EMBEDDED TUTORS FOR REMEDIAL MATH

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By

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DEDICATION

First and foremost, this dissertation is dedicated to my beloved husband, Justin D. Hayes. His continued encouragement, love, and support during this process has gone above and beyond the call of duty. He has motivated me to continue in my pursuit of this degree with unwavering love and support. I would also like to dedicate this body of work to my parents, David and Trena Holmes, who raised me to know that I can do all things through Christ who gives me strength. Lastly, I would like to dedicate this work to my mother-in-law, Diane Hayes, who continually prays for me and cheers me on through every step of the way.

ABSTRACT

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Community college systems across the US have impacted the higher education goals and purposes in American education in profound ways. The mission of the community college is often seen as an opportunity for underprepared students to earn a degree or obtain a certification. The National Center for Educational Statistics (2014) reported that 60% of community college students are placed into a remedial course during their first year of college. As a result, these courses often delay completion of gateway courses that create the pathway to degree completion. According to Boylan, Bonham, and Bliss (1992), through developmental education, underprepared students are provided the necessary interventions and skills, such as tutoring, needed to pass gateway courses and complete their degree programs. Embedded tutoring is characterized as a program where a tutor works in the classroom under the instructor's guidance to help students understand course concepts and enhance student engagement (Calma & Eggins, 2012). This study focused on a remedial math intervention program developed for students in a community college located in rural Alabama during the academic year of 2018-2019. Specifically, this study will evaluate the impact of an embedded tutor program for remedial math students.

KEY WORDS: Embedded tutor; Remedial math; Developmental education.

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PREFACE

The foundation of this research stemmed from my passion for developing interventions for developmental students at Gadsden State Community College. As both traditional and non-traditional students continued to come to college unprepared for college-level math courses, there is a greater need for interventions that help students develop confidence, perseverance, and skills to help them meet their academic and career goals. Through this body of work, I hope to provide a foundation for which other colleges and universities can evaluate their own interventions and tutoring programs for remedial students.

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Introduction

The Federal Student Right-to-Know and Campus Security Act requires colleges and universities to publish both retention and graduation data (Astin, 1997). As a result, performance-based funding has become the norm for many colleges and universities across the US; therefore, many community colleges have launched initiatives to better assist students required to take developmental courses to complete degree programs (McKinney & Hagedorn, 2017). Complete College America (2018) reports that only 60% of full-time students earn a bachelor's degree within eight years; furthermore, only 29% of students required to take developmental education courses complete a college degree within 8.5 years.

Developmental coursework generally focuses on math, reading, and writing. Colleges and universities determine placement in these courses based on benchmark scores on admission exams or placement tests. Typically, developmental coursework is designed to assist students who lack the basic foundations in reading, writing, or mathematics. In a study conducted by Xu and Dadgar (2018), 40% of undergraduate students in the United States are required to take at least one developmental class. According to the Achieving the Dream project, Bailey (2009) concluded that students who are required to take multiple developmental English and math courses are at risk of not completing their degree programs. These alarming numbers have called for a new approach to developmental support and student achievement programs. This study, which was applied to a particular group of colleges participating in the study, notes that

students required to take three remedial math courses only pass a college-level math course at a rate of 16% (Bailey, 2009).

Many students begin their journey into higher education unprepared for college-level math; however, in recent years efforts to improve persistence and completion rates have been made across the US (Bettinger, Boatman, & Long, 2013). In a 2014 study conducted by Brown, it was asserted that students who are proficient in basic level math skills are more successful in college as these skills are necessary for a wide range of scientific degrees. According to the Center for Community College Student Engagement (2014) the relationship between students who complete developmental courses earning a C or better leads to improved student outcomes. However, students enrolled in developmental courses often lack the ability to understand or acknowledge their own deficiencies and engage in tutoring or other interventions. Fike and Fike (2012) discovered that mandatory developmental interventions implemented by institutions are in the best interest of the students. These interventions range from face-to-face tutoring, peer led team learning, and online tutoring support systems. The problem for all institutions lies in determining the best intervention programs to serve developmental students in order to increase both retention and graduation rates.

Background of the Study

Community college systems across the US have impacted higher education goals and purpose of American education in profound ways. From providing opportunities for educational advancement to increasing community development, the community college system has changed the structure of education in rural the US. In the fall of 2014, 42% of all undergraduate students were enrolled in community colleges (Baum, Ma, Pender, &

Welch, 2016). The mission of the community college is often seen as an opportunity for underprepared students to earn a degree or obtain a certification. It is well documented that community colleges serve a large proportion of minority, first-generation, low-income, and adult non-traditional students (Baum et al., 2016). Community colleges are open-admission which often times results in the enrollment of a greater number of underprepared students that test into developmental coursework. According to Boylan, Bonham, and Bliss (1992) over 90% of community colleges offer developmental courses. The National Center for Educational Statistics (2014) reports that 60% of community college students are placed into a remedial course during their first year of college. These developmental courses are often multi-sequenced and require two or more semesters of coursework that do not count toward a degree. As a result, these courses often delay completion of gateway courses that create the pathway to degree completion. Recently, the American Association of Community Colleges has urged institutions to double to number of students who successfully complete developmental courses and transition into gateway courses 2020 (CCCSE, 2016).

According to Boylan et al. (1992), through developmental education, underprepared students are provided the necessary interventions and skills needed to pass gateway courses and complete their degree programs. Levin and Calcagno (2008) argue that, "Taking one or more remedial courses in a two-year college does not, in itself, lower a student's chances of graduation" (p. 908). In other words, remedial coursework can lay the foundation for students to successfully meet their academic goals.

According to Dvorak (2004), tutoring has been a pivotal part of higher education that dates back to even the earliest colleges in the US. Research shows that tutoring

positively contributes to academic outcomes, student retention, graduation goals, and a sense of community or belonging to those students that take advantage of the tutoring services that are offered by these institutions (Calma & Eggins, 2012). In a study conducted by Laskey and Hetzel (2011), students at-risk for failing and who attended tutoring sessions were significantly more likely to be retained and earn a higher grade point average than at-risk students who did not attend tutoring. Tutoring is commonly described as one-on-one or small group learning assistance sessions with the ultimate goal of fostering independent learning. Tutoring is a form of learning support found in many colleges and universities (Arendale, Wolf-Wendel, & Ward, 2010).

In a study conducted by Skomsvold (2014), 41% of first and second year students enrolled in some type of developmental coursework while seeking a degree in a community college in 2011-2012. Bahr (2013) noted that two-thirds of first-time freshmen enrolled in a community college required math remediation; furthermore, three -fourths of these students did not successfully complete college math courses. However, across the US incoming college students are often placed in developmental math courses as a result of placement test scores that assess a student's understanding of sequenced-Algebra skills such as arithmetic, pre-algebra, introductory algebra, and intermediate algebra (Bailey, Jeong, & Cho, 2010). Students that are placed into developmental math courses are done so with the intention of providing access to opportunities that will strengthen the student's mathematic abilities prior to entering a college-level math course. Bailey et al. (2010) estimated that 60% of community college students are placed into developmental math. As a result, these students could be required to take a year or more of a non-credit bearing developmental math sequence before enrolling into a credit-

bearing college math course. Fong, Melguizo, and Prather (2015) asserted that students placed into developmental math courses are unlikely to finish their associate's degree as a result of both the time and money that it takes to complete these courses. Rosin (2012) pointed out that students enrolled in developmental math courses can lose early momentum and become discouraged from completing their degree or dissuade students from seeking a degree that requires advanced math coursework.

Community colleges and universities across the US have undergone tremendous changes in an effort to help developmental students complete their degrees. The community college systems of Texas, Florida, Virginia, North Carolina, and California have paved the way for developmental education placement, instruction, and support practices. From placement testing changes to accelerated math programs, a multitude of reforms have been adopted by colleges and universities to help developmental students reach their academic goals. Hu et al. (2015) reported that developmental college students need holistic advisement and support programs such as tutoring to help them succeed.

Developmental Math Tutoring

Bonham and Boylan (2012) assert that tutoring is linked to positive student outcomes in development math. In an effort to support students who are at higher risk of failing and dropping out of developmental math courses, many institutions are responding by implementing academic support programs such as tutoring (Bonham & Boylan, 2012; Bremer et al., 2013). Furthermore, in a 2015 study by Pruett and Absher, they reported that developmental students who participated in tutoring were more likely to be successful academically. Specifically, peer tutoring has become a popular tutoring model for colleges and universities because it is both economical and efficient (Folger, Carter,

& Chase, 2004). One such model is embedded tutoring. This model is a hybrid of traditional tutoring arrangements with elements of supplemental instruction. Embedded tutoring is characterized as a program where a tutor works in the classroom under the instructor's guidance to help students understand course concepts and enhance student engagement (Calma & Eggins, 2012). In other words, the tutor is placed in the classroom either physically or virtually as to provide access to support within the course (Calma & Eggins, 2012). Embedded tutors can be professional tutors or peer tutors that help students understand content, serve as a mentor, or foster connections with various student support services to enhance student success. Coghill (2013) reported that in one embedded tutoring program, the tutors were typically peer tutors who performed prescribed weekly tasks that included both time in the classroom and scheduled tutoring hours either face-to-face and virtually.

Statement of the Problem

A study conducted by Jaggers and Stacey (2014) notes that 68% of community college students enroll in at least one developmental course. The majority of degree programs available to students enrolled in community colleges require at least one math course in order to graduate (Mireles, 2010). Bailey, Jeong, and Cho (2010) estimated that 60% of community college students are placed into developmental math. Boylan, Saxon, and McLeod (2006) note that the lack of student preparedness has remained the same over the past three decades. Bahr (2008) asserted, “Identifying methods of increasing the successful remediation in mathematics should be a topic of central concern to all stakeholders in the community college system” (p. 446). Furthermore, tutoring is linked to positive student outcomes in development math (Bonham & Boylan, 2012). In an

effort to support students who are at higher risk of failing and dropping out of developmental math courses, many institutions are responding by implementing on-campus academic support programs such as tutoring (Bonham & Boylan, 2012; Bremer et al., 2013). However, it must be noted that there is a lack of research in the field of student support programs such as embedded tutoring and peer tutoring in postsecondary education.

Across the US many colleges and universities have launched initiatives to find a solution to better assist community college students with completing courses and degree programs. This study uses Gadsden State Community College (GSCC) as its sample because it is a rural two-year institute located in Northeast Alabama that has a history of low developmental math pass rates in comparison to its fellow community colleges in the Alabama Community College System. GSCC is fully accredited by the Southern Association of Colleges and Schools and is a member of the Alabama Community College System. At GSCC, 75% of students qualify to take at least one developmental course in either reading, writing, or math. In Fall of 2014, 63% of GSCC students qualified for Student Support Services based on income status alone, thus meaning that they quality for a PELL grant. Because of the substantial costs that can incur from taking multiple levels of developmental coursework, it is important that institutions such as GSCC focus on interventions and support programs that help these students succeed. The focus of this study is the effectiveness of an embedded tutor program developed specifically for a remedial math course. Although many institutions may use this approach, there is limited research about its effectiveness.

At GSCC, 43% of students test into developmental Math. Of the students taking a developmental math course, 21% have previously enrolled in the course. The pass rate in MTH 098 in particular is 56%; therefore, 44% of students are not successful in the course. Additionally, the withdrawal rate from MTH 098 is 20%. These alarming numbers have called for a new approach to developmental support and student achievement programs within the college.

Theoretical Framework

In the discussion of developmental education and learning theories, it must be noted that many students enrolled in these courses are studying materials and information that were previously covered in their high school classrooms. Although the students have encountered the information before, the study of learning theories and adult development help us to conclude that students who have 'learned' something before did not retain it because of a lack of cognitive development. To better serve the population of students who are not college ready, educators and administrators can understand the impact of pedagogy, andragogy, and cognitive development through the works of Piaget, Knowles, and Vygotsky. Piaget laid the foundation for understanding the cognitive development of humans from infants through adolescents (Blake & Pope, 2008; Driscoll, 2005). Knowles's et. al (1998) findings challenged the assumptions of pedagogy for certain types of individual, bringing the idea of adult-learning theories to the forefront of educational research. Vygotsky (1978) provides an important tool to support learning across the curriculum in the creation of the Zone of Proximal Development. The intersection of these works help to provide a framework for understanding of how to support underprepared college students placed into developmental courses.

Learning Theory

Pedagogy and andragogy are the two theories of learning that are most often debated within the vast field of research in adult education. Although the term andragogy is synonymous to adult education, the term pedagogy is often associated with the teaching of children. Ozuah (2005) defines pedagogy as, "the art and science of teaching children" (p. 83). Pedagogy requires that the teacher assumes full responsibility of the learning process within the classroom; therefore, it is a teacher-centered approach to learning. When discussing pedagogical theory, there are assumptions that include the learner's dependence upon the teacher, teacher-centered learning methods such as lectures, and content specific information selected by the teacher (Taylor & Kroth, 2009). Knowles et al., (2005) argued that pedagogy, "assigns to the teacher full responsibility for making all decisions about what will be learned, how it will be learned, when it will be learned, and if it has been learned" (p. 61). Within the parameters of pedagogy, the teacher selects, evaluates, and prescribes the subject matter. Knowles et al. (1998) determined that pedagogy made the following assumptions: (a) learners are dependent because of lack of experiences, (b) learning is subject-based, (c) students are motivated extrinsically, and (d) previous experiences of the learner are irrelevant to the content. These assumptions cannot be effectively applied to adult learning because adults are internally motivated and self-directed learners (Merriam, Caffarella, & Baumgartner, 2007).

The term "andragogy" was coined by Knowles in the late 1960's as he discovered that within the classroom, instructors needed to understand the learners' actual interests when making decisions about content and delivery of information (Carlson, 1989). In his

research, Knowles (1980) noted that adult learners were best engaged when cooperative and guided interactions between the learner and teacher were implemented. He also observed that the teacher must guide the adult learner into reaching his or her learning goals and potential (Carlson, 1989). The research of Lindeman influenced Knowles work as he believed that education should be defined by the learners' needs instead of predetermined curriculums (Lindeman, 1926). He also noted that content and instruction should fully engage the learner as the adult learner voluntarily attends classes and seeks an education (Lindeman, 1926).

Knowles (1980) defined andragogy as "the art and science of helping adults learn in contrast to pedagogy as the art and science of teaching children" (p. 43). An andragogical approach to instruction required that adult learners become partners in the learning process. Andragogy is based on six assumptions, "the learner's self-direction, the learners' self-concept, prior experiences, readiness to learn, orientation to learning, and motivation" (Knowles et. al., 2005, p 157). When instructors understand and apply these assumptions, the adult learner will become an active participant within the learning experience.

