earned in Math 121. There were significant differences ($t(3373) = -14.506$ $p < .001$) in the mean grades earned in math 121 for the students who completed DS 099 and those who did not. The mean grades for the students who took math 121 after completing DS 099 ($M=1.33$ $SD= 1.3532$) was significantly lower than the average grade for the students who only took math 121 ($M=2.097$, $SD=1.4039$). The magnitude of the differences in the means is -.7640, and a 95% CI:

-.8673 to -.6607 was significant. The hypothesis for the first research question stated the average grade (on a 4-point scale) in college algebra of students with an ACT of 17 or 18 who did not take remedial math is significantly greater than the students with an ACT math subscore of 17 or 18 that did take remedial math before enrolling in college algebra. Based on the finding for the first research question, the hypothesis was rejected because there was a significant difference in the grades earned in Math 121 for the students who completed DS 099. This analysis aligned with Bailey (2010), who found that only 17% of students placed in developmental math successfully completed a developmental mathematics course sequence of three courses or more because the majority of the student who enrolled in college algebra after taking developmental math at UM failed the course.

The final question asked is there a correlation between the grade earned in remedial math and the grade earned in college algebra by students that scored a 17 or 18 math subscore and took remedial math first? The findings revealed a low correlation between the grade earned in DS 099 and the grade earned in Math 121 because 0.453 is a low correlation, according to Hinkle et al. (2003, p.109). It also showed that about 21 percent of the variance in the letter grades earned in DS 099 could be attributed to the variance in the letter grade earned in Math 121. Therefore, the hypothesis for this research question stated that there is a correlation between the grades earned in remedial math and the grade earned in college algebra by the students who took remedial math first. However, based on the second research question finding, the courses are statistically significant. Therefore, the hypothesis was rejected because there is a low correlation between the grades earned in Math 121 for the student who DS 099 and Math 121 grades for the students who enrolled directly in the course.

Dissemination of the Findings

The researcher completed the study with the following conclusion: enrolling in intermediate math does not provide students with the necessary skills needed to achieve academically. The remedial courses slow down the students' progress because the classes do not count toward graduation. Research showed that the students taking DS 099 before college algebra did not do any better than those who enrolled directly in credit-bearing courses like college algebra. Students in remedial classes are less likely to complete college algebra. Therefore, because many students were successful in the developmental class, I believe that even though developmental math has a negative impact on higher education, the instructional course can significantly impact academics and the personal lives of their underprepared students. This can be done by adjusting the current remedial system. Some of these changes include creating co-requisite courses by tying developmental education more closely to college-level programs, by building a connection with the high schools, by changing the way students are assessed, and lastly, by providing student support and pedagogy.

EQUALITY, ETHICS, AND SOCIAL JUSTICE

Referring back to the CPED's principles, the author believes that pursuing a college degree is one way to eliminate social injustices in America and provide equal opportunity for all students. However, many minority students face barriers when they attend college, and requiring them to take developmental courses seems to have created another obstacle. These barriers are problematic because students are informed that they are not prepared to take specific courses because their ACT/SAT subscores fall below the cut scores. Nevertheless, contrary to popular belief, my research revealed that developmental math does not prepare students for college algebra. Therefore, this barrier could potentially lead to lower retention rates, which is why

higher education practitioners should get involved to help close the achievement gaps for underprepared students by removing barriers that have been demonstrated by this study to be ineffective. Based on the findings from my research, stakeholders can enhance social justice by creating corequisite programs that increase student success and retention. Furthermore, a simple change in the content of a course or the instruction could significantly impact students' success and remove an ineffective barrier that enhances rather than diminishes inequalities.

