SELF-EFFICACY AND STUDENT EXPERIENCES IN A COREQUISITE DEVELOPMENTAL MATH COURSE

by

Jessica Lynn Edmiston

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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APPROVED BY:

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Abstract

The purpose of this phenomenological study was to discover the role of self-efficacy in a corequisite developmental math course for college students at a community college in South Central Texas. In this study, a student's math self-efficacy in a college developmental math course was generally defined as how one's belief in one's capacity in math influences the necessary behaviors to perform certain attainments in mathematics. The theory guiding this study was Bandura's self-efficacy theory. The central research question was how self-efficacy influences the experiences and perceptions of students in prerequisite developmental math courses. The methodology was a transcendental phenomenological study incorporating Moustakas' approach. Convenience sampling was used to recruit students enrolled in Corequisite College Algebra in a South Central Texas community college course during the 2023–2024 school year. Data were collected through individual interviews, journal prompts, and a focus group interview. After data collection, codes were created using Moustakas' approach and coding based on common terms or phrases describing the shared student experiences of the phenomenon. The findings included that past math experiences influenced math self-confidence, outside stressors impacted persistence in the course, and attitudes and beliefs about mathematics influenced student experiences in Corequisite College Algebra. Trustworthiness was utilized by memoing, member-checking, and data triangulation.

Keywords: math self-efficacy, developmental courses, corequisite courses, mastery experiences

Copyright Page

Dedication

I dedicate this dissertation to God and my family. To my Airborne soldier husband, who sacrificed so much for our country, thank you for your support through this process. You have always been my best friend, and you continue to be, no matter what life throws at us. For Jackson and Jeremiah, my two sweet boys, thank you for your patience. For my parents, who often worked two jobs for us to make ends meet, thank you for all you sacrificed for me. I get my work ethic from you. I want to thank God for all the blessings in my life and for working through Liberty University to give me this opportunity.

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List of Abbreviations

CAPR	Center for the Analysis of Postsecondary Readiness
CCRC	Community College Research Center
STEM	Science, Technology, Engineering, & Mathematics
THECB	Texas Higher Education Coordinating Board
TSIA	Texas Success Initiative Assessment

CHAPTER ONE: INTRODUCTION

Overview

Student enrollment in developmental mathematics courses has risen across the United States in the last decade (Skuratowicz et al.; Soland, 2019; Stewart et al., 2020). Developmental courses do not count on transcripts for credit-earning associate's or bachelor's degrees. While many 4-year universities offer developmental courses, the percentage of students enrolling in developmental courses is higher in community colleges than 4-year universities (United States Department of Education et al., 2016). Data suggests that students who enroll in developmental courses have lower grade point averages, have taken the same developmental course multiple times, and are less likely to finish their degree plans on time than students not enrolled in developmental math courses (Skuratowicz et al.; Soland, 2019; Stewart et al., 2020). A specific type of developmental course colleges offer is the corequisite model in which students simultaneously take a course's developmental and college parts. The background of developmental and corequisite courses, the problem statement, the purpose statement, the significance of the study, and the research questions are explored in this chapter.

Background

In Texas, over 40% of students entering a public institution do not meet state college readiness standards (Texas Higher Education Coordinating Board [THECB], 2018). Since 2009, the Texas Higher Education Coordinating Board (THECB) has been working to create and develop education initiatives to improve student success. In 2017, the Texas Legislature passed House Bill 2223, requiring all Texas public institutions of higher education offering developmental education courses to develop and implement corequisite models (THECB, 2018). This requirement included student enrollment in corequisite courses to meet incremental

percentage increases yearly from 2018–2019, increasing in 2021 to 75% (THECB, 2018). The THECB statewide plan recommendation was to "deliver efficient and effective developmental education via corequisite models by 2023" (THECB, 2018, p. ii).

Historical Context

Developmental education has been around since the 1860s (Arendale, 2002). In America, it began with Harvard, which offered remedial English courses to college freshmen, as the faculty complained that students were unprepared for formal writing (Arendale, 2002). During this time, developmental courses were called "remedial education classes." From the 1860s to the mid-1940s, remedial education courses through college preparatory programs and tutoring were mainly offered to White males (Arendale, 2002).

However, institutions began integrating remedial education courses from the mid-1940s to the early 1970s (Arendale, 2002). Remedial courses were offered to more student groups, including female, first-generation, economically disadvantaged, and minority students. From the early 1970s to the 1990s, developmental education was defined and supplemented with learning assistance, tutoring, and supplemental instruction (Arendale, 2002). Developmental education included all groups of college students (Arendale, 2002). From the mid-1990s to the present, developmental education has expanded to include enrichment activities and programs like core courses.

Social Context

Data suggests that inequities exist in developmental education (Akos et al., 2020; Moreno et al., 2019; Morley et al., 2020; Ngo & Velasquez, 2020), including an increase in racial minorities, students below the poverty line, and first-generation students who are more likely to take developmental courses than other student groups (Browne, 2022; Daugherty et al., 2021).

Students who take developmental courses do not earn college credit, fall behind on their degree plans, and pay for courses for which they do not receive credit (Browne, 2022). Thus, first-generation and low-income students are more likely to enroll in developmental courses than non-first-generation students but are less likely to pass them (Evans et al., 2020; Martin, 2015; May et al., 2021; McFadden, 2016). Inequities regarding student enrollment types in college-level classes do not necessarily begin in college.

Researchers have suggested that one reason for misalignment that occurs when students take developmental courses despite their high school achievements and is more likely to occur between racial/ethnic inequities is due to the mathematics track they enter at the high school level (Ngo & Melguizo, 2020; Ngo & Velasquez, 2021). Some high school students can enroll in dual-credit courses and have a head start to college while in high school. Students who participate in and complete dual credit math courses in high school are more likely to attend college, graduate on time, and save money on tuition (Dyer et al., 2022). These students are also not required to take the Texas Success Initiative Assessment (TSIA) in college and are not enrolled in developmental math courses. Research has shown that underrepresented students are less likely to participate in dual credit courses in Texas and the United States (Lee & Villarreal, 2022; Moreno et al., 2019). However, for Texas high school students to enroll in dual-credit courses, they must pass the TSIA during high school. Notably, a lower percentage of minority students pass (Dyer et al., 2022; Morley et al., 2020).

Theoretical Context

According to the National Student Clearinghouse ([NSC], 2022), in 2016, the national college completion rate after 6 years of community college fell behind all other types of institutions at a rate of 43%. Thus, 6 years later, over half of the students who enrolled in

community colleges in 2010 did not complete their degrees (NSC, 2022). This national problem has occurred for decades. Extensive research, state legislatures, and the federal government have produced ways to improve student success in community colleges. Research has suggested that students enrolling in community colleges face other hardships, including family hardships, economic distress, housing insecurity, and other needs that must be met to succeed in college (Goldrick-Rab, 2018).