A clear understanding of the application and challenge of each assumption is required when developing an andragogical approach to adult learning. Knowles (1984) believed that self-directed learning required adults to be an active participant in the selection and application of information. He also argued that self-directed learning is not an isolated experience, but rather a collaborative effort between the learner and teacher (Knowles, 1984). When applying this assumption in the classroom, the learner must establish his own learning goals within the boundaries of the course objectives. The

teacher becomes a facilitator whose goal is to empower learners and allow for the free exchange of information (Conrad & Donaldson, 2004). It must be noted that self-directed learning is the most challenged assumption within Knowles's work. Lam (1985) argued that adult learners are not always equipped intellectually to be self-directed in their own learning goals. Many adult learners prefer explicit instructions and guided practice when understanding new concepts (Conrad & Donaldson, 2004). Schapiro (2003) found that self-directed learning is not practical as access to education and resources is not equal within society.

Knowles et al. (2005) stated that adult learners "have a self-concept of being responsible for their own decisions, for their own lives," thus meaning that as a person matures, he will move from being a dependent learner to becoming a self-directed learner (p. 65). This assumption is the foundation for building upon the value of learners' experiences in the learning environment. An adult learner must be able to understand his or her self-concept in order to value their experiences and apply them to their educational goals. Knowles (1984) believed that the experiences brought to the classroom by the learner have value. Within the classroom, adult learners must be allowed to collaborate and engage in group discussion that encourages each student to share his own life experiences (Knowles, 1984). It is important to understand that Knowles (1984) acknowledged that just as the individual experiences could positively impact the learning environment, they could also negatively impact the learning environment through prejudices, preconceived notions, and bias. Taylor, Marienau, and Fiddler (2000) supported Knowles's claim that life experiences of the adult learner are essential to the

learning process, because unlike children, the adult learner values life experiences and often uses these experiences to be successful in higher education.

Knowles (1984) believed that learners enter the learning environment ready to learn and motivated to learn something new because of outside influences such as family obligations, loss of job, or new job requirements. He also noted that the learning environment and course objectives should be gratifying as to engage the learner into understanding his own needs and goals (Knowles, 1984). This assumption is challenged because adult learners do not always have the skills or ability to identify what they want or need to know within a course (Pratt, 1988). In order to help adult learners identify personal goals and objectives, the instructor must outline learning activities that guide the learner to evaluate the purpose of the task at hand (Pratt, 1988). Allowing the learner to share ideas with other learners will expand the learners' understanding of new information and develop the skills necessary to create their own goals and objectives. Knowles (1984) asserted that learners must collaborate with others such as a counselor or teacher to clarify objectives and goals.

Knowles et al. (2005) believed that adult learners are motivated to learn when they are provided with learning objectives that are applicable to real-life situations. This allows adult learners to connect to the assignments and activities to everyday life and provide authentic problem-solving skills. Blondy (2007) stated that adult content and curriculum, "should be process based versus content based to allow learning to develop content in accordance with their specific needs" (p. 125). Through authentic learning activities, instructors can engage adult learners through case studies, group work, problem solving activities, and practice interviews.

Knowles's (1984) assumptions of andragogy should be used to guide instructors and curriculum developers so that they better understand the impact that adult learners' needs, experiences, characteristics, and goals have on the classroom environment. Adult learners need to experience a carefully constructed learning environment that maintains flexibility to foster a collaborative approach to authentic problem solving.

Cognitive Development Theory

Swiss biologist Jean Piaget's (1952), theory of cognitive development has impacted any study grounded in learning theory. He laid the foundation for understanding the process of acquiring knowledge and the progression through each stage of human development. As a researcher in Alfred Binet's laboratory, Piaget was intrigued by the idea of student errors. Piaget believed that these errors were not random and are the result of stages of cognitive development (Blake & Pope, 2008). Through the observation and study of infants as they grew to children and into adolescence, he focused his theory on the adaptive processes that occurred as children grew within stages of accommodation and assimilation (Mayhew et al., 2016). Considered a pioneer in the study of cognitivism, Piaget's works created a foundation for adult learning theory (Blake & Pope, 2008). He believed that "knowledge is invented and reinvented as the child develops and interacts with the world surrounding him or her" (Driscoll, 2005, p. 189). At the core of his theory, Piaget believed that a person's capacity to attain information was directly related to the learner's mental processes (Blake & Pope, 2008).

Piaget is associated with constructivism because he believed that knowledge and information was not passed down to a learner, but rather knowledge was constructed through experience (Blake & Pope, 2008). Trotter (2006) noted that, "Piaget was less

concerned with growing older and was more concerned with the ability to grow wiser" (p. 11). Piaget did not see intelligence as a permanent condition, but rather as a constant state of growth. Furthermore, Piaget believed that adults progressed through different stages of development because of how they constructed experiences from childhood (Trotter, 2006).

The stages of Piaget's (1963) theory begin at the sensory motor stage that occurs at birth to age two. It is during this stage that an infant uses sensory clues as he or she responds to reflexes. In this stage, the child moves from reflexes to symbolic thought as he reaches out to touch things, put them into his mouth, and operates out of the sensation and movement. However, with greater experience the toddler comes to understand more about his objects as they progress to understanding that the object is permanent (Driscoll, 2005). The child experiences object permanence when an object continues to exist even though the child is unable to see it. For example, if a child sees a set of keys, but this his mother puts them in a pocket, the child understands that the keys still exist. Even though it doesn't exist in the child's senses, the object still there. As a result, the child can now hold onto an idea; therefore, he has developed the first stage of thinking (Driscoll, 2005).

Piaget (1963) established that the preoperational stage exists between ages 2 and 7. At this stage, a child constructs mental representations of the world and is able to do something with those representations. Students within this stage must have the opportunities to engage in problem-solving activities using objects. Although this approach to learning is often associated with the elementary classroom, many mathematics courses taught from adolescence to college engage in symbolic learning for a basic understanding of fractions or multiplication. However, adults have developed a

series of symbolic systems such as reading, language acquisition, and basic mathematics, so adult learning is often stifled when classroom instruction is entirely symbolic (Driscoll, 2005). Adult learning requires that symbolic teaching must include enactive modes that allow information to be taught through real life application.

Piaget (1963) defined adolescence as the stage in which formal operational thought begins and marks the change of thinking for adults. When an 11 year-old child develops to age 15, he is marked an adolescent; therefore, he becomes more idealistic, abstract, and logical. Adolescents begin to use deductive reasoning and understand how to solve problems. Furthermore, they can form a hypothesis about their understanding of the world (Driscoll, 2005). It is within this stage that an adolescent begins to develop concerns over social issues and develop a systematic approach to solving a problem. Within this stage, adolescents acquire reasoning skills that involve the evaluation of logical arguments that consist of clarification and application (Anderson, 1990). It is also within the formal operational stage that students begin to infer and evaluate information. Through inferences, students begin to comprehend inductive and deductive reasoning within mathematics. When the student begins to evaluate information, he begins to connect ideas to real-life problems and develop a hypothesis (Ojose, 2018). It cannot be assumed that adult learners in the college classroom have acquired reasoning skills that allow inferences; therefore, the study of situated cognition demonstrates that most college students, "develop master of study strategies when they directly apply them to real-world course material" (Stahl, Simpson, & Hayes, 1992, p. 6). As adults learn, they require meaningful and direct application when learning new concepts and skills. Arendale (2014) noted that, "Piaget and those who followed him stated that deep long-lasting

learning is impossible unless the student is actively constructing the knowledge" (p. 4). In other words, active learning impacts students beyond the adolescent classroom.

Piaget's theories have been the basis for classroom pedagogy for decades. Teachers are able to better understand student thought processes and can align content to student learning outcomes and objectives. Because of Piaget's theory of cognitive development, pedagogical practices shifted from a teacher-centered classroom to a student-active and engaged environment of learning. It must be noted, however, that Piaget's work was criticized for underestimating the abilities of younger students and overestimating the abilities of adolescent learners (Ojose, 2018). Many researchers have noted that Piaget's work had inconsistencies throughout the stages of his theories because he chose not to include the impact of social and cultural groups on learning (Driscoll, 2005). Piaget did note that peer interactions were an important part of a student's cognitive development as it helps him to move past egocentric thought and to engage in social negotiation (Driscoll, 2005).

Piaget did not establish a set of teaching practices for the classroom, but many researchers developed a Piagetian approach to pedagogical practices that were based upon three principles inspired by Piaget's work (Wadsworth, 1996). The first principle required the learning environment to support the activity and engagement of children. According to Duckworth (1964), by presenting the child with situations in which he was engaged with manipulatives that lead to posing questions and seeking answers, an active learning environment was created. Furthermore, through discovery learning children received feedback that came from their own actions (Driscoll, 2005). Piaget emphasized playing as an important role in the classroom, because it allowed children to, "initiate and

control their own activities" (Driscoll, 2005, p. 190). As a result, the children learned from the feedback and interactions of others.

The second principle of Piagetian inspired instructional practices was the inclusion of interactions between children for cognitive development (Driscoll, 2005). According to Piaget (1951), "peers must interact with one another in order to move beyond egocentric thought" (p. 12). Through peer teaching, children developed both negotiation skills and logical constructions (Driscoll, 2005). The third principle required teachers to, "adopt instructional strategies that make children aware of conflicts and inconsistencies in their thinking" (Driscoll, 2005, p. 192). This practice originated from Piaget's theory of disequilibrium that discussed an imbalance between what the student knew and what the student was learning so that he can grow into a new stage of development (Brainerd, 1978). This was best implemented in the classroom through the Socratic method as the teacher engages the student through a questioning approach that leads to understanding misconceptions. It is important to note that when implementing this principle, the teacher must assess what the student already knows as well as how the student thinks. This will allow the teacher to determine if the student's cognitive level of understanding is at a level in which he can synthesize this new information (Driscoll, 2005). Pascarella and Terenzini's (2005) study of cognitive theories asserted that an individual's "cognitive readiness is a necessary, but not sufficient, condition for development" (p. 44). This distinction is important because students must be able, "to recognize increasing complexity before they move to higher levels of development" (Skipper, 2005, p. 32). When students respond to challenges, development takes place; therefore, the student experiences cognitive growth.

Piaget's longstanding theory of cognitive development relates to peer tutoring in that it affirmed that peer interaction through discussion resulted in the development of, "the critical attitude of mind, objectivity, and discursive reflection" (Driscoll, 2005, p. 193). Piaget's belief that, "co-operation between peers," provided an exchange of thought that encouraged collaboration and self-direction serves as a foundation for peer tutoring programs (Falchikov, 2001). In Piaget's theory of cognitive development, he discussed assimilation and accommodation as the process of incorporating new concepts and perspectives that are applicable to adult learning (Mines, 1986). When applying the work of Piaget to understanding peer tutoring, it is important to recognize that the theory of cognitive development demonstrates the progression of a person's intellect through each developmental stage that requires the student to build upon the stage which proceeded it (Driscoll, 2005). During peer tutoring sessions, tutors must build on the stages of learning to assist the student in academic growth (Mines & Kitchner, 1986). Furthermore, through peer-to-peer interaction and discussion, students become dynamic active participants in learning, thus resulting in a self-directed learner (Falchikov, 2001).

Koch et al. (1992) affirmed the importance of Piaget's theory of cognitive development in the context of the teaching and learning of mathematics within the college classroom. Specifically, Koch et al. (1992) modeled instruction through small group and, "pair-problem-solving" that was framed by Piaget's constructionist theory. In addition to Koch's view, Mann (2005) utilized Piaget's theory of cognitive development in studying peer tutor journals. Moreover, Mann (2005) stated that, "the role-taking aspect of acting as a tutor can also facilitate the transformation of adolescent thinking away from the egocentric perspective of childhood toward a more decentered perspective

that recognizes multiple points of view and is more reflective" (p. 164). In other words, both the peer tutor and the peer tutee experienced cognitive development and reflection that resulted in intellectual growth. It must also be noted that through the guidance of Piaget's findings, peer tutors can use active learning strategies and manipulatives to build student confidence and connection between math and the world around them.

Russian theorist, Vygotsky (1978) offered an alternative understanding of cognitive development through the belief that the development of intellect was the result of social and cultural influences. Through his research, Vygotsky argued that cognitive development required social interaction so that meaning could be constructed from experiences (Falchikov, 2001). Vygotsky (1978) defined this interaction or zone of proximal development (ZPD) as, "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). In other words, the ZPD was defined as the point where problem solving challenged the learner to understand beyond what was known to him/her, but was furthered by the collaboration and help of peers. When a person is able to collaborate with another person to solve a problem or answer a question, their development increases their new found understanding or access to knowledge. When collaborating with an advanced peer, students experience a social interaction before they internalize the experience, thus increasing their mental functioning (Doolittle, 1995). Cherrstrom, Zarestky, and Deer (2017) stated that, "A learner's development comprises three stages: what the learner can do now, cannot do now, and can accomplish with help from others." Through academic support and engagement with peers, a student can move beyond what

he or she cannot do to a level of understanding in which could not have been attained on one's own.

Most importantly, it is essential to understand that Vygotsky's research focused on the relationship between learning and development. It must be noted that the ZPD is an objective idea as it does not refer to a specific age of a child, but the psychological functions that are developed during a range of age in order for development to continue into the next age period (Driscoll, 2005). Vygotsky sought to develop pedagogical interventions for specific stages of development that were based on proper assessment. He stated, "A true diagnosis must provide an explanation, prediction, and scientific basis for practical prescription" (Vygotsky, 1978 p. 205). It is essential for the educator to implement procedures to assess a student's level of development so that proper instructional procedures can be put in place to assist a student to the next level of development.

According to Gillani and Relan (1997), the zone of proximal development has four learning stages that "range between the lower limit of what the student knows and the upper limits of the student has the potential of accomplishing" (p. 231). Zaretski (2009) employed the ZPD in the classroom to understand the step in which learning takes place and the level of development achieved by the student. For example, when a child is learning to read or write, he can identify the letters of the alphabet, but is unable to read complete sentences. While the student could not read a novel at this point, he can be guided by a teacher to develop the ability to recognize and spell words, because this task is within his ZPD. When the student further develops his ability to comprehend words

and phrases, his ZPD will evolve to the level of reading novels and understanding literary constructs

Vygotsky (1981) explained that humans are capable of imitation that leads to intellectual understanding. He explained that through "intellectual operation" humans develop reasoned understanding that leads to construction of mental growth (Vygotsky, p. 263). In his own writings, Vygotsky (1981) created an analogy between the process of development and a farmer's harvest. He explained that a farmer must understand and analyze the type of harvest he will have based on the fruits' level of maturity (Vygotsky, 1981). Through understanding the levels of maturity, the farmer can differentiate between those fruits that are still ripening and those that are ready for harvest. In the context of the classroom, the instructor can determine which students are at the "ripening stage" and which students are at a level of mastery or "harvest" (Vygotsky, 1981, p. 262). When applying the concept of the ZPD, it must be understood that teaching leads to development (Guseva & Solomonvich, 2017). Vygotsky argued that language was the primary tool for learning as it transmits information from one person to another through social interaction. Often times, this social interaction involves groupwork and classroom engagement through pedagogical approach of "scaffolding." Wood et al. (1976) identified scaffolding as a process "that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts" (p. 190). Furthermore, they argued that scaffolds require an adult "controlling those elements of the task that are initially beyond the learner's capability, thus permitting him to concentrate upon and complete only those elements that are within his range of competence" (p. 190). In the classroom, scaffolded learning is applied to active reading in that the four skills are

broken down into steps of summarizing, questioning, clarifying, and predicting. In mathematics instruction, the teacher employs scaffolded learning by modeling a problem or equation, then the teacher guides the students through the process, and lastly, the students practice interpedently. When utilizing this skill in tutoring, scaffolding requires tutors to support tutees until they are comfortable with a new concept. The tutor then removes the scaffold once mastery is demonstrated by the tutee, and then progress to more difficult concepts. According to Dvorak (2004) at-risk students are successful when this method is used in tutoring sessions.