RECOMMENDATIONS

Several recommendations have been presented in this final manuscript. First, however, to help more students, the University of Mississippi should take the advice of authors Woodard & Burkett (2010). They suggested developmental mathematics courses should be offered in a compressed form. In their research, these authors found that the compressed course technique could increase student success and minimize the chance of students being burned out (Woodard & Burkett, 2010). Their findings aligned with authors Sheldon & Durdella (2010), who believed that compressed courses could provide access for all students to learn beyond high school by closing the equity gap and making education affordable for all students. Like Jimenez et al. (2016), they contended that colleges, universities, faculty, and policymakers should work together to help students become successful. Their student success agenda focus on the following:

> a) that all students are on a guided academic pathway leading to a high-quality credential,
>
> b) that robust institutional data tracks the progress of all students along their pathway in real-time, identifies any problems they face in meeting their learning goals, and
>
> c) that targeted academic, social, and financial supports get students back on track and keep them on a pathway to completion (p.16-17).

If universities and colleges worked together with high schools and focus on developing a more rigorous curriculum, students would be better prepared for college-level math courses, which would, in turn, assist more students in being successful at completing college. Other alternatives to assist with developmental education should include executing mentor/mentee programs (support), offering co-requisite courses which would create a structured pathway, and requiring states institutions to implement the same cut score standards for developmental classes.

Effective/Caring Instructors

Hiring instructors who genuinely care about student success can make a difference in the student's success. As O'Banion mentioned in his article, *The Learning College*, faculty and staff need to be creative in new ways of thinking regarding higher education (Harper & Jackson, 2011, p. 167). In their article, authors Jaggar and Hodara (2011) conveyed their opinion on the "one size fits all approach." They believed that because every student has a different background, for them to succeed, there should be multiple exams, one to fit the individuals' need of the students (Jaggar & Hodara, 2011; Mangan, 2014). However, implementing a model like this could benefit the student, but it could also burden instructors. It would require the instructors to get to know the students personally and spend several more hours creating different exams. According to Goldwasser, Martin, & Harris (2017), centralization is also a significant component of success; when there is a collaboration between the faculty and the academic support offices, students will succeed. In their article, *What works in developmental education*, McCabe and Day (1998) referenced Pat Cross's five key recommendations for designing effective developmental courses. Her recommendations, listed below, align with my belief that institutions must have committed staff to work with underprepared students.

She suggested that:

(1) the program should integrate skills training and instruction with other college experiences of the student,

(2) the instructors should pay attention to the social and emotional development of the student,

(3) as well as to their academic achievement,

(4) the staff should be selected for their interest and commitment to working with remedial students, as well as for their knowledge of learning problems, and

(5) that remediation should be approached with flexibility and open-mindedness-a spirit of exploration into student learning, and success skills should be cultivated (p. 20).

In his study, Chingos (2016) found that the faculty level of education impacts the student success rates in developmental math courses. After interpreting data for this study, I believe this may also be the case for college algebra. In addition, Chingos (2016) indicated that faculty with master's degrees appear to be more successful teaching students in the classroom than faculty with doctoral degrees. However, because this study focused on students' success in remedial and college algebra, additional research should be conducted to determine the effects faculty rank has on the students' grades enrolled in math courses at the University of Mississippi.

Mentoring

Mentoring has been considered an approach for positive development, preventing risky behavior, and improving academic success for college students (Mangan, 2013; DuBois and Karcher, 2005). Therefore, colleges and universities should implement bridge programs. These programs should be designed to assist students with their transition from high school to college; the program should consist of a small classroom setting, and the students should be assigned a mentor to help with their academic challenges. Research has shown that students who utilize

mentor/mentee programs are more successful in colleges and universities (Leirenfront, Stassning, Carbon, & Spiel, 2011).

In their study, authors Leirenfront, Stassning, Carbon, and Spiel (2011) examined three different mentoring programs: motivating master mentoring, informatory standard mentoring, and negative minimalist mentoring. They found that among the three programs they evaluated, students who participated in a mentoring program performed better than those who did not in terms of their average grades and the number of courses they passed.

Peer Mentors and learning communities

"High expectations are a condition for student success, low expectations a recipe for failure" (Tinto, 2012, p. 12). Tinto found that students learn from their peers in the classroom, they retain the information, and they do not consider the time they spend together as hours studying (Tinto, 2012, p. 90) – their classroom is the building blocks to retention (Tinto, 2012, p. 124.).