Noncognitive factors, including self-efficacy, a growth mindset, and grit, influence student success in an academic setting. Colleges offer first-year-level orientation courses, student development, and skill courses to help students build study skills, including College Success, Strategies for Success, and Foundations for College Learning. In Texas, a statewide plan to support underprepared students includes refining and scaling developmental education practices, as data have shown that 14.9% of underprepared students entering community colleges and 32.3% of those entering 4-year universities graduate (THECB, 2018). Research has shown that accelerated developmental courses, including corequisite courses, have a higher percentage of all types of students completing the course than developmental-only courses (Miller et al., 2021; Ran & Lin, 2022; Ryu et al., 2022). Since 2018, the Texas State Legislature has required public universities to offer developmental courses to increase student enrollment in corequisite courses to "ensure efficient and effective delivery of developmental education" since success has followed implementing corequisite courses in Texas, California, Connecticut, West Virginia, Colorado, and Tennessee (THECB, 2018, p.8)

Problem Statement

The problem is that students who take developmental math courses are less likely to pass their subsequent next-level college math courses and graduate on time (McKinney et al., 2018;

THECB, 2018; Zhao et al., 2022). Over half of the students who enroll in community colleges must take developmental courses before they can take college courses (United States Department of Education et al., 2016). Researchers have suggested that students who enroll in developmental math courses are less likely to engage in the science, technology, engineering, and mathematics (STEM) fields (Bahr et al., 2016; Blotnicky et al., 2018). Many states have written reforms requiring colleges to offer instructional strategies, corequisite models, and other strategies to make developmental courses more effective and equitable to students (Skuratowicz et al., 2019; Zhao et al., 2022). Data have shown that racial inequities exist in developmental math participation and passing rates (THECB, 2018).

In Texas, as developmental education has evolved, the placement of students into developmental courses has also evolved. The TSIA program is designed to determine student placement (Humes, 2023) as mandated by the Texas State Legislature. The TSIA is designed to guide Texas public institutions in determining if students are ready for entry-college coursework in the subject areas of mathematics and English language arts and reading (ELAR; Humes, 2023). Students who meet college benchmarks on college tests such as the ACT and SAT or high school state assessments are exempt from the TSIA.

Students who pass college courses in high school (e.g., dual-credit courses) are exempt from the respective subjects and are not required to take the TSIA. While students may still be admitted to public institutions in Texas with TSIA scores that do not meet TSIA benchmarks, they are required to receive developmental education as determined by the public institution (Humes, 2023). Although a multitude of quantitative and qualitative research exists on developmental math course effectiveness, a gap in the literature exists concerning students' individual experiences, motivations, and perceptions in developmental math courses, especially

concerning the newly developed corequisite models that include taking a developmental math course and a college course simultaneously.

Purpose Statement

The purpose of this phenomenological study was to discover the role of self-efficacy in a corequisite developmental math course for college students at a community college in South Central Texas. In this study, a student's math self-efficacy in a college developmental math course was generally defined as how one's belief in one's capacity in math influences the necessary behaviors to perform certain attainments in mathematics. The theory guiding this study was Bandura's (1977) self-efficacy theory.

Significance of the Study

Students required to take developmental courses while beginning their college careers face many challenges and difficulties (Evans et al., 2020; Martin, 2015; May et al., 2021; McFadden, 2016). Many variables are attributed to one's success in college. This study is significant because it examines students' experiences with newly developed, required prerequisite courses to better understand their perspectives. Using student voice to obtain strategies for success can help determine how to help future students and equip future faculty on implementation strategies. Self-efficacy is attributed to math perceptions and experiences in prerequisite courses and can be further investigated as time passes with other students in other parts of the country. In line with Texas higher education, the corequisite requirement is built on creating fair and equitable opportunities for all students to better their lives through postsecondary education to meet their academic and career aspirations (THECB, 2018).

Theoretical

The theoretical underpinnings of the longstanding problem of developmental courses'

impact on student outcomes in college include describing and understanding how self-efficacy impacts student success in developmental math courses. Diving deep into the different components that address self-efficacy, listening to and recording student experiences, and finding common themes among successful students in corequisite math courses can provide insight into self-efficacy theory.

Empirical

The empirical significance of the study is that it relates to a multitude of quantitative research and, more recently, qualitative research on the impact of corequisite courses for students in colleges and universities across the United States. Hearing students' voices and stories can aid in understanding and describing the influence of self-efficacy in corequisite developmental math courses.

Practical

The study's practical significance is to help determine how to help students gain self-efficacy to increase their student success in college math courses. For colleges and instructors who teach corequisite developmental math courses, learning about student experiences and successes can help create ways to help other corequisite developmental math students. Students may also understand how self-efficacy impacts their learning and find ways to improve it.

Research Questions

Central Research Question

How does self-efficacy influence the experiences and perceptions of students in corequisite developmental math courses?

Sub-Question 1

How do personal experiences with mathematics instructors influence student self-efficacy in corequisite developmental math courses?

Sub-Question 2

How do peer experiences influence self-efficacy in corequisite developmental math courses?

Sub-Question 3

How do experiences with others outside of the classroom influence corequisite developmental math students' self-efficacy?

Sub-Question 4

How do prior math experiences influence student perceptions about math self-efficacy in corequisite developmental math courses?

Definitions

1. *Corequisite courses* are an instructional strategy whereby non-exempt undergraduate students who have not demonstrated college readiness in mathematics or ELAR are co-enrolled or concurrently enrolled in a developmental education course or non-course-based option and the entry-level, credit course with the same semester for the respective subject area (THECB, 2018).
2. *Developmental courses* are below college level and cannot be applied to the requirements for a certificate or degree program (Law Insider, 2023).
3. *First-generation students* are those whose parents did not complete a 4-year college degree (Center for First-Generation Student Success [NASPA], 2020).

4. *Self-efficacy* is the belief in one's capacity to execute behaviors necessary to perform certain attainments (Bandura, 1997).

Summary

Numerous states across the United States are improving developmental education based on research that indicates that the improvement is warranted (THECB, 2018). Students entering college who are required to take developmental courses before earning college credit fall behind their peers, are less likely to obtain a STEM career, and are more likely to withdraw from college (McKinney et al., 2018; THECB, 2018; Zhao et al., 2022). This phenomenological study used Bandura's (1977) self-efficacy theory to describe student experiences in South Central Texas' newly required corequisite courses and investigate ways to improve students' success in corequisite math courses.

CHAPTER TWO: LITERATURE REVIEW

Overview

A systematic review of the literature was conducted to explore how self-efficacy influences student achievement in developmental math courses. This chapter offers a review of the research on this topic. Self-efficacy theory is discussed in the first section, followed by a review of the recent literature on developmental education, reforms in developmental education, the role of developmental courses in community colleges, and how self-efficacy influences students' academic mindsets, social skills, academic perseverance, and perceptions in a developmental math course. Lastly, the literature surrounding student experiences in developmental math courses with a specific focus on self-efficacy's four sources of performance accomplishments are discussed, including mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states. Finally, a gap in the literature is identified with the need for more research on creating higher self-efficacy in developmental math students.