Vygotsky's (1962) ZPD serves as a foundation for peer tutoring in that students are able to engage in co-operative learning and development through social interaction and opportunities for verbal interaction. The ZPD requires the peer tutor to support the tutee in problem solving until the tutee is able to solve the problem with no assistance (Chaiklin, 2003). In the context of peer tutoring programs, Gucciardi, Mach, and Mo (2016) stated, " the interactions between peers allows students to enter the zone of proximal development where a less able peer is able to enter a new area of potential development through problem-solving with someone more able" (p. 406). In other words, peer tutors and tutees are able to construct meaning and create knowledge; therefore, both students grow in understanding the content at hand. The peer tutor's prior experiences within the college classroom allows the peer tutor to lead the tutee into a cooperative exchange of ideas that supports the sharing and clarifying of information (Tien, Roth, & Kampmeier, 2002).

Educational Significance of the Study

Although there is a great deal of research related to course-based learning assistance, there is little research focused on the efficacy of an embedded tutor model for developmental education courses. Furthermore, since the embedded tutor model is a relatively new intervention, there is a limited amount of scholarly research that specifically addresses its benefits (Calma & Eggins, 2012; Coghill, 2013). Hendriksen et al. (2005) found that students in sections with embedded tutors routinely outperformed their non-tutored peers but did not provide specific measures. In another study, Vick, Robles-Pina, Martirosyan, and Kite (2015) found that the effect of the embedded peer tutor model used in developmental English courses revealed that the mean grade total was significantly higher in two out of three embedded peer tutor sections observed. Embedded tutor models provide resources that allow students to reach beyond gateway courses and into honors level coursework, because students have built-in support from this resource. According to Koselak (2017), peer tutors positively influence the school culture and confront cultural biases through either direct or indirect interaction with students. This is a beneficial opportunity for both the peer tutor and tutee become leaders (Koselak, 2017). If this embedded peer tutor model improved the completion and persistence rates of remedial math students, then perhaps embedded peer tutors could be used in other areas of academia to help students in multiple content areas succeed and complete their degrees.

The educational significance of this study rests in the findings that embedded peer tutors may help prepare students to persist, complete, and succeed in remedial college coursework. At present, there are few studies that focus on the persistence and

completion rates of remedial math students who are provided an embedded peer tutor. The study of the success and completion rates of these students is important as policy makers continue to mandate approaches for remedial course instruction. Understanding the impact of different interventions and academic support will allow colleges to evaluate the most effective approaches for supporting at-risk students.

Purpose Statement & Research Questions

The purpose of this study is to evaluate an embedded peer tutoring program implemented for a remedial math course in a community college in rural Alabama. For remedial math programs to meet the needs of students, it is vital to understand different types of interventions that can be put into place to support students both inside and outside of the classroom. Tutoring programs invite meaningful improvements to learning outcomes and remedial education programs.

This study will evaluate the frequency that remedial math students met with their embedded peer tutor outside of class and their success in a remedial math course (MTH 098). It is important for the peer tutor program to be a part of a functioning tutoring center that allows an extra layer of support that partners with teachers and students. The tutoring center offers a systematic response to assist students who need one-on-one instruction. In this study, student success if defined as students who complete MTH 098 with a grade of C or higher. This study will also evaluate the percentage of students enrolling in and completing the next higher math course, Intermediate Algebra (MTH 100), after successfully completing MTH 098.

1. What are the differences in developmental math course pass rates (MTH 098) between students who received tutoring versus students who did not receive tutoring during the 2018-2019 academic year at a two-year community college?
2. What are the differences in enrollment rates of the next highest math course (MTH 100) among developmental math (MTH 098) students who received tutoring versus students who did not receive tutoring courses during the 2018-2019 academic year at a two-year community college?
3. What are the differences in the course pass rates of the next highest math course (MTH 100) among developmental math (MTH 098) students who received tutoring versus students who did not receive tutoring during the 2018-2019 academic year at a two-year community college?

Limitations

Limitations are considered circumstances beyond a researcher's control that can impact the interpretation of the findings (Lomax, 2001). Any conclusions drawn from this study are limited to a rural college located in northeastern Alabama; therefore, this study cannot be generalized to represent all community colleges. This study was delimited to students who were previously enrolled in MTH 098 in the academic year of 2018-2019.

Johnson and Christensen (2014) state that external validity is, "the extent to which the study results can be generalized to and across populations of persons, settings, times, outcomes, and treatment variations" (p. 387). One threat to external validity exists because the selection of the students near the cutoff score are selected at random; therefore, students who do not score within the set perimeters are excluded. As a result,

this selection of students might not fully represent all developmental students enrolled in remedial math. This study has threats to internal validity because there are controlling factors that impact the selected outcomes for study. These factors include quality of instruction, student ability, socioeconomic status, and outside responsibilities. Another threat to internal validity is student attitudes or anxieties that could have contributed to their failure or success in the course.

Delimitations

The sample does not contain participants older than 22 years of age as students who delay enrollment in college are further removed from their last mathematics course. Part-time students will not be a part of this study because oftentimes students who choose not to enroll as full-time college students are often burdened with responsibilities such as full-time work or families that do not allow the student to meet the rigor of college coursework. Students not enrolled as first time, full time students will not be considered for this study because research shows that remedial students who enroll in required coursework within the first year of their college enrollment are more like to complete their remedial coursework (Center for Community College Student Engagement, 2012).

Definitions

Developmental Education

Developmental education is a field of practice and research within postsecondary education that is founded in theoretical research, learning theory, and developmental psychology that promotes both the cognitive and affective growth of all students in postsecondary students (National Association of Developmental Education, 2015).

Remedial Education

Remedial courses are a component of developmental education Remedial courses are often multi-sequenced and require two or more semesters of coursework that do not count toward college credit (Parsad & Lewis, 2003).

Tutoring

Tutoring is commonly described as one-on-one or small group learning assistance sessions with the ultimate goal of fostering independent learning, and is a form of learning support found in many colleges and universities (Arendale, Wolf-Wendel, & Ward, 2010).

Peer Tutoring

Peer tutoring is defined as, “people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by teaching” (Falchikov, 2001, p. 216).

Embedded Tutoring

Embedded tutoring is as a program where a tutor works in the classroom under the instructor's guidance to help students understand course concepts and enhance student engagement (Calma & Eggins, 2012).

CHAPTER II

Review of Literature

This chapter is a review of literature related to the topics of developmental education, the role of developmental education in the community college, the impact of developmental education, tutoring programs, and the evaluation of tutoring programs. It is often assumed that tutoring programs are beneficial to students, but there are many gaps in the literature regarding the impact and effectiveness of tutoring in higher education. The following review of literature also explores the history of developmental education and its impact on community colleges and university students alike. The researcher will examine different types of tutoring such as peer tutoring, emerging scholars, peer-led team learning, structured learning assistance, supplemental instruction, online tutoring, and embedded tutoring.

Developmental Education

Remedial education has been an integral part of higher education since the establishment of Harvard College in 1630. When Harvard opened its doors to its first class of clergymen, it was quickly confronted with a student population that was in need of remediation (White & Boylan, 1987). As a result, the college provided tutors for the students; therefore, implementing the first form of remediation within the college setting. Since the founding of Harvard University, access to education expanded thus requiring new standards and requirements for student success. Because most colleges were strictly funded by donations and student fees, many colleges admitted those who could afford to attend college exclusive of academic ability or standards (Brubacher & Rudy, 1976). As the United States continued to grow in population and endured wars, migrations, and

economic trends, colleges broadened their remediation services as a, “natural response to growing needs by an increasingly diverse heterogenous college student body” (Arendale, 2010, p. 10). An ever-evolving country requires education to meet the needs of its people in ways that will support the academic pursuits for all. Learning assistance programs, such as tutoring, remedial courses, and supplemental instruction, are widely used to support students’ success.

A number of terms have been used to describe the study of remediation in college over the years. Developmental education is often used in conjunction with terms such as “remedial” and “compensatory” education. Although these terms are related, developmental education is a much broader than remediation. Boylan (2002) defined developmental education as, “courses or services provided for the purpose of helping underprepared college students attain their academic goals” (p.3). He further explained the term “underprepared students” as those who need to further develop cognitively or affectively to succeed in the postsecondary classroom (Boylan, 2002). The College Reading and Learning Association (1991) defined developmental education as “a field of research, teaching, and practice designed to improve academic performance” (para. 4). Colleges and universities determine placement in these courses based on benchmark scores on admission exams or placement tests. Fike and Fike (2012) argue that students who meet the standard for developmental courses should take those courses at the beginning of their college career. Typically, developmental courses are not credit-bearing, thus delaying developmental students’ graduation.

A more contemporary view of developmental education is that it is more than just remediation and instead a comprehensive approach to assisting students who are not

college ready as it focuses on developing the skills, knowledge, and abilities needed to be successful in the postsecondary classroom (Arendale, 2010). While these courses are designed to help students develop skills that they may not have obtained in high school or through a GED program, developmental education programs seek to help students overcome affective barriers of learning (Miglietti & Strange, 1998). Furthermore, developmental education is a comprehensive approach to supporting the academic and affective domains of students as they pursue a degree in higher education (Arendale, 2010).

Many students, educators, and policymakers do not fully understand the difference between the terms "developmental" and "remedial." Cross (1976) argued that the purpose of developmental education is to, "give attention to the fullest possible development of talent and to develop strengths as well as to correct weaknesses" (p. 52). Rather than focus primarily on a student's deficits or weaknesses, developmental education seeks to strengthen a student's abilities to become more successful learners. In essence, developmental education goes beyond just academic intervention, but rather seeks to develop a student's abilities to succeed in coursework both academically and socially. For this study, the term "developmental education" will be defined according to the definition provided by the National Association of Developmental Education, now known as the National Organization for Student Success, as developmental education as a field of practice and research within postsecondary education that is founded in theoretical research, learning theory, and developmental psychology that promotes both the cognitive and affective growth of all students in postsecondary students (National Association of Developmental Education, 2015). Remedial courses may be a component

of developmental education, but developmental education represents a broader, more holistic approach to support the needs of college students. Within this study, the research will focus on the impact of embedded peer tutors in a developmental math course within a community college.

Developmental Education in the Community College

Over the course of the last century, the community college system has impacted the higher education goals and purposes in American education in profound ways. From providing opportunities for educational advancement to increasing community development, the community college system has changed the structure of education in rural America. In 1947, President Harry Truman initiated the creation of a higher education system that would bring open-access to veterans of World War II as they returned from active duty. This new education system was designed to fill the gap that existed between high schools and limited access to both public and private universities. As a result, the community college system was established to serve rural populations that needed an educational solution that would allow for accessible education (Arendale, 2010). While the history of these American institutions has proven to positively impact workforce development and successful transitions to four-year institutions, there are many issues that still plague the two-year college system. For decades, two issues that remain are completion and retention of college students.

Through the creation of the community college system across the United States, developmental education became a fundamental component to student success and degree completion. Community colleges afford students many opportunities depending on their educational or training needs. The comprehensive mission of community colleges makes

these institutes of higher learning appealing to a broad range of people who seek particular programs or opportunities of special interest (Mullin, 2010). In the fall of 2014, 42% of all undergraduate students in the U.S. were enrolled in community colleges (Baum, Ma, Pender, & Welch, 2016). The mission of the community college is often seen as an opportunity for underprepared students to earn a diploma or obtain a certification.

One fundamental mission of community colleges is to provide access to higher education for students who may not otherwise be able to attend college. Levin (2001) argues that two-year colleges are a bridge between underprepared students and the pursuit of a postsecondary degree. Community college is appealing to wide range of students, because of its open access admission policies, close geographic proximity, flexible schedules and course offerings, and relatively low costs. As a result, community colleges represent a student population that is often considered socially, economically, and academically disadvantaged (Baum et al., 2016; O'Gara, Karp, & Hughes, 2009). It is well documented that community colleges serve a large proportion of minority, first-generation, low-income, and adult non-traditional students (Baum, Ma, Pender, & Welch, 2016). The Digest of Educational Statistics 2015 (Snyder, de Brey, & Dillow, 2016) clarifies that minorities, older non-traditional students, and students from lower-income households are disproportionately represented in public two-year institutions. It must also be noted that a significant number of community college students are considered first-generation students. Consequently, the challenges and disadvantages that exist in the lives of these students are directly related to their completion and retention rates (Petty, 2014). According to Tinto (2000), first-generation students are four times more likely

than non-first-generation students to drop-out of their degree programs before graduation. This alarming rate of incompletion requires the attention and study of community college administrators and instructors to determine how these students can be supported to complete their programs of choice and successfully pass remedial courses.

Many students who are eligible to begin college are simply not ready for the rigors of college-level course work. Spence (2009) argued that there is a substantial difference between college eligibility and college readiness. College eligibility implies that students have met minimum requirements for admission, whereas college readiness indicates that students are adequately prepared to be successful in college coursework. Students who are college eligible, but not college ready, are often required to take remedial course work to better prepare them for future college success. The problem is that for students who start their educational careers at a community college in remedial or basic skills courses, they are less likely to achieve their educational goals (Barnes & Piland, 2010).

Community colleges are open-admission which often can result in the enrollment of underprepared students that test into remedial coursework. According to Boylan, Bonham, and Bliss (1997) over 90% of community colleges offer remedial courses. The National Center for Educational Statistics (2014) reports that 60% of community college students are placed into a remedial course during their first year of college. These remedial courses are often multi-sequenced and require two or more semesters of coursework that do not count toward college credit. As a result, these courses often delay completion of gateway courses that create the pathway to degree completion.

One of the most difficult challenges a community college faces is to create developmental programs that effectively support a growing population of students who

are testing into remedial courses, specifically remedial mathematics. At present, entering freshmen at community colleges are more likely than their counterparts at four-year institutions to take at least one remedial and/or developmental course (O'Gara et al., 2009; Snyder, de Brey, & Dillow, 2016). Recently, the American Association of Community Colleges urged institutions to double to number of students who successfully complete developmental courses and transition into gateway courses 2020 (CCCSE, 2016). Bailey, Jeong, and Cho (2010) analyzed data collected by the Achieve the Dream: Community College initiative for the Community College Research Center. In their analysis, they discovered that almost half of the students in who registered for remedial courses did not complete them. The researchers examined the completion of rates of students who placed into remedial courses upon their initial assessment at their respective community colleges. In this sample studied by Bailey et al. (2010), they found that only 33% of the students enrolled into remedial math completed these courses. As a result of this analysis, the researchers surmised that colleges must improve the remedial course sequence and developmental support provided to students (Bailey et al., 2010).