In addition to academic and social involvement, Tinto is a firm believer in the effectiveness of cooperative learning and learning communities. His scholarship found that students who participate in learning communities and cooperative learning have higher retention rates than students who do not (Tinto, 2012, 72). Additionally, many students found collaborative learning to be very efficient, and they did not view them as a form of studying (Tinto, 2012, p. 81). As O'Bannon mentioned in his article, *The Learning College*, faculty and staff need to be creative in coming up with new ways of thinking regarding higher education (Harper & Jackson, 2011, p. 167), and allow students to learn from their peers by creating peer mentor programs is successful in higher education.

Co-requisite Courses

Co-requisite courses are a hot topic in higher education. I think students on the border with their standardized test scores could benefit from a math Co-requisite course at the University of Mississippi. Because co-requisite course instruction is becoming a popular approach to accelerate math course completion, it is also helping students enroll directly into an appropriate mathematics pathway. In addition, a co-requisite course is also saving students a lot of money. The traditional model of developmental courses can be very costly, and these courses do not contribute any credits towards a degree (Bailey & Cho, 2010). Therefore, students could benefit from co-requisite in multiple ways.

Although there are many versions of co-requisite instruction, the broad definition refers to the placement of students who have been labeled as underprepared directly into college-level courses and providing additional support (Hartzler & Blair, 2019). Thus, the Co-requisite models will allow prospective students to enroll in both a remedial and a credit-bearing course (Bailey &Cho, 2010). Furthermore, enrolling in the courses simultaneously will motivate several prospective students to complete developmental math and college algebra (Hartzler & Blair, 2019).

"Co-requisite remediation is more than a remedial education technique; it is a fundamental redesign of the system of support for academically underprepared students" (Vandal, 2014; Hartzler & Blair, 2019). Due to several states considering restructuring their developmental/remedial program, there is a growing sense of adoption of co-requisite models. Researchers stated this model will result in a significant increase in the number of students who complete the gateway courses in one year (Vandal, 2014). Vandal (2014) stated:

> "Co-requisite support is the perfect complement to current innovations in high schools that are providing early assessments for college readiness and then delivering transition courses or dual credit opportunities for students who are not fully on track to be college-ready. Developing a system where students address academic deficiencies during their senior year of high school and then are guaranteed placement into gateway college-level courses, either with or without Co-requisite support, is an achievable and worthy goal for policymakers and education leaders to pursue (p. 9)."

The co-requisite model was designed to deliver students' academic support while allowing them to enroll in the credit-bearing courses and learn the material. While there are several approaches to the co-requisite model, all approaches seem to benefit the students. These models allow students to receive assistance while also completing credit-bearing courses. Researchers Hartzler and Blair (2019) advocated co-requisite classes and did not think students are harmed by completing developmental courses and credit-bearing courses at the same time. Instead, they believed that more students will successfully use the co-requisite model (Hartzler & Blair, 2019; Bailey, Jaggar, & Scott-Clayton, 2013). In addition, authors Sheldon and Durdella (2010) observed that a benefit of offering developmental mathematics courses in a compressed format as opposed to a traditional design is that "developmental students are very capable of assimilating course material quicker when presented in an in-depth and compressed format" (p. 52).

Researchers have found that implementing co-requisite models is very successful in the number of students who pass their first credit-bearing math course. As authors, Hartzler & Blair (2019) indicated in their study, co-requisite classes could take many forms. Therefore, each institution should research different groups of students to determine who would benefit from the

co-requisite course and which pathway would work best for their college/university. Studies show that institutions will help more by implementing a design that will assist the underprepared students by providing them with one to three additional hours of extra support per week (Hartzler & Blair, 2019). I believe that students can benefit from offering intermediate math courses alongside college algebra. In addition, the students and the colleges/universities can benefit from using multiple measures of placement. Taking the co-requisite route will allow institutions to stop relying on standardized tests and start focusing on providing access to all students and closing the achievement gap by implementing different strategies.