Theoretical Framework

Bandura's self-efficacy theory is defined as "an individual's belief in his or her capacity to execute behaviors necessary to produce specific performance attainments" (Bandura, 1977, p. 191). Self-efficacy reflects individual motivation and goal setting based on an individual's perception. Self-efficacy impacts human behavior and affective states. Self-efficacy theory explores the beliefs and types of performance outcomes expected within given social systems. This structural feature of social systems includes the opportunities provided and the constraints that occur. People with higher self-efficacy have positive outcomes considered productive: engagement, aspiration, and personal satisfaction. In contrast, people with lower self-efficacy will have negative outcomes, resignation, and apathy. The relationship between beliefs of self-

efficacy and outcome expectations begins with the person, then self-efficacy beliefs, behavior based on those beliefs, the outcome expectancies, and, ultimately, the outcome.

Bandura (1997) expanded on self-efficacy theory by citing numerous studies regarding self-efficacy and performance outcomes. In mathematics, self-efficacy is "a situational specific assessment of an individual's confidence in his or her ability to successfully perform or accomplish a particular mathematics task or problem" (Hackett & Betz, 1989, p. 262). Schunk's (1984) research showed how efficacy beliefs influenced academic performance. The study consisted of mathematical competencies through self-directed instruction. The results showed that skill development had a smaller direct effect on academic performance and that children's beliefs in their academic efficacy contributed to a higher skill outcome (Schunk, 1984). Hence, "perceived efficacy exerts a more substantial impact on academic performance, both directly by affecting quality thinking and good use of acquired cognitive skills and indirectly by heightening persistence in the search for solutions" (Bandura, 1997, p. 216).

In a study of undergraduate students, Hackett and Betz (1989) concluded that "the importance of mathematics self-efficacy to the career choice process and the moderate relationship between self-efficacy and performance indicate that mathematics teachers should pay as much attention to self-evaluations of competence as to actual performance" (p .271). Bandura (1997) highlighted that self-inefficacy barriers in the mathematical domain limit future career choices as perceived mathematical efficacy leads to a lack of quantitative skills and dissuades scientific and technological careers. Four sources of information construct self-efficacy beliefs: mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states (Bandura, 1977, 1997). A brief discussion of each is presented, and recent literature appears in the related literature section. Mastery experiences are the most influential of

the four as they create the most authentic evidence to determine if one has what it takes to achieve a task or outcome.

The influences of the four factors of self-efficacy—mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states—play a crucial role in student learning throughout all ages, including entry-level college students enrolled in developmental math courses. The literature regarding developmental education, the current trends and issues, and the reforms to improve it are explored in the related literature section. The recent literature regarding self-efficacy at different age levels is discussed. The literature review explores self-efficacy through mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states in student achievement.

Related Literature

This section explores the recent literature on developmental education, reforms in developmental education, the role of developmental courses in community colleges, and how self-efficacy influences students' academic mindsets, social skills, academic perseverance, and perceptions in a developmental math course. The literature surrounding student experiences in developmental math courses with a specific focus on self-efficacy's four sources of performance accomplishments (i.e., mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states) are discussed, with implications for curriculum and instruction. The literature surrounding improving affective mindsets includes growth mindset, grit, and perseverance. Moreover, the literature on how self-efficacy influences career choices is discussed.

Traditional Developmental Education

Over 50% of the millions of students in developmental math courses do not complete the developmental requirements or their degree or certificate. In community colleges, only 16% of developmental math students complete a required college-level math course within 3 years (Bailey, 2015). Numerous research studies have examined the effectiveness of developmental education courses. Both research and data have suggested that based on student success rates and student completion of degrees, traditional developmental courses need much improvement (Bailey et al., 2010; Boatman, 2021; Jaggars & Bickerstaff, 2018; Park et al., 2017; Rutschow et al., 2019; Valentine et al., 2017). Reasons for ineffectiveness include inefficient placement testing, a lack of progression in earning college credit due to developmental courses not counting towards college credit, financial aid hindrances due to taking longer to earn college credit, self-esteem issues due to developmental course placement, and developmental courses lacking effectiveness (Boatman, 2021; Jaggars & Bickerstaff, 2018). Due to the ineffectiveness of traditional developmental courses, many states and colleges have created reforms to help increase student success (Boatman, 2021; Rutschow et al., 2019).

Developmental Education in Community Colleges Versus 4-Year Institutions

Developmental education courses are designed to help underprepared students improve their skills to prepare them for college-level courses, as offered at community colleges and 4-year institutions (Ganga et al., 2018). In community colleges, 67% of students who enroll must take at least one developmental course, while 40% of students in 4-year institutions take at least one developmental course (Ganga et al., 2018). Data from 2016 showed that of first-time students in developmental education courses, less than 40% earned a credential in 6 years or less (United States Department of Education et al., 2016). For community colleges, fewer than 28%

earn a degree within eight years (United States Department of Education et al., 2016). In mathematics, the percentage is even lower. According to the Community College Research Center (CCRC, 2023), in a study involving 63,650 students assigned three levels of developmental math, only 11% completed college algebra (CCRC, 2014).

Developmental Reforms

Many state policymakers and college systems have begun adopting better developmental education practices. Many colleges are using alternate ways to determine college readiness to combat the fact that many students required to enroll in developmental math courses do not need to. The Center for the Analysis of Postsecondary Readiness (CAPR, 2023) conducted widespread research in developmental education at 2-year and 4-year institutions and found that 19 states had encouraged or mandated colleges to include other ways to assess college readiness besides standardized testing (Rutschow et al., 2019; Whinnery & Odekar, 2021). Fifteen states had recommended or required colleges to enroll students in courses that included college credit with support, such as the corequisite model. Notably, Texas and California have mandated specific reforms for developmental courses for all public colleges and universities (Logue et al., 2019; Rutschow et al., 2019).

While multiple reforms exist to improve developmental education, one university used self-efficacy theory to improve student achievement in developmental mathematics (Morris et al., 2023). During 2015–2018, in the Mountain West region of the United States, a university piloted a mathematics intervention supported by the United States Department of Education's Strengthening Institutions Program that applied pedagogical practices and delivery practices devoted to self-efficacy theory in mathematics mindset (Morris et al., 2022). The pilot addressed

self-efficacy theory using its four sources. In this pilot, students enrolled in the intervention program were three times more likely to pass college algebra (Morris et al., 2022).