In 2018, the Center of Community College Student Engagement examined the relationship between remedial coursework and the completion of gateway coursework (Bohlig et al., 2018). The researchers focused on a larger population of community college students in an effort to have a more complete understanding of, "the effect of developmental education on student outcomes" (Bohlig et al., 2018, p. 54). The findings of this study confirmed that most students in community colleges are enrolled in at least one remedial education course; however, students who enrolled in remedial math or English and completed a gateway course with a C or better were not significantly

influenced by their enrollment in remedial coursework (Bohlig et Al., 2018).

Furthermore, this study showed that students who placed into a middle or higher level of remedial math fared better in completing gateway math courses with a C or better than those students who did not place into remedial math (Bohlig et Al., 2018). In contrast, students placed into the lowest level of remedial math were significantly less likely to complete a gateway math course with a C or higher (Bohlig et Al., 2018). Ultimately, this study determined that remedial coursework does not have a negative influence on student success as some literature or studies might suggest. It must be noted that the larger body of research in developmental education focuses specifically on student success in remedial coursework, but not on developmental interventions or support such as tutoring.

Criticisms of Developmental Education

Although developmental education serves as a bridge to support college readiness, risks exist such as increased costs regarding time to graduation and limitations in the majors that students choose (Attewell et al., 2006; Martorell & McFarlin, 2011; Parsad & Lewis, 2003). Parsad and Lewis (2003) identified arguments for and against the implementation of remedial coursework in institutions of higher education. On one hand, the inclusion of remedial coursework in postsecondary institutions can potentially increase access for students who have deficiencies in core subject areas. According to Boylan, Bonham, and Bliss (1997), through developmental education, underprepared students are provided the necessary interventions and skills needed to pass gateway courses and complete their degree programs. On the other hand, opponents of remedial courses question the role of postsecondary institutions in providing developmental

education in the first place (Parsad & Lewis, 2003). It must be noted that the major concern is the well-documented higher risk of dropout for students who must enroll in remedial coursework (Parsad & Lewis, 2003). Bailey (2009) noted that developmental education and coursework does not in and of itself contribute to the lack of student success, but he also argued that there are many differences such as motivation, that go unmeasured in studies conducted to evaluate developmental programs. Baxter and Smith (1998) also argued that developmental education programs demand significant human and financial resources it appears that they discourage student success (Baxter & Smith, 1998). However, even with the potential negative effects, many colleges and universities still feel that remedial courses or developmental education programs are still relevant.

Gerlaugh et al. (2007) argued that when developmental programs are provided to students enrolled in a college or university, the college is creating opportunity for all students to be successful in pursuit of their academic goals. Over 90% of two-year institutions and almost 80% of four-year institutions offer some form of remedial coursework (Snyder, de Brey, & Dillow, 2016). As states shift to performance-based funding models, student success and completion rates are becoming increasingly important; therefore, understanding how to support students in remedial coursework is imperative.

According a study conducted in association with the Achieving the Dream project, Bailey (2009) concluded that students who are required to take multiple developmental English and math courses are at a strong disadvantage and often do not complete their degree programs. This study noted that students who were required to take three remedial math courses only passed a college-level math course at a rate of 10%

(Bailey, 2009). Remedial math enrollment rates are consistently higher in all postsecondary education institutions that offer remedial courses (Jimenez, Sargrad, Morales, & Thompson, 2016). Students placed in remedial courses are at-risk for not completing gateway courses. According to Quint et al. (2013), 16% of students enrolled in remedial courses will complete a gateway course within three years. Furthermore, only 28% will have earned a certificate or diploma within eight years of completing a remedial course. These alarmingly low completion rates has forced developmental education researchers and administrators to determine the best way to support students placed into remedial courses.

Tutoring as an Intervention Strategy

Dvorak (2004) argued that colleges and universities should consider tutoring as a tool to enhance learning that allows tutors to model the learning process and students are able develop learning strategies that will assist in the development of problem-solving skills. Tutoring is a learning intervention that works not only for underprepared students but for all students (Dvorak, 2004). Currently, tutoring programs are growing across college campuses where increasing numbers of underprepared students are in enrolled (Dvorak, 2004). Tutoring engages students in active learning while providing a proactive intervention to encourage student success. It has been argued that tutoring can label students as remedial; however, a large majority of college students need academic support outside of the college classroom (Dvorak, 2004). Tutors can help students by serving as models of appropriate behavior as they demonstrate the importance of organizing classwork, asking guiding questions, demonstrating self-management, and

encourage social interaction while facilitating better study habits (Gordon, Morgan, O'Malley, & Ponticell, 2006).

House and Wohlt (1990) studied the effect of student participation in tutoring on the performance of college freshmen. The researchers hypothesized that freshmen who participated in tutoring for the academic year would achieve higher grades than freshmen who participated in one semester of tutoring or than those who did not participate in tutoring. The study determined that tutoring had a positive effect on both GPA and credit hour achievement (House & Wohlt, 1990).

According to Bonham and Boylan (2012), tutoring has been linked to positive student outcomes in remedial math. Many institutions respond to the concern of students enrolled in remedial courses being at higher risk for dropout by implementing on-campus academic and student engagement interventions (Bonham & Boylan, 2012; Bremer et al., 2013). Of these interventions, tutoring programs were the most common (Bonham & Boylan, 2012; Bremer et al., 2013). Academic engagement through the implementation of tutoring programs has practical implications for institutions with high populations of students enrolled in remedial courses (Bremer et al., 2013). Folger, Carter, and Chase (2004) reported that peer tutoring, specifically, is both an economical and efficient way for institutions to aid students with developmental education needs. Pruett and Absher (2015) found that the more time underprepared students spend preparing for mathematics through tutoring, the higher their likelihood of academic success and retention.

Lesik (2006) reported that participating in remedial mathematics courses can be effective at helping students succeed at gaining skills necessary for higher-level mathematics courses and helping students stay motivated to persist. Students who

develop meaningful connections on campus are more likely to succeed academically, persist, and graduate. Research shows that students who receive some form of tutoring are more likely to feel that they have established a meaningful connection with someone on campus and generally see improvement their grades, motivation, and learning skills (Rheinheimer & McKenzie, 2011). Di Tommaso (2012) indicated that tutoring contributed to the social integration of participants by emphasizing group interaction and collaborative learning. Additionally, by providing underprepared students with an opportunity to interact with peer tutors, students reported lower levels of social anxiety and distrust (Di Tommaso, 2012). Kostecki and Bers (2008) also supported the assertion that tutoring connects the student to the institution and contributes to the student's perception that someone at the institution is invested in his or her success. The connection between the student and the institution must become a priority, because it affects a student's college experience by making the student feel comfortable, thus resulting in persistence and completion (Kostecki & Bers, 2008). It is important to create an atmosphere where students can feel connected and integrated into the college community (Lesik, 2006; Tinto, 1996).

Research shows that tutoring positively contributes to academic outcomes, student retention, graduation goals, and a sense of community or belonging to those students that take advantage of tutoring services offered at institutions (Arendale, Wolf-Wendel, & Ward, 2010; Vick et al., 2015). Tutoring is commonly described as one-on-one or small group learning assistance sessions with the ultimate goal of fostering independent learning, and is a form of learning support found in many colleges and universities (Arendale, Wolf-Wendel, & Ward, 2010). It is important to understand that tutoring

involves continuous summative assessment, feedback, and questioning (Roscoe & Chi, 2007). Tutoring programs in higher education are designed to have a positive impact on student learning in coursework being actively pursued and to have a positive impact on the student's ability to apply effective learning strategies and study techniques independently (Vick et al., 2015). There are two broad forms of tutoring models that can be found in colleges and universities – professional tutors and peer tutors (Vick et al., 2015).

Developmental Math Tutoring

According to the Center for the Analysis of Postsecondary Readiness (2019), 56% of community colleges have implemented support programs for developmental math. Furthermore, these community colleges reported that up to 90% of developmental math students were utilizing developmental math support programs such as bootcamps, tutoring, and success coaches. In the reporting community colleges specifically, 42% of developmental math students have utilized tutors as a primary means of academic support. While these reported percentages indicate that the structure of academic support for developmental math is changing, there is a complete lack of research that focuses on the impact of tutoring in these math courses and within community colleges.

Peer-Tutoring

Peer tutoring is considered a cost-effective response to meet the increasing need for tutoring on college campuses (Rheinheimer, Grace-Odeleye, Francois, & Kusorgbor, 2010). According to Hott, Walker, and Sahni (2012), peer tutoring is a flexible, peer-mediated strategy that involves students serving as academic tutors and tutees. Falchikov (2001) defined peer tutoring as, "people from similar social groupings who are not

professional teachers helping each other to learn and learning themselves by teaching" (p. 216). Peer tutors are hired based on their understanding of content knowledge and their ability to work with fellow students (Maxwell, 1990). Typically, a higher performing student is paired with a lower performing student to review critical academic or behavioral concepts. Peer tutoring requires that one peer takes on the role of the tutor while the other must take on the role as the tutee (Topping, 1996). Furthermore, it must be noted that peer tutors generally do not have professional qualifications nor do they have control over the materials presented; therefore, the equality of a peer tutor and his tutee stems from the fact that both are students who have experiences in the information at hand (Falchickov, 2001). Generally, peer tutors are selected because of their advanced knowledge and academic achievement. Often times, peer tutors are expected to be experts in a specific subject area even though they are not the instructor of a course (Topping, 1996). Peer tutoring is collaborative learning between two minds in which a student works to solve a problem and the tutor guides the tutee toward the answer to the problem at hand (Merrill et al., 1995) According to Ullah, Tabassum, and Kaleem (2018):

As far as peer tutoring is concerned, it is a teaching strategy where a group of students interact to help each other's learning by one student occupying the role of tutor and the other the role of tutee. Usually peer tutoring involves the linking of intelligent students with less-intelligent ones. (p. 1) The established domains for peer tutors require that the tutor build a positive rapport with students (Topping, 1996). Through positive relationships between the peer tutor and student, a safe and supportive

environment can foster student engagement outside the classroom (Drane, Micari, & Light, 2014).

Peer tutoring programs are often constructed through four different approaches: emerging scholar programs, peer-led team learning, structured learning assistance, and supplemental instruction. These models have been studied across the US in both colleges and universities and provide a useful framework for the implementation and creation of new programs. Researchers examined these models because peer tutor programs meet the following criteria: successful implementation, maintain a clear set of implementation procedures, actively studied and have proven to have both valid and positive results, embeds learning strategies and content review, contribute to student persistence, and replicated at other colleges and universities (Arendale, Wolf-Wendel, & Ward, 2010). While not all models are ideal for community colleges, various elements can be combined to create a unique learning environment that meets the needs of students.

Training of Peer Tutors

Boylan, Bliss, and Bonham (1997) argued that the impact of tutoring is most positive when tutors are well-trained and prepared for their positions. Bray (2010) defined a professional tutor as someone who is a trained professional, such as a teacher or professor, who assists students outside of traditional class-time or as a full-time employee of an institution whose role it is to provide tutoring assistance to students. Casazza and Silverman (1996) stated that tutor training programs must acknowledge, "learning theory, metacognition, motivation, counseling/interviewing, group dynamics, and adult learning models" (p. 110). Appropriate training allows tutors to consistently apply learning strategies that fit the needs of each student (MacDonald, 1994).

In order to properly train and prepare tutors for assisting students, it is important that the program obtain certification through organizations such as the College Reading and Learning Association (CRLA) International Tutor Training Program Certification (ITTPC). CRLA is a professional organization that has certified over 1,000 international tutoring programs (CRLA, 2016). Through this certification program, tutors are provided with guidelines that help them assist students at different levels of learning. The program also provides sexual harassment, academic integrity, and confidentiality training for tutors. The tutor training curriculum is designed to focus on learning strategies rather than content-specific subject matter (CRLA, 2016). The Association for the Tutoring Profession (ATP) requires the individual tutor to seek out the certification rather than the program itself (Association for the Tutoring Profession, 2014). Wilson and Arendale (2011) studied best practices for learning assistance programs and refer to both the CRLA and the ATP as leading training programs for tutoring centers and individuals. In the study conducted by Wison and Arendale (2011), nine best-practices for peer tutor programs were listed. These practices are as follows: training of peer tutor, process skills, content skills, curriculum resources, format of training, supervision, session observations, session notes, and reflection (Wilson & Arendale, 2011).

Peer-Tutoring Models

Emerging Scholars

Emerging scholar peer-tutoring programs was developed at University of California Berkley as part of the Calculus Workshop program. This model seeks to build a community of students, “who share a common purpose for earning high grades and support one another” (Arendale et al., 2010, p. 42). Originally, this program was

developed to serve African American students enrolled in graduate mathematics courses (Arendale, 2014). The students who participate in this model must work together with other students to provide support for exams and understanding of complex instructional modules. This program has been implemented in over 100 colleges and universities in the United States.

According to Fullilove and Treisman (1990), the emerging scholars program at the University of California Berkley is, "a comprehensive program for responsible, motivated, enthusiastic, and hardworking freshmen and sophomores enrolled in first-year calculus" (p. 39). At Columbia University, the Computer Science Department implemented the emerging scholar model to improve the recruitment and retention of women in a computer science major (Powell et Al., 2012). This program engages women in computer science majors to participate in group problem solving activities and build a community of support (Powell et al., 2012). The four year study ultimately confirmed that students engaged in emerging scholars programs completed computer coursework at a rate of 3 times higher than those who did not engage in the emerging scholars program (Powell et al., 2012).

Peer Assisted Learning

Peer Assisted Learning (PAL) developed as an academic support program at the University of Minnesota in 2006 (Arendale, 2014). PAL was implemented as a responses to the need for academic support for students enrolled in historically difficult coursework such as chemistry and math. This is not a program centered around at-risk students, but rather focuses on students enrolled in challenging courses that could result in withdrawal or failure in a gateway course. PAL offers regularly scheduled, out-of-class sessions

facilitated by a student who was previously enrolled in the course and is confident in the subject matter.

According to Topping and Ehly (1998), peer assisted learning requires that students work in teams lead by a student facilitator toward a goal by divvying out subgoals to each team member so that each individual can offer a contribution to the end goal. The student facilitator attends at least one course each week to gather information in the course in order to better meet the needs of the students in the PAL group. The facilitating student meets twice a week with his/her team of students to review what the students are learning and how to approach learning new concepts (Arendale, 2014). Ultimately, the collaboration among the team of students promotes a community of learning, but most importantly, the students are learning together. Cheng and Walters (2009) evaluated the PAL model and discovered that students enrolled in two different mathematics courses who attended PAL sessions earned higher final grades than those who chose not to participate in PAL sessions.

Parkinson (2009) conducted a study on the PAL model in the School of Biotechnology at the Dublin City University located in Ireland as a form of intervention to help students succeed in upper level math, chemistry, and physics courses required for a degree in Biotechnology. While the study focused on a small group of students in a very specific field, Parkinson (2009) was able to determine that of the students selected to be in the controlled PAL group, there was a 2% increase in final grades in comparison to the non-controlled student group. Parkinson notes that such a small-scale research study made it very difficult to demonstrate a statistically significate effect on the groups;

however, his work is consistent with the literature that supports positive impacts on peer tutoring (Parkinson, 2009).