CONCLUSION

After reviewing the literature on remediation in higher education, I believe students at higher education institutions should not be forced to enroll in developmental courses. Instead, colleges/universities should construct new strategies and policies for development and implementation of these courses. The University of Mississippi should ensure that if they admit underprepared students, they should employ someone willing to assist them with their studies adequately. The university should create a mentor program to connect students with peers and other administrators to help them during their first year of college. UM should also ensure they hire educators who will have the student's best interest when instructing them. These students do not need someone who will criticize them because their skills are not college-level or because they have to take a developmental course. In addition to hiring skilled professors, UM should create and extend the co-requisite math model to students to help decrease educational costs and increase their readiness for other college-level math courses. Lastly, UM should evaluate their math courses, especially developmental math and college algebra. The key stakeholders should investigate the pass/fail rate of the students enrolled in college algebra. A further study is needed

to determine the barriers that prevent students from passing college algebra at the University of Mississippi after taking developmental math.

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APPENDICES

APPENDIX A: Math Developmental Policy Fall 2010- 2011

DS 099: Intermediate Algebra

DEVELOPMENTAL STUDIES

A remedial course for students not yet prepared to take college mathematics. Students with ACT mathematics subscores less than 17 or SAT mathematics scores less than 400 are required to enroll in DS 099 during their first semester of enrollment and continue in the course until receiving a passing grade. Students with ACT mathematics subscores of 17, 18, or 19 are strongly encouraged to enroll in Intermediate Algebra. Students enrolled in Intermediate Algebra are not allowed to enroll in other mathematics courses (nondegree).

3 Credits

Prerequisites

- Developmental Studies Program Only
- This course is a blend of online and traditional classes. Two fifty (50) minute meetings on the Oxford campus will be required. Other work will be completed online.

Instruction Type(s)

- Lecture: Lecture for DS 099

Subject Areas

- General Studies

Related Areas

- Humanities/Humanistic Studies
- Liberal Arts and Sciences, General Studies and Humanities, Other
- Liberal Arts and Sciences/Liberal Studies

APPENDIX B: Math Developmental Policy Fall 2014- 2015

THE UNIVERSITY of MISSISSIPPI

DS 099: Intermediate Algebra

DEVELOPMENTAL STUDIES

A remedial course for students not yet prepared to take college mathematics. Students with ACT mathematics subscores less than 19 or SAT mathematics scores of 450 or less are required to enroll in DS 099 during their first semester of enrollment and continue in the course until receiving a passing grade. Students with an ACT mathematics subscore of 19 are strongly encouraged to enroll in Intermediate Algebra. Students enrolled in Intermediate Algebra are not allowed to enroll in other mathematics courses (nondegree).

3 Credits

Prerequisites

- Developmental Studies Program Only
- This course is a blend of online and traditional classes. Two fifty (50) minute meetings on the Oxford campus will be required. Other work will be completed online.

Instruction Type(s)

- Lecture: Lecture for DS 099

Subject Areas

- General Studies

Related Areas

- Humanities/Humanistic Studies
- Liberal Arts and Sciences, General Studies and Humanities, Other
- Liberal Arts and Sciences/Liberal Studies

VITA

MARTINA BREWER

PROFESSIONAL SUMMARY

- Dedicated higher education administrator with 18 years of experience in managing many aspects of college admissions, including undergraduate admissions
- Strong interpersonal skills and an excellent communicator
- Experienced in establishing and maintaining positive relationships with coworkers

EDUCATION

The University of Mississippi, May 2022
Doctor of Education (Ed.D.)

The University of Mississippi, August 2015
Master of Arts in Higher Education/Student Personnel

The University of Mississippi, May 2003
Major: Bachelor of Arts in Political Science, Minor: English

The University of Mississippi, May 2005
Certificate of Paralegal Studies

HIGHER EDUCATION & STUDENT AFFAIRS

THE UNIVERSITY OF MISSISSIPPI OFFICE OF ADMISSIONS

Associate Director Admissions, February 2016 – Present
Interim Associate Director Admissions, October 2015- February 2016

- Provides supervision and guidance to assigned individuals
- Selects, trains, and supervises processing staff; evaluates and implements operating procedures
- Interprets Institution of Higher Learning and University of Mississippi admission policies and regulations