To promote student mastery experiences, the university added an instructional hour to focus on math concepts and problem-solving with math helpers/tutors and provided students with several low-stakes assessments that could be taken multiple times to improve their grades (Morris et al., 2022). Vicarious learning was explored by allowing multiple group work periods during class time (Morris et al., 2022). Students were also assigned a math helper/tutor who supported learning, provided support, and encouraged students to grow their math confidence (Morris et al., 2022). Social persuasion resulted in implementing faculty mentoring students about math mindsets and self-efficacy, including positive and encouraging feedback and discussion prompts that encouraged perseverance and self-efficacy building in mathematics (Morris et al., 2022).

Peer social persuasion was also addressed through math helpers/tutors who would meet with students one-on-one multiple times a semester to encourage them and offer support. These helpers/tutors held office hours and contacted students who had not completed their coursework (Morris et al., 2022). Physiological and affective states of self-efficacy were addressed by providing reflective writing activities encouraging students to write about their thoughts regarding mathematics and the learning process. The math helpers/tutors met with students to discuss their writing and ways to improve learning approaches (Morris et al., 2022). Furthermore, students participated in goal setting and were encouraged to emphasize understanding versus grades (Morris et al., 2022). While this study addressed the four sources of self-efficacy, much research on developmental education reform has addressed parts of self-

efficacy. The several types of reforms may be divided into three categories: assessment reforms, instructional reforms, and student support reforms.

Instructional Reforms and Influence on Curriculum and Instruction

Instructional reforms include compressed courses, self-paced courses, corequisite models, learning communities, multiple math pathways, integrated reading, and writing. The corequisite model has shown promising results of increased student success compared to developmental-only courses. Multiple studies have shown that corequisite courses, including the developmental and college part of the course, have higher success rates than developmental ones alone (Boatman, 2021; Logue et al., 2019; Rutschow et al., 2019). One long-term study of students taking developmental math courses versus corequisite math courses showed a higher quantitative course pass rate and graduation rates (Logue et al., 2019).

Another study that included 907 students randomly placed into math courses that included remedial elementary algebra with workshops or college statistics with corequisite remediation showed that students placed in college statistics corequisite courses had higher pass rates and accumulated more college credits, arguing that allowing students to take corequisite courses can increase student success (Logue et al., 2016). A study that included a matched-sample comparison of co-enrolled developmental math and college math versus students in developmental math only found that students in developmental and college-level math were three times as likely to pass than those in developmental alone (Anderson et al., 2020).

Assessment Reforms

Cognitive predictors for academic achievement in college-level courses include standardized exams such as the American College Test (ACT, 2022), the Scholastic Aptitude Test (SAT, 2022), the Texas Success Initiative (TSI, 2022), and other state-created exams. Multiple

sources have suggested that cognitive tests accurately predict college achievement (Kingston & Anderson, 2013). A 2019 study involving 223,000 students across 171 4-year colleges and universities showed that the SAT was as effective at predicting college performance as high school grade point average (College Board et al., 2019).

However, other research has suggested that other factors besides standardized tests are better predictors of college success (Cox & Dougherty, 2018; Rutschow et al., 2019) and that the implications of placing students into developmental courses have long-term consequences. Many factors, including noncognitive factors and self-efficacy, impact minority and first-generation college students' experiences (Akos et al., 2020). Studies have shown that minority and first-generation students' noncognitive factors were more predictive of college success than SAT math scores. However, most colleges do not consider this factor when enrolling students in courses (Elliot, 2014).

Most high school students across the United States take the SAT or ACT. While the scores are still used for college admission, many colleges no longer require the SAT or ACT (Geisinger, 2021). Most community colleges across the United States require enrolling students to take an initial placement test. Students with low math scores are required to enroll in developmental courses; for some, the requirement is more than one. This experience is one of the first that students participate in, which research has suggested results in poor academic outcomes and decreased motivation (Kosiewicz & Ngo, 2019).

Another problem seen in the research is that sometimes, students who take placement tests do not understand what the results mean, so they do not do their best to prepare for it, resulting in incorrect placement (Cox & Dougherty, 2018). Hence, many states have passed reforms on how students are placed in developmental courses by integrating other factors like

motivation and self-efficacy to address the limitations of testing to place students (Koseiwicz & Ngo, 2019; Rutschow et al., 2019; Whinnery & Odekar, 2021).

Students enrolling in Texas community colleges must take the TSIA (Humes, 2023). After the test, students are told which courses they are qualified to take (McKinney et al., 2022; Morley et al., 2020). Students who do not score high enough on the TSIA for mathematics must enroll in a developmental math course. This experience of not showing TSIA mastery may impact the rest of these students' college experiences. Data have shown that students who take developmental math courses are less likely to pass their subsequent next-level college math course and are less likely to graduate within 6 years (McKinney et al., 2018; THECB, 2018; Zhao et al., 2022).

Assessment reforms include multiple measures using two or more measures to determine college readiness, measures of motivation or commitment, and planned courses of study, allowing multiple math pathway models (Rutschow et al., 2019). In one study, when students were given a choice to take a developmental math course or enroll directly in a college math course, the students who chose the college math course experienced improved self-efficacy and academic outcomes (Kosiewicz & Ngo, 2019). One student highlighted in a qualitative study (Cox & Dougherty, 2018) that she did not believe she had been correctly placed based on her placement test, "I'm like, can't I just take the test again?" A different student in the same study identified some questions on the placement test that she could not remember how to do. However, if she had reviewed and studied beforehand, she would have had a better chance to be placed in the college-level course. It was too late for the student to retake the placement test, so she was forced to take developmental math. In this study (Cox & Dougherty, 2018), another

student responded, “These math classes are definitely holding me back” since he planned to become a physical therapist but was taking classes that did not earn college credit.

Student Support Reforms

Student support reforms focus on integrating ways to individually help students, including targeted instruction or support, individuals or courses to help students learn about learning strategies and college life, showing students the supports offered, offering self-paced learning using computer-based instruction, and presenting preventive measures like camps before students begin college (Lundberg et al., 2018; Rutschow et al., 2019). At some colleges, students enrolling for the first time take courses that assist in different learning and study skills and strategies. Often, students placed in developmental courses take learning strategies courses at the same time. Some colleges offer embedded tutors or instructor assistants in developmental courses to provide more support for students.

One study showed that modular, self-paced programs increased student confidence and passing rates (Weiss & Headlam, 2019). However, other studies have successfully created developmental courses with faster sequencing (Barnett et al., 2018; Logue et al., 2016; Rutschow, 2018). Thus, while many approaches exist to reforming developmental education, more research is needed to examine student experiences with developmental education.

The Influence of Developmental Enrollment

Many researchers, policymakers, and college educators have agreed that the need for improvement for underprepared college students is warranted (Chen, 2016; Cox & Dougherty, 2018). Extensive data analysis of developmental coursework and student completion showed that while 60% of students in a 2-year public university enroll in a developmental math course, only 30% complete the remedial requirements (Chen, 2016). Inequities in underrepresented students

are also seen as these students are less likely to complete the coursework than other peers (Attewell et al., 2006; Bahr, 2010; Bailey et al., 2010; Cox & Dougherty, 2018).