Peer-Led Team Learning

Peer-led team learning (PTLT) was designed to help students enrolled in introductory science classes. The original model for this program was designed in the mid-1990s at the City University of New York. This model requires that the peer tutors guide activities in weekly small group sessions and challenge students to actively participate with one another. The requirements of this program include mandatory weekly attendance at two-hour workshops, peer leader/group leader workshops, and faculty support of peer tutors (Arendale, Wolf-Wendel, & Ward, 2010). Tien, Roth, and Kampmeier (2002) studied the implementation of PTLT in undergraduate organic chemistry courses. The researchers argue that the PTLT model, "preserves the lecture and introduces a new structure, the PTLT workshop that requires active engagement of the students with specially constructed material and with each other" (Tien et al., 2002, p. 607).

Undergraduate expert-students who have successfully completed the course are given the role of "peer leader" for a group of six to eight students in which the peer leader works with the students to guide, mentor, and encourage new approaches to problem solving (Tien et al., 2002). The peer leaders are provided training that prepares them to meet the needs of the students and to create a cohesive group that supports student motivation and collaborative communication (Tien et al., 2002). The workshop model creates a scientific community for students to become engaged in active problem solving opportunities with fellow peers. The PTLT workshop lays the foundation for students to

understand how to work with others in a collaborative environment that prepares them for group research in fields of scientific study (Tien et al., 2002). Ultimately, Tien et al.'s (2002) study concluded that students who did not participate in PTLT workshops passed the course at a rate of 80.01%. The students who did participate in PTLT workshops passed the course at a rate of 89.6%; therefore, the researchers surmised that the PTLT model positively impacted course retention and pass rates (Tien et al., 2002). The ultimate goal of the PTLT workshops were to form learning communities among students that encourage active and collaborative support and learning in contrast to the teacher-centered lecture-based classroom often found in secondary education science courses. Tien et al.'s (2002) results, "indicate that the PTLT workshop is a powerful, pedagogic approach, improving achievement for a diverse student population" (p. 626).

Structured Learning Assistance

In 1994, Ferris State University implemented structure learning assistance (SLA) workshops that assist students in the development and application of course material (Doyle & Hooper, 1996). This program targets specific courses such as math and computer sciences that require supplemental support for retention and persistence of at-risk students. According to Doyle and Hooper (1996), "SLA workshops assist students in developing the background needed to connect to the course content and to develop and apply the learning strategies best suited to the content area" (p.5). Students participating in the targeted classes are required to attend session until the student can provide evidence that he/she demonstrates satisfactory performance in the targeted class (Arendale et al., 2010). In the original study of Ferris State's landmark SLA program, it was determined that of the 505 students enrolled in courses that utilized SLA workshops

10% earned a higher pass rate than those students who were not enrolled in courses were SLA workshops were offered (Doyle & Hooper, 1996). Furthermore, 91% of the students who utilized SLA workshops recommended taking courses with the SLA offerings (Doyle & Hooper, 1996).

Diehl (2017) conducted a study of an SLA program at a four-year public university in Pennsylvania. This research was focused on the SLA program created for Introductory Algebra (ACT 100) students who require remediation in order to continue to credit-bearing courses at the university. Students enrolled in the ACT 100 courses were required to attend at least two SLA workshop session each week during the first four weeks of the course. If a student earned a grade of C or higher on the initial exam, then the student was no longer required to attend the SLA workshops, but were encouraged to continue to attend. However, if a student was at risk of failing the course, he or she was required to attend SLA workshops. Diehl's (2017) study showed that 76% students who did not attend SLA sessions failed the course, whereas 55% students who did attend SLA sessions failed the course. The results of this study led to restructuring ACT 100 courses to include SLA sessions in an effort to encourage student success beyond gateway math courses (Diehl, 2017).

Supplemental Instruction

In the 1970s, the University of Missouri in Kansas City developed the supplemental instruction (SI) model in an effort to help learners develop abstract reasoning skills (Martin & Arendale, 1992). Arendale (2014) reported that the result of the positive research of SI programs led to this model becoming certified by the United States Department of Education as an Exemplary Educational Program in 1981.

According to Boylan (2002), “Supplemental Instruction combines the advantages of collaborative learning with an emphasis on developing study strategies associated with a particular subject area” (p. 77). This intervention creates a community of learners that can assist in understanding difficult content while also receiving immediate feedback from a peer.

At-risk students are not the primary focus for this program, but rather it is implemented to support all students enrolled in historically difficult courses. Peer educators work to assist students navigate and master course content and instructional strategies. The peer educators are chosen from the student population for exemplifying “course competence” (Arendale et al., 2010, p. 44). While the peer tutor provides workshops and study models, a faculty member assists in integrating course content and learning strategies. It must be noted that supplemental instruction is not a remedial strategy, rather it focuses on high-risk courses such as engineering, health science, and advanced math courses (Wallace & Rye, 1993). In some ways, the instructor could see the tutoring program as an extension of their classroom and could work with the tutor to facilitate general education content (Graziano-King & Parisi, 2011). Peer tutors in this capacity are generally second year students who support first year students to master course content and provide support in at-risk coursework (Falchickov, 2001).

Studies have shown that supplemental instruction programs reduce drop-out rates and increase student grades while also encouraging better study habits and problem-solving skills (Wallace & Rye, 1994). Martin and Arendale (1997) studied the impact of the SI program at the University of Missouri Kansas City. The researchers discovered that students who participated in one or more SI sessions were successful in their courses

(Martin & Arendale, 1997). Boylan, Bonham, Claxton, and Bliss (1992) found that SI programs created specifically for remedial students result in higher success rates. Since the mid-1990's, St. Louis Community College-Meramac has implemented SI in 20 of its courses in areas of math and science (Boylan, 2002). At present, SI models have been implemented in over 2,500 institutions in 50 countries (Arendale, 2014).

Online Tutoring

Not only does peer tutoring show a positive impact on academic outcomes, but participation in online tutoring has yielded similar results. As early as Skinner's 1961 teaching machines, computer assisted or online tutoring has influenced the role of the online tutor in varying capacities. From the Computer Assisted Learning (CAL) systems to virtual companions, online tutoring response systems support directive learning through a simulated tutor and peer learning with a co-learner (Frasson & Aimeur, 1996). Smith (2005) lists a number of advantages to online tutoring which include availability of tutors at any hour, more efficient tracking of student data, greater privacy for students, and greater consistency in tutoring assistance. Yukselturk and Bulut (2009) reported that online tutoring positively impacts student achievement as evidenced by observing that students who used online tutoring services earned a significantly higher GPA than the students who did not use online tutoring services.

Price, Richardson, and Jelfs (2007) piloted a study that examined the impact of face-to-face and online tutoring in undergraduate distance education. The researchers compared, "the experiences of students taking the same course by distance education when tutoring support was delivered either conventionally or online" (Price, Richardson, & Jelfs, 2007, p. 2). Through a quantitative survey, the researchers sought to compare

the perceptions of students engaged in face-to-face tutoring and online tutoring in regards to academic quality of the services provided (Price, et al., 2007). The students were not required to participate in tutoring, but were given the choice of engaging in tutoring throughout the semester using either face-to-face tutoring sessions, online chat/phone sessions, or via email. Of the 400 participating students, 102 students received face-to face tutoring and 52 students received online tutoring sessions during the study (Price et al., 2007). While the study did not yield statistically significant results, it was surmised that the students who participated in face-to-face tutoring services provided more positive responses than those of whom utilized the online tutoring services (Price et al., 2007). It must be noted that this study was completed before the availability of new tutoring software that allow online tutoring to be available through chat, email, or video. At present, there is a lack of available literature to examine the impact of new technologies and programs.

Another popular online tutoring program is *Smarthinking* and their results have mirrored those of other tutoring programs. McDonell, Parkes, and Tynan (2010) conducted a survey to evaluate the value of *Smarthinking* through a web-based 20 question survey. The respondents of the survey reported that they were pleased and claimed that the online tutoring had made a positive impact on their academic performance. De Fazio and Crock (2008) reported that *Smarthinking* contributed to retention, higher grades, and completion of coursework. Of the 330 students and 20 tutors that participated in the study, 93% of students who used *Smarthinking* were retained from one semester to the next and there was a positive correlation between grade

and usage of *Smarthinking*. The students who used the service attained a higher grade than non-users (De Fazio & Crock, 2008).

Embedded Tutoring Programs

The embedded tutoring model is a hybrid of traditional tutoring arrangements with elements of supplemental instruction mentioned earlier. Embedded tutoring is characterized as a program where a tutor works in the classroom under the instructor's guidance to help students understand course concepts and enhance student engagement (Calma & Eggins, 2012). In other words, the tutor is placed in the classroom either physically or virtually (Calma & Eggins, 2012). Embedded tutors can be professional tutors or peer tutors that help students understand content, serve as a mentor, or to help students foster connections with various student support services to enhance student success. Coghill (2013) reported that in one embedded tutoring program, the tutors were typically peer tutors who performed prescribed weekly tasks that included both time in the classroom and scheduled office hours face-to-face and virtually.

In 2009, Central College piloted an embedded tutor model to function within first year writing-intensive courses to assist students with learning research and citation strategies in an effort to meet the information literacy components required within the college's student learning outcomes (Pagnac et al., 2014). This embedded model has two support systems built into the writing course by providing an embedded peer tutor and an embedded librarian. The librarian and peer tutor seeks to support student research to help students, "gain insight into new information literacy and writing pedagogy" (Pagnac et al., 2014, p. 40). In the evaluation of this program, researchers Pagnac et al. (2014) observed that the writing students were able to receive feedback on working drafts in a

timely manner and were able to feel confident in their ability to find assistance from the instructor, embedded tutor, and embedded library. It was noted in the review of the program that there are challenges within the embedded tutor model such as scheduling and embedded tutor training (Pagnac et al., 2014). Ultimately, the researchers determined that the sense of community and accessibility provided by the embedded tutor program made a significant difference in student performance and instructor support; however, the study did not include specific pass rates or completion rates to support their claims (Pagnac et al., 2014).

Embedded tutoring has become an important tool for the Chicago School of Professional Psychology Online Campus's writing center. Researchers Marshall, Valentic, and Rasmussen (2019) evaluated the impact and efficacy of the embedded tutor model for fully-online doctoral programs. The goal of the embedded tutoring program is, "to create a geography of shared experience between students, faculty, and writing specialists to facilitate the process of enhancing student self-regulation of and self-efficacy for writing" (Marshall et al., 2019, p. 88). This program differs employed professional embedded tutors rather than peer tutors in an effort to provide students with doctoral-level strategies to encourage progress in writing skills. In this model, embedded tutors provide asynchronous paper reviews and offer group tutoring sessions through the online learning platform Go2Meeting (Marshall et al., 2019). Ultimately, Marshall et al. (2019) sought to evaluate the impact of the embedded tutors on student and faculty self-efficacy. The results of this study demonstrated that the embedded tutor model served the doctoral students well in that it was reported that students reported that the embedded

tutors allowed students to focus on writing outside of the classroom, thus building a bridge that enhanced student learning within the classroom (Marshall et al., 2019).

Although there is a great deal of research related to course-based learning assistance, there is little or no literature focused on the efficacy of an embedded tutor model for developmental education courses. Furthermore, since the embedded tutor model is a relatively new intervention, there is a limited amount of scholarly research that specifically addresses its benefits (Calma & Eggins, 2012; Coghill, 2013). Hendriksen et al. (2005) found that students in sections with embedded tutors routinely outperformed their non-tutored peers but did not provide specific measures. In another study, Vick et al. (2015) found that the effect of the embedded peer tutor model revealed that the mean grade total was significantly higher in two out of three embedded peer tutor sections observed.

Factors Related to Successful Peer-Tutoring Programs

The organization of any peer tutoring program is a foundation key to success. Falchickov (2001) argued that it is important for peer tutor program leaders to understand Sinclair Goodlad's seven rules for peer tutoring, "define your aims, define roles, train tutors, structure the content, support tutors and mentors, keep logistics simple, and evaluate" (p. 215). Furthermore, it is important for peer tutor program leaders to evaluate the selection process for matching peers in a tutoring setting.

Student motivation is a challenge within peer tutoring programs. Duckworth et al. (2007) relate student motivation to the term "Grit," which they define as, "working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress" (p. 1088). Paulsen and Feldman argue that

motivation consists of, "factors and processes that initiate and direct the magnitude, persistence, and quality of goal-directed behaviors" (p. 18). McMillan and Forsyth (1991) define motivation within the context of learning as, "a process in which students value learning and involve themselves in classroom assignments and activities" (p. 39). While many argue that college students are motivated because they have made the choice to attend college, researchers Beard and Hartley (1984) argued that college students lack motivation because they are often required to take courses that are not beneficial to their chosen field of study. A well-documented problem with students in remedial math courses is that they exhibit a lack of confidence in their academic abilities due to identifiable deficits. Many students experience negative feelings upon learning that they will be required to enroll in developmental coursework since additional classes will only add time to their goal of finishing or transferring (Jiminez, Sargrad, Morales, & Thompson, 2016).

In addition to a lack of confidence and negative attitudes toward remedial courses, the literature also shows that a majority of college students enrolled in developmental courses do not take advantage of tutoring sessions even though tutoring has been linked to student success (McClenny, Marti, & Adkins, 2012). Furthermore, research shows that motivational factors (Henry, Plunkett, & Sands, 2011), beliefs and attitudes toward learning assistance (Hwang & Chang, 2011), and the stigma often attached to learning assistance (Winograd & Rust, 2014) strongly influences a student's likelihood of using tutoring services. The stigma attached to developmental education overshadows the need for learning assistance for many students because they do not realize the benefits that can be garnered from seeking assistance (Marbley et al., 2013). The research clearly shows

that if students are embarrassed or too intimidated to attend tutoring sessions, they will likely not attend (Navarro, 2012). Recognizing the stigma attached to tutoring programs is the first step toward increasing attendance and reducing the attached stigma.

Evaluation of Tutoring Programs

Researchers have shown that evaluating and assessing the success of tutoring programs presents a unique set of challenges (Norton & Agee, 2014). It is important to understand the outcomes and measurements of peer tutoring programs in order to improve them. Kushner (2005) argues that programs have to be evaluated in order to determine the changes that should be expanded or cancelled; furthermore, program evaluation is a vital part of any organization and must be a priority to the institution. Soven (1993) argued that, "when budget time rolls around again, no argument may be more compelling than data gathered during the evaluation process" (p. 66). Many institutions measure the success of tutoring programs by examining output measures of students who voluntarily seek tutoring compared to students who do not (Hattie, 2006). The challenge is that such comparisons may not be causal. (Chan & Leung, 2015).

In a separate report, Hatch and Bohlig (2016) argued that it is the student's performance in subsequent coursework that best determines the level of success achieved. However, student success in his or her coursework is not necessarily a reflection of positive or negative achievement of the intervention program. Therefore, it is difficult to measure the impact of "academic support" on a student's successful completion of developmental coursework (Chan & Leung, 2015, p. 268).