- Responsible for collection and analysis of undergraduate admissions data; compiles reports to inform predictive enrollment model efforts
- Serves on the leadership team for the Admissions Office and serves as a liaison to other university departments in regards to admissions
- Participates in annual enrollment goal-setting and assists with various recruitment events Manage budgets for processing operations
- Evaluates and implements operating procedures
- Communicates with internal and external stakeholders concerning policies and procedures
- Develops and monitors an annual schedule of applicant mailings
- Plans and implements new approaches for communicating with applicants
- Organizes systems to facilitate data collection; compiles and presents admissions-related data in appropriate formats
- Helps host routine campus visitors
- Travels to assist with school visits and participates in special recruitment conferences
- Ensures all assigned tasks comply with University, SEC Conference, and NCAA rules

Coordinator of Undergraduate Admissions, August 2005- October 2015

- Provided supervision and guidance to assigned individuals
- Trained and instructed support personnel
- Monitored work operations to ensure accuracy
- Audited admission documents for American undergraduate, international and off-campus students
- Monitored students in deferral and development courses and supervised follow-ups
- Reported academic progress of deferral and development courses to IHL board
- Re-evaluated admission documents for the validity of classification, residency, and academic standing
- Maintained computer backup for all operations
- Assisted with registration, new student orientations, and commencement exercises
- Corresponded with students, parents, and high school academic counselors
- Interpreted final term grades with respect to academic eligibility
- Maintained documents for each student and audits academic records at the end of the enrollment period
- Prepared computer-generated daily cash deposits and receipts; audits daily overall cash deposits
- Interpreted University policy, answers questions from parents, students, departments, or outside persons regarding University requirements and standards for individual applicants with respect to their applications, advance credit decisions, and academic status
- Prepared a variety of reports or analyses reflecting statistical data and trends
- Assisted in interviewing prospective employees

Admissions Specialist, May 2004 - August 2005

- Reviewed and evaluated applications for admissions
- Assigned and entered coding information into a computerized database
- Maintained appropriate filing system on assigned group applicants; rotated files at the end of each enrollment period
- Communicated with applicants regarding admissions requirements, policies, and procedures
- Prepared notices of admission and admission deficiencies; reviewed notices for accuracy, and distributed information to proper sources
- Answered routine correspondence; provided information to faculty, staff, students, and visitors

- Assisted in recruiting activities and distributed admissions materials
- Trained and offered guidance to lower-rated personnel (student workers)

TEACHING EXPERIENCE

THE UNIVERSITY OF MISSISSIPPI, University, MS
Center for Student Success and First-year Experience
Fall 2015 -2018, Instructor
Course: The Freshman Year Experience (EDHE 105)
Fall 2013- 2014, Co-instructor
Course: The Freshman Year Experience (EDHE 105)

AFFILIATIONS AND PROFESSIONAL DEVELOPMENT

- MACRO – Mississippi Association of Collegiate Registrars and Admissions Officers
- SACRAO - Southern Association of Collegiate Registrars and Admissions Officers
- AACRAO – American Association of Collegiate Registrars and Admissions Officers
- Mississippi ACT State Council (2016 – Present)
- MASH (UM Supervisory Certification Program), 2006 Graduate

COMMITTEE INVOLVEMENT

- The University of Mississippi Non- Resident Admissions Application Review Committee (2016 – Present)
- The University of Mississippi Chancellor's Recruitment, Admissions, Orientation & Advising Committee (2016-Present)
- The University of Mississippi Athletic Compliance Committee (2016- Present)
- The University of Mississippi Prospective Student Athlete 9A Committee (2016- Present)
- MOST- Mississippi Outreach to Scholastic Talent (2016 – 2019)
- The University of Mississippi Undergraduate Council (2016- Present)
- The University of Mississippi Staff Council (2013-2017)
- The University of Mississippi Sensitivity and Respect (2013-2016)
- The University of Mississippi Professional Development Committee (2013-2016)
- The University of Mississippi Retirement and Insurance (2015 – 2016)
- The University of Mississippi Financial Aid Committee (2006)