Placement in developmental math impacts future STEM participation and career choices. Students in community colleges enrolled in developmental math courses are less likely to take future STEM courses (Bahr et al., 2016; Park & Ngo, 2020). Several government reforms have addressed this issue by incentivizing colleges with more STEM majors (THECB, 2018). Reforms regarding assessments, student support, and instructional reforms offer ways to combat the challenge of developmental education. Research exists on self-efficacy and its influence on learning, particularly in mathematics. Therefore, discovering more about how a student's self-efficacy influences success in a developmental math course may pave the way for future implications for reform.

Self-Efficacy in Mathematics

Self-efficacy refers to an individual's belief in being able to perform behaviors necessary to attain specific performance attainments or goals. Students who have self-efficacy can adjust and exhibit flexibility based on individual circumstances. Students who show self-regulation are more likely to succeed academically as they set goals, create learning plans, and follow through with them (Day et al., 2020; Dyer et al., 2022; Lee & Villarreal, 2022). Self-efficacy and motivation are major proponents for student achievement levels and retention (Day et al., 2020; Dyer et al., 2022; Lee & Villarreal, 2022). Motivated students who believe they will be successful are more likely to be so (Dyer et al., 2022).

Self-efficacy in the college environment can be explored by looking at the related literature for how specific factors influence academic performance and student experiences. In the mathematics classroom, students' math self-concept influences their achievement in

mathematics (Hann, 2019; Huang et al., 2018; Peterson & Hyde, 2015). Numerous studies in the education field have been conducted on academic predictors of student success, including cognitive and noncognitive predictors such as self-efficacy (College Board et al., 2019; Dyer et al., 2022; Yeager & Dweck, 2020). The literature intersects in areas related to how self-efficacy and mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states relating to the experiences one exhibits in a classroom setting. An analysis of the literature regarding developmental education and the pathways of recent changes to developmental education is exhibited to better understand current issues.

Mastery Experiences

Enactive mastery experiences rely on past mastery to develop a sense of self-efficacy that one can accomplish a new, similar task. Starting with a small success in understanding a concept catalyzes bigger and more complex victories (Bandura, 1997). Bandura's (1997) self-efficacy theory indicates that the largest component of self-efficacy comes from mastery experiences. Hence, people who have successfully completed activities and tasks are highly motivated to complete similar activities and tasks. However, early failures may undermine self-efficacy because one's efficacy is not yet established at that point (Bandura, 1997). In self-efficacy theory, a person who experiences easy successes and then fails may be afraid of failure and easily discouraged (Bandura, 1997).

In this framework, a person with a resilient sense of self-efficacy can have difficulties but, through perseverance and effort, can overcome obstacles to be successful. People with resilience can rebound quickly from small setbacks and persevere through tough situations (Bandura, 1997). Mastery experiences may be obtained through smaller subsets and skills of the higher attaining goal, which may be created by breaking down smaller subskills (Bandura, 1997).

While mastery experiences play a significant role in self-efficacy, people also vicariously derive information about their capabilities through others who have modeled attainment.

Meta-analytic studies have suggested a positive correlation between academic self-efficacy and performance among middle school, high school, and college students (Honicke & Broadbent, 2016; Richardson et al., 2012). Longitudinal studies among older students have found a positive correlation between math self-efficacy and later mathematics achievement (Grigg et al., 2018). Another study showed mastery as the strongest source of an individual's mathematics self-efficacy, as prior success reinforces self-efficacy while failure lessens it (Zientek et al., 2017).

Research has suggested that students' first academic semester highly influences their success and persistence in community college (McKinney et al., 2022). In one study, students' ability to feel confident and optimistic about their math ability in their first college math course was affected by their high school performance in mathematics (Sinha et al., 2022). This finding matched another study that suggested that if students started their first college math courses with high self-efficacy, they had a better chance of succeeding than students who believed math was hard and struggled (Post et al., 2010). In one qualitative study, instructors were interviewed and asked what they believed was the biggest problem for developmental students. The underlying theme was that students had low confidence based on past experiences (Cox & Dougherty, 2018).

Data have shown that student success in corequisite math courses is higher than in developmental math courses (Ryu et al., 2022; Schudde & Keisler, 2019). Students have many supports in corequisite courses, including developmental scaffolding and sequencing, active learning strategies, strategies to improve attitudes toward math, and performance in math course

work (Schudde & Keisler, 2019). Mastery is obtained in the developmental part of the course, which in turn creates small victories for students to translate into college algebra material. Mastery experiences are seen in early child development and continue to grow throughout one's school years.

Early Math Mastery Experiences

Research has suggested a positive correlation between academic self-efficacy and performance among middle school, high school, and college students (Koponen et al., 2021). While students have shown to have different ideas about self-efficacy in various subject areas, multiple studies have shown a strong relationship between students' math self-efficacy in elementary, middle school, and high school and performance (Ahn et al., 2017; Ayotola & Adedeji, 2009; Butz & Usher, 2015; Chen & Zimmerman, 2007; Ford et al., 2022; Kitsantas et al., 2011). Data have supported that negative math mastery experiences at a younger age impact students' math self-efficacy and future success in mathematics (Ahn et al., 2017; Ayotola & Adedeji, 2009; Butz & Usher, 2015; Chen & Zimmerman, 2007; Davis-Kean et al., 2021; Echeverría Castro et al., 2020; Ford et al., 2022; Kitsantas et al., 2011).

Numeracy Skills and Interventions

Even before attending school, one's math self-efficacy can influence future learning in mathematics (Davis-Kean et al., 2021). Research has suggested that early numeracy skills are vital in several foundational math skills, followed by deeper mathematical skills (Davis-Kean et al., 2021; Libertus et al., 2016; Lyons et al., 2018; Matthews & Fuchs, 2018; Matthews et al., 2015; Sokolowski et al., 2017). Therefore, children with low numerical skills may continue on a lower mathematical track than their peers throughout their schooling (Davis-Kean et al., 2021). Previous studies have concluded that emphasizing improving early childhood education in

mathematics and targeted interventions may begin to address the achievement gaps documented in research that have long-term consequences for adult outcomes (Davis-Kean et al., 2021; Heckman et al., 2018).

One peer-reviewed study explored children's willingness to challenge themselves during their math activities and determined that children with higher levels of math anxiety experienced lower success and proficiency (Tarkar et al., 2022). The study found that elementary children who had high math anxiety were less likely to expose themselves to challenging problems and were more likely to experience a high degree of failure (Tarkar et al., 2022). Two recent studies implemented a growth mindset to raise math self-efficacy in elementary students and suggested that when practices were enacted to enhance sufficient mastery and vicarious experiences, children's math self-efficacy increased, and they were more likely to overcome challenges and setbacks (Lee et al., 2021).