According to Hodara and Xu (2016), data sources that are useful for the evaluation of tutoring programs are session logs and reflection sheets, tutor training

agendas, tutor-created session activities, stakeholder surveys, tutoring assistance attendance records, student work samples and benchmark data, and standardized pre-test and post-test assessments. It must be noted that Saxon, Martirosyan, Wentworth, and Boylan (2015) suggested that best practices for evaluating interventions in developmental education include identifying student achievement outcomes that can be realistically measured, identifying outcome targets that target multiple years to observe student success in subsequent coursework, and identifying new or adjusting old objectives as new knowledge and experience is gained with the program.

Summary of the Literature Review

Tutoring programs invite meaningful improvements to learning outcomes and developmental education programs. Embedded tutor models provide resources that allow students to reach beyond gateway courses and into honors level coursework, because students have built-in support from this resource. According to Koselak (2017), peer tutors positively influence the school culture and confront cultural biases through either direct or indirect interaction with students. This is a beneficial opportunity for both the peer tutor and tutee become leaders (Koselak, 2017).

It is important for the peer tutor program to be a part of a functioning tutoring center that allows an extra layer of support that partners with teachers and students. The tutoring center offers a systematic response to assist students who need one-on-one instruction. It is vital that the tutoring center is led by strong and supportive leadership, but is also ran by a passionate leader that is not afraid to advocate for students. It is also important for instructors to collaborate with this tutoring center so that proper instruction and intervention can be provided (Koselak, 2017).

CHAPTER III

Method

The purpose of this chapter is to introduce the research methodology for this quantitative study that explores the effect of embedded tutoring on developmental math students in a rural community college. This approach allows for a scientific understanding of the impacts that tutors can make within a developmental math course. The research design, study participants, procedures, method of analysis, and ethical concerns are primary components of this chapter.

Research Design

This study employed a quantitative research design which allows a researcher to analyze numerical data and test hypotheses of a collected data. According to Creswell (2013) quantitative research requires, "specific, narrow questions to obtain measurable and observable data on variables" (p. 14). The purpose of this study was to examine the differences between students in remedial math (MTH 098) who utilized tutoring services versus those who did not utilize tutoring services at a two-year community college in rural Alabama during the 2018-2019 academic year. The data for this study was collected from the office of Institutional Effectiveness at Gadsden State Community College. This study was guided by the following research questions:

Research Questions

1. What are the differences in development math course pass rates (MTH 098) between students who received tutoring verses students who did not receive tutoring during the 2018-2019 academic year at a two-year community college?

2. What are the differences in enrollment rates of the next highest math course (MTH 100) among developmental math (MTH 098) students who received tutoring verses students who did not receive tutoring courses during the 2018-2019 academic year at a two-year community college?
3. What are the differences in the course pass rates of the next highest math course (MTH 100) among developmental math (MTH 098) students who received tutoring verses students who did not receive tutoring during the 2018-2019 academic year at a two-year community college?

Background of the Study

Nationally, remedial education has become a major concern to legislatures and college systems. Specifically, remedial mathematics continues to be a barrier to educational success in community colleges (Bonham & Boylan, 2012). Merseth (2011) argued, "nowhere in the community college curriculum is this failure rate of graver concern than in developmental mathematics" (p. 32). Furthermore, Merseth (2011) contended that remedial mathematics was an impediment to student success in college. Bradley (2011) suggested that remedial mathematics courses most frequently have the lowest student success rate. Deficiencies in mathematics is one of the major factors holding students back from success in course completion, graduation, and future career goals. According to Complete College America (2016), 51.7% of community college students are placed into a remedial course or course sequence upon entering; furthermore, of these students only 9.5% graduate within three years of enrollment. While a multitude of remedial education reforms have occurred across the US in recent years, research is lacking in understanding how to improve success rates and what interventions are most

effective for helping students achieve success in remedial mathematics. This study explored the effectiveness of one intervention, embedded peer tutoring, as an approach to improve student success in remedial mathematics.

Participants

Participants were selected from Gadsden State Community College (GSCC) which is the fourth largest community college in the ACCS. GSCC has six campuses located in three rural counties and has an average enrollment of 6,500 students each year. There are three main campuses and three smaller campuses that reach a service area over four counties. During the academic year of 2018-2019, total enrollment at GSCC was 6,456. Of these students, 86% of students received financial aid, 74% of students were required to take at least one developmental math or English course; furthermore, 66% of students were first-generation college students. The college's racial and ethnic makeup was 73% Caucasian, 17% African American, 7% Hispanic, and 3% other groups.

The sample for this study was taken from GSCC students that were placed in remedial math (MTH 098) in the 2018- 2019 academic year. Across the US, a number of states and college systems- including Georgia, Virginia, North Carolina, Tennessee, and Texas- have implemented new remedial education reforms to reduce the number of non-credit bearing (remedial) courses required by students who are not college-ready and to improve student success rates (Weiss & Headlam, 2018).

Changes in Remedial Coursework. The Center for the Analysis of Postsecondary Readiness (2019) completed a descriptive study to examine changes to developmental education across the US. The study acquired data and information from 1,055 two-year and four-year colleges in an effort to provide a nationally representative perspective of

reforms (Rutschow et.al, 2019). The findings of the CAPR study reported that 19 states mandated or encouraged colleges to implement new approaches to developmental coursework such as corequisite models, self-paced courses, and revised standards for developmental math (Rutschow et.al, 2019). States such as Georgia and Texas laid the groundwork for reforms by implementing corequisite courses and limiting developmental math courses to one semester (THECB, 2018; TCSG, 2018). In the fall of 2018, the Alabama Community College System (ACCS) modified remedial courses and course requirements by changing the placement sequencing, structure, and content of these courses. The ACCS removed the remedial math sequence and created one remedial math course (MTH 098) and one co-requisite course (MTH 099). The student placed in a remedial math course (MTH 098) is assumed to be less-skilled and less-proficient in math according to the new testing guidelines. According to the new guidelines provided by the ACCS, upon completion of remedial math course (MTH 098), the student will be proficient in solving mathematical problems with real numbers, solve problems involving linear equations, and solve systems of equations in two variables using a variety of methods. Once the student has successfully completed remedial math, the student will be prepared for the next level math course, Intermediate College Algebra (MTH 100), where the student will study algebraic concepts such as laws of exponents, polynomial operations, factoring polynomials, radical and rational expressions and equations (ACCS).

Placement. Many institutions across the US use two or more methods to determine remedial course placement. Because community colleges have less admission requirements than four-year colleges and universities, they have often relied on

standardized test scores from high school and college entrance exams such as the ACCUPLACER to assess reading, writing, and math proficiency levels (Fields & Parsad, 2012). ACCUPLACER is one of the most frequently used adaptive placement exams across the US. According the Center for the Analysis of Postsecondary Readiness (2019), 56% of two-year colleges and 60% of four year colleges in the US have implemented multiple measures to determine if students should be placed in remedial courses.

At GSCC, there are three separate screening levels of placement to determine student placement in math. The first screening level utilizes the student's ACT score if he or she has taken it in the last five years. Students scoring below a 17 on the math portion of the ACT are moved to a second screening level where the student's high school GPA and specific grades from math courses are evaluated. If the student reports an overall high school GPA below 2.75 in math courses, then the student is moved to a third level of screening. The exception are students returning to school after five years of completing high school or equivalent who are advised at screening level 3. The third level of screening requires that students take the ACCUPLACER to determine specific placement for math. Students who score in the range of 200-249 are recommended for remedial math (MTH 098) to help him/her to be successful in college-level math courses. This non-credit bearing course reviews the fundamentals of basic math and algebra.
The purpose of narrowing the sample is to help minimize confounds; therefore, for this study, the sample consisted of first time, full time freshmen enrolled in the remedial math course at GSCC during the 2018-2019 academic year whose ages range from 18-21 years old by the first day of enrollment in the remedial math course. This age range of students

was selected as such to not violate any age restrictions that require parent or guardian permissions and to minimize the time students have been out of high school. The sample of students that was used have scored within the range of 236-246 on the ACCUPLACER exam; therefore, this group of students had demonstrated similar limited knowledge and proficiency in the areas of arithmetic and basic algebraic expressions (ACCUPLACER, n.d.).

Embedded Peer Math Tutoring

Colleges across the US have not only changed placement practices for remedial coursework, but have also implemented academic support services specifically designed for these students. According to CAPR (2019), 98% of remedial students received assistance from a tutor while enrolled in remedial mathematics coursework. Quality math tutoring assistance can solidify an institution's efforts to ensure that students are developing math skills that will make them successful in their future careers and pursuit of lifelong learning.

Di Tommaso (2012) indicated that tutoring contributed to the social integration of participants by emphasizing group interaction and collaborative learning. Additionally, by providing developmental students with an opportunity to interact with peer tutors, students reported lower levels of social anxiety and distrust (Di Tommaso, 2012). Furthermore, embedded tutor models provide resources that allow students to reach beyond gateway courses and into honors level coursework, because students have built-in support from this resource.

To evaluate the effectiveness of tutoring as an intervention for remedial math (MTH 098), students in this course were separated into two groups: those who

participated in tutoring or those who did not participate in tutoring. The students were not required to attend tutoring; therefore, the students chose to attend tutoring out of their own volition. It must be noted that the students who attended tutoring may have been self-motivated to do so. Students were made aware of tutoring services through a class visit to the college tutoring center, placement of embedded tutoring, and promotional tutoring events. Students who received tutoring during this experiment met with a tutor weekly or as needed. Students were also given the option of utilizing the online tutoring service, Upswing. Embedded tutors did conduct group tutoring sessions with no more than three tutees during the semester. The final grades of students who received tutoring were compared to the final grades of students who did not receive tutoring. All remedial math students were made aware of tutoring services through their embedded tutor and college-wide marketing.

Embedded Peer Math Tutors

In order to qualify to be a peer tutor in the Cardinal Tutoring Center program at GSCC, students must maintain a 2.5 GPA or higher and have completed at least 12 hours of college coursework to be a part of this program. The students who are selected receive a half-tuition scholarship in exchange for serving as a peer tutor for four hours each week. Peer tutors who excel at math are specifically assigned to the role of "embedded tutor" and assigned to a remedial math course where he/she serves as the tutor for this course. The embedded tutor attends the assigned remedial math course each week and builds a relationship with students in an effort to support student learning. The embedded tutor is also placed within the Blackboard shell of the remedial math course so that he/she can communicate with students outside of class. Students within the remedial math class

have the opportunity to work with the embedded tutor before, during, and after class each week. Many embedded tutors play an important supporting role during class by assisting the instructor in helping students while practicing mathematical concepts taught during class.

Variables

Dependent. Three dependent variables were examined separately for each of the research questions explored in this study. The first dependent variable was dichotomously coded to indicate completion of remedial math (MTH 098) during the specified academic year (YES= 1 and NO =0). Completion of remedial math was defined as a score of C or higher at the end of the MTH 098 course. The second dependent variable was dichotomously coded to indicate enrollment in the next highest math course (MTH 100). Enrollment in this course was determined based on whether or not the student was enrolled on the 12th class day of the following semester. The third and final dependent variable was dichotomously coded to indicate completion of the next highest college-level math course during the specified academic year (YES=1 and NO=0). Completion of the next highest college-level math course was defined as a score of C or higher at the end of the course.

Independent. The independent variable in this study was the amount of time, measured in minutes the students utilized the assigned embedded tutor for assistance with the developmental math (MTH 098) course content. This variable was representative of the time spent in tutoring sessions. For this study, the number of minutes were placed in categories to explore it in a more meaningful way. These categories are as follows: 1 minute to 60 minutes = 1, 61 minutes to 120 minutes = 2, 121 minutes to 180 minutes =

3, 181 minutes to 240 minutes = 4, 241 minutes- 300 minutes = 5. This study also included two control variables related to placement into remedial math courses. Control variables included student demographic information (race/sex). These demographic characteristics were self-reported through their application for admission to the college. Race consisted of two categories for this study: White Non-Hispanic = 1 and Non White = 2. Gender consisted of two categories for this study: Male =1 and Female =2.

Table 1

Coding of Categorical Variables

Tutoring	
No Tutoring	1
Tutoring (1-60 Minutes)	2
Tutoring (61-120 Minutes)	3
Tutoring (121-180 Minutes)	4
Tutoring (181-240 Minutes)	5
Tutoring (241-300 Minutes)	
Gender	
Male	1
Female	2
Race/Ethnicity	
White	1
Non-white	2

Procedures

Data was obtained from the community college's Division of Institutional Effectiveness and Dean of Academics. The community college uses ARGOS and Banner systems to maintain student information and data. For this study, data collected was final grades of developmental math (MTH 098) and student demographic information (race/sex). The tutoring program used Upswing to track students who participate in tutoring. Embedded tutors were responsible for keeping a log of tutoring sessions both online and in person via the Upswing software. This software was used to extract the sum of the time each student spent in the tutoPring center with his/her assigned embedded tutor. This information was encrypted and stored on a password protected computer located in the researcher's office located on the main campus of GSCC. To comply with the Family Educational Rights and Privacy Act, the data will was de-identified. The office of Institutional Effectiveness coded the students' data so that confidentiality and privacy was not violated in this study.

Analysis

Logistic regression was used in this study for each research question to determine the relationship between the independent variable and covariates on students' completion in developmental math (MTH 098), enrollment in the next highest college level math (MTH 100), and completion of the next highest college level math (MTH 100). Logistic regression is appropriate when exploring the relationship between a dichotomous dependent variable and continuous and categorical independent variables. In accordance with recommendations in Peng et al. (2010), the results of the logistic regression included, " an overall evaluation of the logistical model, statistical tests of individual

predictors, goodness-of-fit statistics, an assessment of the predicted probabilities" (p. 9). Logistical regression, "holds no assumptions for skew, homogeneity of variance, equal variances among predictors, or equal 'n' for binary predictors" (Tabachnik & Fidel, 2019, p. 362). Logistic regression does include assumptions of linearity with predictor variables, independence of errors, and an absence of multicolinearity. According to Cabrera (1994), multicollinearity within predictors can bias the analysis. Issues of linearity were addressed by transforming time tutored to an ordinal level variable. Multicolinearity was assessed using tolerance and VIF statistics as well as correlation coefficients between predictor variables.

Limitations

A limitation to ACCUPLACER placement scores is that it is representative of only what each student demonstrates knowledge of at the time of the testing and does not include information on what the student would understand should he or she be provided with an opportunity for practice or review of his or her mathematical skills. Furthermore, grades can be subjective in any course and is not always fully indicative of the student's ability. The study is limited to three semesters of data during the 2018-2019 academic year as it is the first full academic year in which the embedded tutor program was implemented across the college. This study intended to address the impact of tutoring on the final grades of remedial math students, but it does not explain student motivation for seeking tutoring services.

CHAPTER IV

Results

This chapter presents findings from the data analysis of students who were enrolled in remedial math and either utilized tutoring or did not utilize tutoring to support their success in remedial mathematics and persistence through the college level mathematics course. The purpose was to explore the relationship between participation in tutoring, success in remedial mathematics, and persistence through the college level mathematics course. The data were collected from a two-year community college in rural Alabama during the 2018-2019 academic year. The findings are presented in a sequence to address the research questions. Descriptive data is presented first to inform characteristics of students enrolled in developmental mathematics. Logistic regression was then used to evaluate the relationship between these demographic characteristics and participation in tutoring on remedial course completion, enrollment in the college-level course, and successful completion of the college level course.