Determining strategies to help young students with math self-efficacy is vital. Research has suggested that children who showed low numeric competencies at a young age where less likely to enroll in higher-level math classes in high school and college (Davis-Kean et al., 2021). As children grow older and have more mastery experiences in mathematics, the influence of mastery experiences increases with time (Palestro & Jameson, 2020). Bandura indicated that mastery experiences are the main component of one's self-efficacy. However, another way self-efficacy is influenced is through vicarious experiences.

Vicarious Experience

Vicarious experience is another source of information about one's capabilities (Bandura, 1997). People use their environment around them to observe, take in information, compare themselves to others, and create group norms (Bandura, 1997). The thought of someone else

being able to do something means “I can do it, too.” The more similar the model is to the person, the higher the efficacy will rise (Bandura, 1997), which can be accomplished by seeing or visualizing people, like oneself, achieving or mastering a task or activity. Unfortunately, seeing others similar to themselves fail may undermine self-efficacy. The more people lack self-efficacy, the more they rely on others to evaluate their capacities and abilities.

Vicarious experiences in a classroom setting happen numerous times as students are exposed to the learning of their peers throughout the year. Students develop self-efficacy through observations, including models and social comparisons (Bandura, 1997; Falco & Summers, 2019). When students observe the actions of their peers or classmates, they develop their own sense of capabilities (Bandura, 1997), which can be accomplished through partner and group work as students see other students struggling and succeeding in similar ways (Klee et al., 2021; Zientek et al., 2019). Once students realize that others are struggling, it decreases their math anxiety, and they are more likely to ask questions and engage in the material (Klee et al., 2021). Collaborative learning increases students’ interactions with each other by creating authentic verbal messages, enhancing social persuasions, and creating encouragement and affirmations of competence and mastery (Zientek et al., 2019).

Research has suggested that mixed-ability college-level math classes, including corequisite courses, improve students’ probability of passing college-level math classes (Ryu et al., 2022; Xu & Dadgar, 2017). Many colleges nationwide offer math labs or tutoring centers, including peer tutoring. Research has suggested a correlation between improved achievement in mathematics and overall GPAs, completion rates, and final course grades for students who participate in tutoring (Sinha et al., 2022). Numerous studies have shown that peer tutoring has helped students raise self-efficacy with positive attitudes, increased attendance, increased time on

task, and improved retention rates (Colver & Fry, 2015; Hendriksen et al., 2005; Sinha et al., 2022). A comprehensive study showed that the students who benefited the most were those who began college with below-average math scores (Gordanier et al., 2019).

Tucker et al. (2020) explained that the model of having peer support embedded in a course with a centralized tutoring location positively impacted students' grades and retention for all types of students. Tutoring and a place for students to practice math should be at a centralized location and should be free to students. However, some students felt they did not have time to go to the tutoring lab because they also worked full-time. Therefore, more peer and student modeling should be developed to help students inside the classroom, not just outside the classroom (Sinha et al., 2022).

One way to improve vicarious experiences within the limited time in the classroom is to create environments conducive to active learning strategies, including collaboration and group work. This approach can help improve student learning and social skills. Students who have strong social skills, relate and connect to others, and feel a sense of community are likelier to have higher grade point averages and stay in college than those who do not (MacCann et al., 2020; Wibrowski et al., 2016). Several studies have shown that students who participated in social skills groups and/or social-emotional learning programs had increased achievement levels in an academic setting (MacCann et al., 2020; Wibrowski et al., 2016). Students who feel connected to the academic environment through interactions with others, technology, and social networking are more likely to continue their education in college (Campbell et al., 2019; Wibrowski et al., 2016).

Bandura (1997) explained that vicarious experiences can influence self-efficacy the most when the model is someone remarkably similar to the person, which may be shown with

classroom experiences of student success. Many reform measures incorporate peer tutoring, mentoring, and other means involving students seeing others like themselves being successful. Thus, mastery and vicarious experiences are two factors that influence people's beliefs about their capabilities. Another factor is social persuasion.

Social Persuasion in Developmental Math

Social persuasion is a way to strengthen people's beliefs in their capabilities and may come from social sources or significant others (Bandura, 1997). When teachers express belief in students' capabilities, teachers become a source of verbal persuasion. If a teacher believes in a student's capabilities, the student is likelier to sustain a sense of self-efficacy (Bandura, 1997). This persuasive adult could also be a loved one, parent, or sibling in the family setting. While verbal persuasion is an effective way to boost self-confidence in one's capabilities, Bandura (1997) noted that evaluative feedback is crucial as it can have a negative impact if not examined extensively. Schunk and Cox's (1986) research furthered this idea by showing that children who struggled in mathematics and reading were given certain types of feedback, including praise for their work ethic and positive self-affirmations, which increased their self-efficacy. Children in the study showed a higher sense of self-efficacy and were likelier to persist in their efforts (Schunk & Cox, 1986).

Classroom instructors/teachers and students strongly influence social persuasion concerning self-efficacy. Research has suggested that positive, supportive relationships between students and teachers positively affect student engagement and math performance (Peixoto et al., 2017; Yang et al., 2021). Self-efficacy may be raised when students feel a sense of belonging and connectedness and believe the teacher believes in them. Research has shown that teacher encouragement can improve students' efforts and self-confidence (Hughes & Chen, 2011).

The influence of social persuasion on self-efficacy may assist in higher mastery experiences, raising math self-efficacy. Research has shown that teacher persuasion influences math self-efficacy as early as primary school, moving into secondary school and beyond (Yang et al., 2021). Teachers who provide positive feedback in mathematics may provide opportunities for students to correct their mistakes, which can positively affect students' motivational beliefs and achievements (Küçükalioğlu & Tuluk, 2021). Students who struggle and persist but are successful increase their self-efficacy (Bandura, 1994). While the educator plays a role in social persuasion to aid students in raising their math self-efficacy, another influence is family members.

Parental Influence of Math Self-Efficacy

Research has suggested that the family system may help students achieve academic self-efficacy in protective and promotive roles (Elliott & Bachman, 2018; Masten, 2014). One predictor of children's math skills is parents' beliefs, practices, and language, which can be seen early in childhood persisting across child development (Elliott & Bachman, 2018). Specifically, in gaining math and science achievement, the family is considered a key proximal system across youth development into adolescence (Delgado et al., 2021; Elliott & Bachman, 2018; Masten, 2014). Data has suggested that the more time parents spend with their preschool-aged children at home working on academic skills, the more skills children have when they enter kindergarten (Bornstein & Bradley, 2014; Elliott & Bachman, 2018). Examining the home numeracy environment and parents' practices exposing children to mathematical concepts, including formal and informal mathematical activities, result in increased achievement in kindergarten and first grade (Elliott & Bachman, 2018; Kleemans et al., 2012; Nicklas & Schneider, 2013). Nonetheless, some inconsistencies in the research exist as studies have suggested that math

abilities and numeracy are more influenced when children are engaged in math activities alone (Blevins-Knabe & Musun-Miller, 1996; Missall et al., 2014) versus with parents.

Extensive evidence highlights that mathematical-type interventions at home, such as parent programming, providing parents with math activities, and activities that include math play, can influence children's mathematics achievement positively (Berkowitz et al., 2015; Niklas et al., 2015; Starkey & Klein, 2000; Vandermaas-Peeler et al., 2012). Research based on children in upper elementary school grades 3–5 showed that parents' influence on math achievement correlated with parental involvement with math homework—examining the quality of involvement was indeed important (DiStefano et al., 2023). Students whose parents had higher math achievement and lower math anxiety seemed to have higher quality in homework-helping interactions that included more patience with the process, low math anxiety, and appropriate parental roles. In contrast, parents with high math anxiety displayed negative interactions and stress while their children learned less math and became more anxious compared to their peer counterparts (DiStefano et al., 2023; Maloney et al., 2015).

In middle school, math self-efficacy is related to parental influences and supportive parent-child relationships (Sağkal & Sönmez, 2021). In high school, interpersonal relationships among students, parents, and teachers influence their academic success and future career choices (Benner et al., 2016; Benner et al., 2021; Rumberger & Lim, 2008; Zhan & Sherraden, 2011). Specifically, in one study, higher parent and math teacher expectations of students in tenth grade were positively correlated with higher grade point averages and better math scores when the students were in 12th grade. Furthermore, the influence of parents' and teachers' math expectations showed higher math course-taking sequences and higher achievement 2 years after high school (Benner et al., 2021).

Teacher/Instructor Influence on Student's Self-Efficacy

Students of all grade levels, including the collegiate level, are heavily influenced by their teachers/instructors. Teachers who provide emotional support increase student motivation, participation, connectedness, and emotional well-being in elementary, middle, and high school (Meyer & Turner, 2007; Yang et al., 2021; Zhou et al., 2019). This type of teacher support raises internal and external motivation for students, thereby increasing academic self-efficacy (Yang et al., 2021). In the mathematics classroom, teacher-student relationships have shown a stronger positive correlation between supportive teacher-student relationships and mathematical achievement (Hajovsky et al., 2017; Ma et al., 2017; McCormick & O'Connor, 2015; Zhou et al., 2019). Studies have shown that student beliefs about teacher support influence self-efficacy: the greater the perceived teacher support, the higher the self-efficacy (Kim et al., 2018; Yang et al., 2021). Studies of students in college echoed these findings in that student self-efficacy was influenced by instructors' perceptions of students (Allari et al., 2020; Cwik & Singh, 2022; Guo et al., 2019).

Several studies have concluded that the relationship between college students and their instructors influences student success more than other factors, including technology use and presentation skills (Parnes et al., 2020; Schneider & Preckel, 2017). Students who feel secure in class based on their interactions with the instructor are more likely to speak up and have positive attitudes about the course. In several studies (Barnett, 2010; Parnes et al., 2020), the findings indicated that when students had validation from instructors, they were more likely to continue their college education and felt academically integrated. Research has suggested that instructor and student interactions significantly impacts learning outcomes, general education skills, science and technology, and career aspirations (Brown & Burdsal, 2012; Lundberg, 2003).

While numerous studies have investigated student-instructor relationships, several studies have attempted to link self-efficacy to the influence of the instructor (Aloia, 2020; Cwik & Singh, 2022; Eakman et al., 2019; Hughes & Chen, 2011; Park et al., 2023). For example, Aloia (2020) showed a positive relationship between classroom connectedness and learning when self-efficacy was high rather than low but was inconclusive about how instructor interactions influenced self-efficacy. Hence, the author suggested that more research should be conducted (Aloia, 2020).

In a study of undergraduate physics students (Cwik & Singh, 2022), students' self-efficacy was influenced by the perceived recognition of others, including the instructor, peers, and teacher assistants. Another study showed how an instructor's response to students' questions raised their self-efficacy and motivation (Park et al., 2023). The study further suggested positive instructor responses improved STEM-related outcomes (Park et al., 2020).

Gender Differences in Social Persuasion of Math Self-Efficacy

Gender may play a role in mathematics self-efficacy and the influence of social persuasion. Several studies have reported that females were more affected by vicarious experiences and social persuasion experiences than males (Sawtelle et al., 2012; Zeldin & Pajares, 2000). This effect was also seen in STEM studies in which academic feedback played a pivotal role in mathematics self-efficacy (Stewart et al., 2020), and women expressed lower self-efficacy but benefited most from social persuasion and feedback. Vicarious experiences and social persuasion are outside influences that affect math self-efficacy. The last factor is internal and includes physiological and affective states. Huang et al. (2018) identified that a growth mindset has a substantial role in males' success and career interests in mathematics, while females exhibit a higher level of mathematics anxiety.

Physiological and Affective States

Physiological and emotional states are considered somatic self-efficacy indicators and are partially relied upon in judging personal capabilities (Bandura, 1997). Thus, stress, health functioning, mood, and other physical and physiological impacts can alter one's reactions. Mood impacts evaluative judgment and can impact bias attention and perceptions of how events are interpreted (Bandura, 1997). Depressive and sad moods produce a global view of oneself as worthless or inadequate and can directly impact learning processes and memory (Bandura, 1997). However, a positive correlation exists between happy moods and a larger sense of self-efficacy (Bandura, 1997).

Mathematics anxiety affects students' perceptions about their ability to solve math problems. Bandura (1997) expressed that physiological and affective states are crucial in self-efficacy. Research has suggested that mathematics anxiety can be seen as early as primary and elementary grades (Barroso et al., 2021; Harari et al., 2013). Math anxiety can influence students' future career and educational outcomes since math anxiety at younger ages can significantly relate to avoidance and mastery avoidance at older ages (Barroso et al., 2021; Cribbs et al., 2021). Mathematics self-efficacy and achievement are interrelated as high math anxiety and low math achievement levels influence math beliefs and perceptions (Barroso et al., 2021).

Studies have found that anxiety creates a problematic cycle for students as it inhibits working memory and inhibits prior abilities and new learning (Ashcraft & Krause, 2007; Cho, 2022; Deshler et al., 2019). Math anxiety is the feeling one experiences during math, including fear, tension, and apprehension (Ashcraft, 2002). Math anxiety has a physiological implication as it affects heart rate, neural activation, and cortisol (Faust, 1996; Lyons & Beilock, 2011; Pletzer

et al., 2015; Sarkar et al., 2014). Math anxiety impacts working memory, a short-term memory system that regulates and controls a limited amount of information relevant to the task (Engle, 2002; Shah & Miyake, 2012; Ramirez et al., 2018). Working memory is used when completing math tasks and can be affected by intrusive thoughts and ruminations.