Descriptive Findings

A descriptive analysis was conducted to provide an overview of the sample used in this study. In the fall of 2018, 1077 new students were admitted to GSCC and 865 students were classified as first time, full time freshmen (80%). The sample of first time, full time freshmen were 46% male and 53% female. Furthermore, 68% of these students identified as White, 17% as Black, 5% Hispanic, and 5% as Asian. This sample was further limited to the 357 students enrolled in remedial math (MTH098) during the 2018-2019 academic year. Some of these students were “no-shows” and did not pay for or attend the course (n = 88). Another 62 students withdrew from the course and did not

persist. Because their withdrawal from the course could include reasons that were non-academic (Conklin, 1997), they were removed from the analysis. Of the 206 remaining students in the sample, 43% were male and 56% were female. Additionally, 64% reported their race as White Non-Hispanic, 30% as Black, 5% as Hispanic, and 1% as Asian. This analytic subsample was comparable to the larger sample of first-time, full-time freshman reported at the institution. Because the percentage of students who identified as belonging to Hispanic or Asian was too small for any meaningful comparison, these students were combined into one dichotomous group with Black students for the purpose of this study (white/non-white).

The data were examined for outliers, missing values, and/or errors in the data for tutoring participation. This examination resulted in no outliers, missing values and/or errors in the data. Tests of normality for the number of minutes tutored reported a mean of 117.9 (M=38), standard deviation of 104 (SD=104). The underlying assumptions of normality was assumed based upon analyzing the skewness of .46 (SE=.46) and kurtosis of -.78 (SE= -.77). These results indicate that there is no issue with the normal distribution of outliers.

The number of students who participated in tutoring was 151 (75%). Descriptive statistics for the final sample are reported in Table 2. Descriptive statistics for the final sample are reported in Table 2.

Table 2

Characteristics of Students in Math 098 (N=206)

Variables	n	%
Tutoring		
No Tutoring	55	27
Tutoring (1-60 Minutes)	34	17
Tutoring (61-120 Minutes)	34	17
Tutoring (121-180 Minutes)	33	16
Tutoring (181-240 Minutes)	32	16
Tutoring (241-300 Minutes)	18	9
Gender		
Male	68	33
Female	83	40
Race/Ethnicity		
White	95	46
Non-white	36	17
Total	206	

Pass Rates in Developmental Math

The first research question explored differences in developmental math (MTH 098) course pass rates between students who received tutoring verses students who did not receive tutoring during the 2018-2019 academic year. A passing grade was defined as a C or higher. The overall pass rate for students enrolled in developmental math (MTH

098) was 74%. Of these students, 56% were females and 43% males. Additionally, 64% of the students who passed were identified as White, while the remaining 36% were identified as Non-White.

Table 3

Student Enrollment Rates in Developmental Math

Demographics	Enrollment		Tutored		Not Tutored	
	n	%	*n*	%	*n*	%
Gender						
Male	66	44	59	40	8	5
Female	85	56	47	32	11	7
Race/Ethnicity						
White	100	66	58	39	16	11
Non-White	51	34	48	32	3	3
Total	151		116			

A logistic regression was used to explore the relationships between demographic characteristics (race, gender), enrollment in tutoring, and remedial math pass rates. Assumptions of logistic regression were considered prior to conducting the analysis. Multicollinearity was tested by examining tolerance and VIF values. The tolerance values were between .99 and 1.0, the VIF values were between 1.0 and 1.01. Because the VIF value was less than 10 and the tolerance values were greater than 0.2 there was no indications of serious multicollinearity.

According to Peng et al. (2002), “A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the intercept-only model" or model with no predictors. The likelihood ratio test for the logistic regression model was statistically significant (χ^2 = 93.67, p< .01). The goodness-of-fit test for the logistic regression (Hosmer-Lemeshow) yielded a χ^2 = 6.56 and was insignificant (p= .58), indicating that the model fit well to the data. Model effect sizes were considered given their importance in the literature (Wilkinson & APA Task Force on Statistical Inference, 1999). The Nagelkerke R^2 in this study was .53 which suggested a large effect size.

Because the model was statistically significant and determined to meaningfully explain differences in math pass rates, statistical tests of individual predictors were examined further. Of the three predictor variables, participation in tutoring was statistically significant (p < .001). For every additional hour of tutoring, students were 4.53 times more likely to pass remedial math than those who did not. Race was also statistically significant (p < .04). Non-white students were 2.5 times less likely to pass remedial math than white students. There was no difference in developmental mathematics pass rates between male and female students (p= .82). Prior to interpreting the odds ratios associated with these comparisons, all ratios below 1.0 were inverted to improve interpretation (Osborne, 2008).These inversions are interpreted as times less likely.

Table 4

Summary of Logistic Regression Weights

Variable	*B*	*S.E.*	Wald	*df*	*p*	OR
Gender[1]	.09	.42	.05	1	.82	1.10
Race[2]	-.09	.45	4.12	1	.04	.39
Tutoring	1.51	.23	40.60	1	<.001	4.52

[1] Men Served as the comparison group for women.

[2]White students served as the comparison group for non-white students

Progression into College-Level Math

The second analysis examined progression into the college-level math course. Of the 206 first time, full time freshmen enrolled in remedial math, 74% (n=152) passed and enrolled in the next-highest math. Of the 152 students who passed remedial math, 86% (n=134) enrolled in the next-highest college level math course. This group was comprised of 54% female and 46% male; furthermore, 67% were white and 33% were nonwhite.

Table 5

Student Enrollment Rates in College-Level Math

Demographics	Enrollment		Tutored		Not Tutored	
	n	%	*n*	%	*n*	%
Gender						
Male	62	46	54	40	8	5
Female	72	53	62	46	10	7
Race/Ethnicity						
White	90	67	75	56	15	11
Non-White	44	33	41	31	3	2
Total	134		116			

A logistic regression was used to explore the relationships between demographic characteristics (race, gender), enrollment in tutoring, and enrollment in the next-highest college level math course. Assumptions of logistic regression were considered prior to conducting the analysis. Multicollinearity was tested by examining tolerance and VIF values. The tolerance values were between .99 and 1.0, the VIF values were between 1.0 and 1.01. Because the VIF value was less than 10 and the tolerance values were greater than 0.2 there was no indications of serious multicollinearity. The goodness-of-fit test (Hosmer-Lemeshow) yielded a χ^2 = 15.06 and was insignificant (p= .05), indicating that the model fit well to the data. Model effect sizes were also considered given their importance in the literature (Wilkinson & APA Task Force on Statistical Inference, 1999). The Nagelkerke R^2 in this study was .24. Because the model was statistically

significant and determined to meaningfully explain differences in math pass rates, statistical tests of individual predictors were examined further. Of the three predictor variables, participation in tutoring was statistically significant ($p < .001$). For every additional hour of tutoring, students were 1.84 times more likely to enroll in the next highest math than those who did not. Race was not statistically significant. There was no difference between male and female students; thus, gender was not statistically significant.

Table 6

Summary of Logistic Regression Weights

Variable	*B*	*S.E.*	Wald	*df*	*p*	OR
Gender[1]	.28	.33	.73	1	.32	.75
Race[2]	-.53	.33	2.54	1	.08	.58
Tutoring	.61	.11	29.17	1	.00	1.58

[1] Men Served as the comparison group for women.

[2]White students served as the comparison group for non-white students.

Completion of College Level Math

The third analysis examined the completion rate of the college-level math course. Of the 134 students who enrolled in college-level math, 59% were females and 41% males. Additionally, 60% of the students who passed were identified as White, while the remaining 40% were identified as Non-White. Of the 134 students enrolled in the college level math course, 57% (n= 118) passed the college level math course.

Table 7

Completion of College Level Math

Demographics	Pass Rate		Tutored		Not Tutored	
	n	%	*n*	%	*n*	%
Gender						
Male	48	41	35	30	13	11
Female	70	59	47	40	23	19
Race/Ethnicity						
White	71	60	45	38	26	22
Non-White	47	40	37	31	10	8
Total	118		112		36	

A logistic regression was used to explore the relationships between demographic characteristics (race, gender), enrollment in tutoring, and enrollment in the next-highest college level math course. Assumptions of logistic regression were considered prior to conducting the analysis. Multicollinearity was tested by examining tolerance and VIF values. The tolerance values were between .99 and 1.0, the VIF values were between 1.0 and 1.01. Because the VIF value was less than 10 and the tolerance values were greater than 0.2 there was no indications of serious multicollinearity. The goodness-of-fit test (Hosmer-Lemeshow) yielded a $\chi^2 = 6.14$ and was insignificant, indicating that the model fit well to the data. Model effect sizes were also considered given their importance in the literature (Wilkinson & APA Task Force on Statistical Inference, 1999). The Nagelkerke

R^2 in this study was .02. Because the model was statistically significant and determined to meaningfully explain differences in math pass rates, statistical tests of individual predictors were examined further. Of the three predictor variables, participation in tutoring was not statistically significant (p =.72). Race was not statistically significant (p =.85). There was no difference between male and female students; thus, gender was not statistically significant (p= .30).

Table 8

Summary of Logistic Regression Weights

Variable	*B*	*S.E.*	Wald	*df*	*p*	OR
Gender[1]	-.64	.61	1.07	1	.30	.55
Race[2]	-.10	.03	.03	1	.85	.90
Tutoring	-.05	.12	12	1	.72	1.06

[1] Men Served as the comparison group for women.

[2]White students served as the comparison group for non-white students

Summary of Results

The findings in Chapter 4 establish that for every additional hour of tutoring, students are more likely to pass remedial math than those who did not. Furthermore, non-white students are less likely to pass remedial math courses than their white peers. These findings also indicate that students who attend tutoring are more likely to enroll in the next highest math course for college credit. While this sample is limited to one community college in rural Alabama, the results indicate that interventions such as peer tutoring make a positive impact on the final grades of remedial math students.

Furthermore, this study demonstrates that the further students are removed from tutoring, the less likely that they are to succeed in their math course. However, this study clarifies the need for more research in regards to tutoring and remedial courses on a larger scale and across the US. The outcomes and results of this study are useful, but in order to make broader generalizations, this study should be replicated to a larger and broader population. This would allow researchers to make generalizations and enhance the value of the results.

CHAPTER V

Discussion and Recommendations

This chapter discusses the limitations and implications of this study. Furthermore, it presents recommendations for improving interventions for remedial math courses in the community college setting. Remedial math is considered a gatekeeper course for students who come to college underprepared. According to Bailey (2009), "only 30 percent of students pass all of the math developmental classes in which they enroll" (p. 13-14). Increased scrutiny and demands to change remedial courses require colleges and universities to explore ways to encourage student success within them. Without adequate support, barriers will remain, and students placed into remedial courses will fail to meet their academic goals.

The results of this study indicated that students who utilized embedded peer tutors were more likely to pass remedial math and more likely to immediately enroll in the college-level course, although these effects dissipated by the time students completed the college-level course. Although this study was limited to a small population of students in a community college in rural Alabama, findings from this study were consistent with prior research on the persistence and completion rates among students who attended tutoring in college-level courses. For example, students who visited the tutoring center at Western Washington University had statistically significant higher GPAs than those students who visited the tutoring center less than 10 times (Cooper, 2010). The positive relationship with student outcomes in both studies have implications for improving developmental education interventions.

Limitations

It is important to consider the limitations of a study in order to place research findings in context (Loannidis, 2006). This study was limited to one community college in rural Alabama during one academic year; therefore, the research may not be indicative of other developmental students or remedial math and tutoring programs across the US. According to the American Association of Community Colleges (Juszkiewicz, 2020), in the fall of 2018, five million students enrolled in noncredit bearing (remedial) courses. Additionally, the Southern Regional Education Board (2015) reported that community colleges in the Southern US have remedial course enrollment rates above 70%; whereas nationally, 50% of community college students enroll in one developmental course. Because of differing placement policies and wide-spread developmental reforms, it is difficult to compare developmental student populations from State to State.

The remedial math course that was used for this study was the result of developmental sequence restructuring by the Alabama Community College System for placement within both math and English remedial courses. In 2018, the Alabama Community College System shifted away from a two-tiered developmental math course sequence to one remedial and one co-requisite course. This study did not explore the effectiveness of tutoring within corequisite models. The co-requisite model seeks to help students earn college credit while receiving supplemental instruction alongside the required credit-bearing math course. Some have argued that corequisite approaches lead to higher pass rates in developmental courses (Fair 2017; Boatmen, 2012), which has resulted in developmental education reforms in states such as Tennessee, West Virginia, Georgia, Indiana, and Colorado. It must also be noted that the Community College

Research Center (2014) asserts that reducing the number of remedial math courses can quickly result in positive improvements in student success.

The sample in this study was limited to first time, full time freshmen enrolled in the remedial math class; therefore, it did not include students who were unsuccessful in previous remedial courses or who were enrolled only part time in college. These limitations did not allow for a comprehensive look at the remedial math program or peer tutoring math program at the College. Furthermore, this sample included only traditionally aged students (18-22) which meant students were not far removed from their last high school math course in comparison to other adult learners. It is difficult to compare adult learners to traditional college students as these learners are generally defined as students who are age 25 years or over that delayed enrollment in postsecondary institutions (Falchikov, 2001). However, according to Chen (2017) this group represents 38% of the postsecondary population and these students seek a degree for differing reasons than traditional college students.

Discussion

The results of this study provided evidence that tutoring was positively related to student completion rates in remedial math courses. Furthermore, findings from this study indicated that students are more likely to pass remedial math with each additional hour of tutoring compared to those who did not. Tutoring has been suggested as a key resource for students in higher education by affording students with a proactive support for learning (Sansone, Ligorio, & Buglass, 2018). While tutoring is a valuable intervention strategy that has been implemented in college and universities across the US, there is a

lack of research on the impact of tutoring in the college setting. This study adds to this body of research and provides insight to the positive impacts of tutoring programs.

This study also revealed that students who attended tutoring were more likely to enroll in the next highest math course- a course that is credit bearing. Zientek et al. (2020) investigated the enrollment patterns of remedial math courses. Specifically, it examined the differences in academic success of students who delayed enrollment in remedial math and those who were enrolled immediately into these courses. The researchers reported that students who immediately enrolled in a college-level course, rather than delay their enrollment, were more likely to be retained after one-year (Zientek et al., 2020). These findings may suggest that the use of embedded peer-tutoring alongside developmental mathematics may be an effective retention strategy.

Nonwhite students were less successful than their white peers in remedial math in this study. This finding is consistent with other studies that have found marginalized groups are disproportionately represented in remedial math courses (Hodara, 2019). Because these students are an underserved population, they enter college underprepared relative to nonmarginalized groups; thus, the gap in college retention and complete rates continue (Ngo & Velazquez, 2020). Bailey et al. (2010) concluded, minority students are more likely to be required to take multiple sequences of remedial coursework; therefore, these students are lesslikely to complete credit-bearing math courses. Although corequisite remediation strategies may help to minimize this issues, alternative strategies are needed to reduce the inequities between white and nonwhite students in remedial math courses (Hodara, 2019; Ran & Lin, 2019). Laskey and Hetzel (2011) affirmed that students who attend tutoring are significantly more likely to remain enrolled in college

classes and earn a higher grade point average than those who did not seek tutoring. In addition, Gallard, Albritton, and Morgan (2010) reported that when tutoring is utilized as a form of early intervention, student completion rates increase. Hodges and White (2001) published a study that found that one tutoring model, Supplemental Instruction, had a statistically significant impact on the grade point averages of students. These studies support the claim that tutoring can directly impact student retention and completion rates.

Impact of Tutoring. Peer tutor programs have become a cost-effective response to implementing tutoring programs on college and university campuses. Traditionally, peer tutors are recruited and hired based on their understanding of content knowledge and their ability to work with fellow students (Maxwell, 1990). These programs are seen as cost-effective because the students are offered scholarships for their time and commitment or they are paid hourly by the college or university (Rheinheimer et al., 2010). Topping (1996) asserts that peer tutoring programs are economical as they help shoulder the burden of student interventions that have traditionally been allotted to staff and instructors. Peer tutoring serves the students while freeing instructors and staff time to focus on improving classroom instruction or other student services. According to Markowitz (2020), peer tutoring programs are "an underutilized, cost-effective resource for enriching student learning and success." Because peer tutors are generally paid minimum wage, colleges and universities can save money and provide educational enrichment for both the peer tutor and tutee.

Recommendations for Practice and Research

This study focused on one intervention-embedded tutoring-for remedial math students. Research of embedded tutoring programs is limited; therefore, the recommendations that follow are gathered from existing literature that reflect and support the experiences of this study.

According to Boylan and Saxon (2012), well-coordinated developmental programs support both student and program success. This coordination requires all faculty and staff clearly communicate activities, objectives, and meeting schedules with one another (Boylan & Saxon 2012). Developmental students need comprehensive or intrusive advisement so that they can better understand what courses they need to take and the programs available to them to help them succeed. Boylan and Saxon (2012) stated that, "The primary objective of this type of advising system is to place students in the best combination of courses, support services, and college experiences rather than in traditional developmental education classes" (p. 35). An intrusive advising system requires the advisor to enroll students in a combination of courses that will encourage student success and inform the students of programs that are available to assist them (Saxon & Morante, 2014). Intrusive advisement differs from embedded tutoring programs as these advisors serve students in areas outside of the classroom such as assisting with academic plans, setting goals, and career choices. One recommendation for this study is for embedded peer tutoring programs to be implemented alongside the intrusive advising program so that students have a network of support that encourages success.

A comprehensive program that offers services to encourage success both in and outside of the classroom should be a priority for administrators seeking solutions for assisting students who are not college-ready. As Hernandez et al., (2013) note, developmental students require interventions that go beyond the traditional supports for college-ready students. In an effort to make a developmental intervention program more effective, a system for evaluating completion and pass rates in developmental courses, pass rates in regular college coursework, and graduation rates allow for appropriate changes to be made within a comprehensive intervention program (Boylan & Saxon 2012). At Gadsden State Community College, an intrusive advisement program was implemented to work in tandem with the embedded tutoring program to provide developmental students with a comprehensive support system. While the embedded tutoring program and the intrusive advisors work together to foster student achievement, these programs need an evaluation system to continually improve the program. Additionally, one recommendation from both Boylan and Saxon (2012) and from this study is the implementation of an evaluation system within the developmental intervention or tutoring program to identify weaknesses and areas in need of improvement.

Other important elements to consider when developing a tutoring program in the community college setting are systemic barriers that influence students' willingness to seek help and support in college. According to Massey and Fischer (2005), marginalized and nontraditional students are often reluctant to pursue additional assistance because of a lack of understanding, concerns about acceptance, and underdeveloped competencies that put them at a disadvantage for help-seeking in the college setting. Furthermore,

nontraditional students often have multiple responsibilities outside of the classroom that keep them from accessing support services. When developing a tutoring program, it is important for administrators to work together with support services to remove barriers and provide access to tutoring programs in a variety of ways. While embedded peer tutoring programs bring the tutor to students, some students need assistance outside of class and in other subjects. One way to encourage use and access of tutoring facilities is by inviting instructors to bring classes to the tutoring center during the first week of classes so that students can visit the tutoring center, register for tutoring, and meet program directors and staff members. This will allow students some familiarity with the facility so that they feel more comfortable when seeking help.

Application of Theoretical Framework for Tutoring. One recommendation is the application of theoretical frameworks for developing and evaluating tutoring interventions. According to Falchikov (2002), educational theory is the most underutilized tool in postsecondary educational support programs. Falchikov (2002) argued that theoretical frameworks "enable us to make predications and evaluations of our initiatives." Vygotsky's (1978) Zone of Proximal Development (ZPD) is one framework that can help researchers interpret results of peer tutoring studies. Forman and Cazden (1985) utilized the ZPD to explain the impact of two different approaches to peer tutoring: singletons and dyads. Additionally, Dolittle (1995) discussed the ZPD's relationship to cooperative learning and cognitive change. There is a general consensus that theoretical frameworks should be considered in the development of intervention programs; thus, the ZPD may be an appropriate framework for designing collaborative learning environments for peers.

Evaluating a peer tutoring program through the lens of the ZPD may allow researchers to better understand the roles of the peer tutor and the tutee by providing insight into the role and authority of the tutor and tutee. Gillam, Callaway, and Wikoff (1994) focused their study on the role and authority of the peer tutor. A better understanding of these roles can provide insight into student self-perception and perception of the peer in the role of the teacher or tutor; thus, allowing administrators to address any issues between these roles during peer tutor training (Gillam, Callaway, & Wikoff, 1994). Because embedded peer tutors are placed within the course and participate in the learning process, students have the opportunity develop a relationship with the tutor that does not exist in a drop-in tutoring center. It must be noted that Cooper (2010) studied a small cohort of freshmen who accessed the drop-in peer tutoring center at Western University. He found that the students who visited the center more than ten times in one quarter had a higher grade point average than those who did not. However, this study also recommended that future research explore the effectiveness of drop-in tutoring verses mandatory or assigned tutoring programs (Cooper, 2010).

Recognizing the Value of Tutoring. Peer tutor programs have become a cost-effective response to implementing tutoring programs on college and university campuses. Traditionally, peer tutors are recruited and hired based on their understanding of content knowledge and their ability to work with fellow students (Maxwell, 1990). These programs are seen as cost-effective because the students are offered scholarships for their time and commitment or they are paid hourly by the college or university (Rheinheimer et al., 2010). The cost-efficient impact that a peer tutoring program can make on the success of college students can foster positive persistence and retention rates

without the financial burden that can come with paying professional tutors or investing in online tutoring programs. Furthermore, an embedded peer tutoring program provides short-term interventions that are specific to students who struggle in gate-keeper courses such as developmental math and reading. Additionally, an embedded peer tutoring program can promote academic integration that can make a positive impact on at-risk students. While there are few studies that measure the impact of tutoring on grades, this study demonstrated that students who attend tutoring are more likely to persist. Thus, the financial and academic impacts of a peer tutoring programs are recommended for practice within a college setting.

Best Practices for Embedded Tutoring Programs. There are few training programs for tutoring centers to utilize when preparing peer tutors to work with students. The College Reading and Learning Association (CRLA) offers one of the most largely recognized tutoring certifications for both professional and peer tutors, which may include those that are embedded (College Reading & Learning Association, 2016). This training requires three levels of certification that engages the tutor in continual education of best tutoring practices such as understanding the role of the tutor, questioning skills, and evaluation processes. Additionally, tutor evaluation should be implemented as a best practice in order to identify areas of improvement within the tutoring program. A formal evaluation process allows for tutoring programs to maintain consistent data that can address concerns regarding the impact of the tutoring program. Peer tutors have been required to complete the CRLS certification at other institutions (Cooper, 2010). Cooper (2010) asserted that tutor tracking software and detailed notes allowed for tutoring programs to understand tutor performance, but not necessarily the impact of the CRLA

tutor training. There is a difference between evaluating the effectiveness of tutor training and the tutoring program itself. The Council for the Advancement of Standards in Higher Education (2010) provides self-evaluation guidelines and processes for learning assistance programs that lay the foundation for program assessment. The results of these assessments guide the development of student learning outcomes to foster continuous improvement of the tutoring or intervention program (Fullmer, 2009).

Community colleges are often under-funded and as a result, cannot afford to invest in training programs; therefore, they often have to create their own training curriculum or lean on federally funded programs such as TRIO's Student Support Services to assist in developing tutoring training content. This program is guided by a program management and planning guide that assists in developing program goals and measurable outcomes. Another free resource available is the W.K. Kellogg Foundation Logic Model Development Guide (2004) that is defined as "a visual way to present and share your understanding of the relationships among the resources you to operate your program, the activities you plan, and the changes or results you hope to achieve." Furthermore, colleges such as Bowie State provide a free manual for tutor training. Tutor training programs are one of the most important elements; therefore, it is recommended that colleges and universities that cannot afford to invest in costly professional training programs seek out some of the free materials offered by other institutions.

One trend that has been implemented among some colleges is that of mandated tutoring in courses with low pass rates. The University of Alabama Huntsville mandates tutoring for at-risk students to ensure the intervention can be both sustained and effective (Vance, 2016). Hodges and White (2001) argued, "High-risk students may need stronger

influences to facilitate positive changes in their behavior" (p. 9). Requiring students to participate in tutoring can have positive benefits, but future research needs to explore how differences in the length of tutoring programs affect students' success. Furthermore, Zientek et al. (2020) suggested that underprepared students are more likely to procrastinate. Those who procrastinate may also be less willing to seek out help and support. Thus, mandating these types of interventions may help address problems related to procrastination.

Vance (2016) reported that high-risk students who participated in mandatory tutoring at Eastern Kentucky University had significantly higher grade point averages than those students who were not required to attend tutoring. This study also asserted that students who were required to attend tutoring for four hours each week were more likely to be retained (Vance, 2016). Tutoring programs require centralized training, faculty input, and yearly program evaluation (Vance, 2016). Gaps in the literature regarding tutoring and its impact on developmental students and higher education in general is evident. Hodges and White (2001) suggested that future research about mandatory tutoring could strengthen this intervention tool.

It is also important to consider the impact of student motivation and tutoring (Rheinheimer et al., 2010). Even though tutoring has been utilized by colleges and universities as an intervention tool, there have been few comprehensive studies conducted that explore the impact of this intervention (Rheinheimer & Mann, 2000; Vance, 2016). Research that focuses on the relationship between tutoring and developmental students might allow for a better understanding of what program elements have the greatest

impact. Future studies should also explore the differences in the level of peer-to-peer engagement.

Future research should expand on the current study to explore how continued engagement in tutoring throughout the pursuit of a degree affects student performance. Such findings may allow for a broader understanding of how varied levels of engagement best support developmental students. Additionally, future research should focus on differences in the structure and implementation of the peer tutor program. Specifically, future studies should explore differences in the peer tutor selection process, as it can provide a foundation for best practices in peer tutor selection.

While this study was conducted using a remedial math course, future research should explore the effects of embedded peer-tutoring in the co-requisite math course. The use of corequisite courses is becoming increasingly common among colleges and universities to reduce the number of remedial math courses a student is required to take in college, which is also a barrier for student success (Edgecombe, 2011). Varying designs of the co-requisite course exists in colleges and universities across the US. Some co-requisite courses are designed to feature individualized tutoring or attend a math lab with a math instructor (Edgecombe, et al., 2013). A randomized controlled study conducted by Logue et al. (2016) found higher success rates among students who were placed in the co-requisite math course than those who had completed a remedial math course. Understanding the positive impact of these courses can improve the structure of remedial math interventions for students placed into these courses. Furthermore, the instructional tools, interventions, and classroom settings should be considered within the body of research.

Conclusions

Increasing the success for remedial math students continues to be at the forefront of education reform. Further research of remedial math intervention programs can guide informed decisions when developing new peer tutoring programs. This study has shown that embedded tutors in a developmental math course make a positive impact on student success. As a result, this study can encourage the expansion of an embedded peer tutoring program within postsecondary institutions. Administrators can use the results of this study and its recommendations to make informed decisions about intervention programs in remedial math classrooms. Furthermore, it is important for college administrators to explore how intervention programs can increase student retention and completion rates within their institutions. Additionally, this study contributes to the body of knowledge regarding developmental math interventions and peer tutoring programs.

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VITA

Farrah Rachel Hayes

Profile: As a third-generation educator, I am a fully committed to aiding students in achieving their full potential. I strive to create a classroom that is student-centered and teacher-facilitated. In my career, I have demonstrated my ability to consistently individualize instruction based on a student's interests and needs I believe that I must remain a student outside of the classroom to meet the needs of every student.

Education:

- Doctorate, Developmental Education Administration

  Sam Houston State University, 2021
- Educational Specialist, English Language Arts

  Jacksonville State University, 2010
- Master of Science in Education, English Language Arts

  Jacksonville State University, 2008
- Bachelor of Arts, English & Spanish

  Jacksonville State University, 2005

Professional Experience:

- Division Chair of Languages & Humanities, Gadsden State Community College, 2019—present.
- Director of Cardinal Tutoring Centers, Gadsden State Community College, 2017-2019.
- English Instructor, Gadsden State Community College, 2015-present.

- Lead English teacher for all 7-12 ELA teachers & Sardis High School English Department chair, Advanced Placement English Language & Literature, Etowah County Board of Education, 2011-2015.
- Adjunct Professor- English & Education

  Jacksonville State University, 2008—2014
- English & Spanish Teacher

  Piedmont City Schools, 2005—2011

Achievements:

•2018 Collegiate Executive Opportunities Cohort Member, Gadsden State Community College

•2017 Leadership Etowah representative for Gadsden State Community College

•2017 New Developmental Educator of the Year, ALADE

•2017 Outstanding Academic Faculty, GSCC Alumni Association

•2016-2017 Quality Enhancement Program committee member, Gadsden State Community College

•2016-2017 Faculty Developmental Institute Member, Gadsden State Community College

•2016 Alabama Community College Systems, Developmental English panel member

•2015 Jewish Foundation for the Righteous Fellowship recipient, Columbia University

•2015 Lead English Teacher for Etowah County Schools

•2014-2015 A+ College Ready Leader for Etowah County, Calhoun County, and Gadsden City Schools

•2014 Target Helps Schools Grant Recipient

•2013-2014 Recognized by A+ College Ready and the Governor of Alabama for outstanding results in AP Language & Composition

•2011 Piedmont High School Teacher of the Year

•2010 Recipient of the STAR research grant from the University of Alabama Huntsville. Received funding to travel to Madrid, Spain to take intense Spanish courses

•2009 & 2010 Belfar Holocaust Memorial Scholarship to attend workshops at the United States Holocaust Museum

2008 Recognized as the Outstanding Graduated Student for the Department of Education at Jacksonville State University