When students with high math anxiety complete a math problem, they deal with negative thoughts and ruminations while trying to solve it (Ramirez et al., 2018). Students who exhibit math anxiety have trouble focusing on math problems in real time, affecting their ability to maintain focus, cognitive ability, and working memory (Leppma & Darrah, 2022). This process impairs working memory, affecting the ability to solve math problems, leading to future failures and fewer mastery experiences—a cycle that can be difficult for students to overcome (Leppma & Darrah, 2022).

Another explanation of how math anxiety starts is the reduced competency account, which argues that math anxiety results from poor math ability (Ramirez et al., 2018). Hence, a student's reduced competency leads to non-fluent learning and performance, contributing to math anxiety (Ramirez et al., 2018). This effect echoes mastery experiences as experience influences future learning. One longitudinal study examined students' math anxiety in seventh through the 12th grade and found that higher math anxiety in previous years predicted lower math achievement in subsequent years. This outcome was also found in similar studies suggesting that poor math achievement appears to cause later math anxiety (Gunderson et al., 2017; Ma & Xu, 2003).

A strong negative relationship exists between math anxiety, test scores, and mathematics final grades in college courses (Cho, 2022; Leppma & Darrah, 2022). Students in developmental math classes face a significant amount of anxiety, as having to take classes before earning

college credit puts them behind a regular track graduating schedule (Deshler et al., 2019). Women have reported higher levels of math anxiety compared to men beginning in their childhood, which continues into adulthood even after formal education (Hart & Ganley, 2019; Lauer et al., 2018). This anxiety for women also affects career motivation in STEM fields, negatively impacting retention (Cho, 2022; Leppma & Darrah, 2022; Samuel & Warner, 2019).

Improving Affective Mindsets in College Students

Recently, noncognitive factors have been studied among different age levels as a predictor of student success (Wanzer et al., 2019). While many researchers have suggested that cognitive factors influence student success in the classroom, other theorists have hypothesized that other factors, including self-efficacy, influence student success (Campbell et al., 2019; Farruggia et al., 2018; Grigg et al., 2018). Research has suggested that students with a solid academic mindset are more likely to stay in college after their first year and are more likely to have a strong academic performance measured by their grades (Farruggia et al., 2018).

Multiple studies have shown that academic mindset and self-efficacy influence student experiences in many ages and stages of school attendance (Campbell et al., 2019; Farrington et al., 2013; Farruggia et al., 2018; MacCann et al., 2020). Intervention programs focusing on academics, growth, and study skills at school may positively impact classroom performance (Farrington et al., 2013; Farruggia et al., 2018). Academic behaviors include attending class, paying attention, having materials ready, and completing homework (Farrington et al., 2013). Grit, self-discipline, and self-control are factors of academic perseverance and are heavily influenced by one's self-efficacy (Farrington et al., 2013). Academic mindsets include beliefs about the relationship between oneself and academics (Farrington et al., 2013) and can affect motivation and performance positively or negatively (Dweck & Leggett, 1988).

Studies have shown that improving psychological experiences, such as incorporating a growth mindset in the classroom, can positively impact student success in math (Samuel & Warner, 2019). Many studies have focused on incorporating social cognitive theory and self-efficacy to help students gain skills that help with mindfulness, self-compassion, positive attitudes, and self-efficacy (Deshler et al., 2019; Leppma & Darrah, 2022). One mixed-methods pilot study of first-year developmental math students who participated in mindfulness and growth mindset intervention indicated reduced math anxiety and increased math self-efficacy (Samuel & Warner, 2019).

Growth Mindset and Math Self-Efficacy

Much research exists on improving student motivation and mindset to improve physiological states. Carol Dweck's growth mindset theory explores people's beliefs about learning and intelligence and how they drive motivation and achievement (Yeager & Dweck, 2020). Mindset is the belief that people can use their mindsets to create desired outcomes regarding intellectual ability. Helping students increase their growth mindset may indeed improve self-efficacy. Decades of research have suggested that a growth mindset may improve educational outcomes (Yeager & Dweck, 2020).

Dweck's (2017) growth mindset compares two types: fixed and growth. A person with a growth mindset believes intelligence can be developed, embraces challenges, is persistent in the face of setbacks, sees effort as the path to mastery, learns from criticism, and finds lessons and inspiration in the success of others (Dweck, 2017). A person with a fixed mindset conversely believes that intelligence is static, avoids challenges, gives up on obstacles, sees efforts as pointless, ignores feedback, and feels threatened by the success of others (Dweck, 2017).

The differences in achievement correlate the fixed mindset with achieving less than one's full potential, while the growth mindset reaches ever higher levels of achievement (Dweck, 2017). A growth mindset and mastery experiences play a critical role in self-efficacy at the college level; however, data have shown that these influences are also seen during childhood and impact future experiences in college (Ashcraft, 2002; Davis-Kean et al., 2021; Du et al., 2021; Jameson, 2019; Lee et al., 2021). Other physiological states, such as grit and perseverance, may improve self-efficacy.

Grit and Perseverance

Recently, grit, perseverance, and self-efficacy have been studied together (Han, 2021; Malureanu et al., 2021; Usher et al., 2019). Perhaps one reason self-efficacy and grit have been studied together is their similar motivations. Grit is the passion and perseverance to reach one's long-term goals despite hardships (Duckworth et al., 2007). Self-efficacy guides human tasks because it "activates cognitive, motivational, and affective processes that govern the translation of knowledge and abilities to proficient action" (Bandura, 1997, p. 37). Angela Duckworth, a psychologist who has studied grit for decades, noted the need for researchers to explore the relationship between self-efficacy and grit in predicting achievement (Duckworth et al., 2007).

In one study of 307 adults in a working environment, data analysis showed that the adults' self-confidence was directly and positively correlated to grit and self-efficacy (Malureanu et al., 2021). Another study that involved 2,400 United States elementary and secondary students found that perseverance and grit did not directly predict students' reading and math achievement, but self-efficacy did (Usher et al., 2019). In this study, teachers rated the students who showed grit as more motivated, with those who showed higher self-efficacy as more competent (Usher et al., 2019). The researchers suggested that school interventions should focus on increasing

students' grit and self-efficacy by increasing students' beliefs about their academic capabilities through nurtured caregivers and educators (Usher et al., 2019). Bandura's self-efficacy theory aligns with this research as social persuasion influences one's self-efficacy (Bandura, 1994).

Other studies have found similar results regarding self-efficacy, perseverance, and grit (Alhadabi & Karpinski, 2019; Han, 2021). The ideal learning result includes self-assurance, grit, and self-efficacy and their impact on the classroom (Alhadabi & Karpinkski, 2019). For instance, Alhadabi and Karpinkski (2020) included 258 university students and found that perseverance of effort was a stronger influence than interest. The researchers suggested that "establishing a learning atmosphere that promotes grit and self-efficacy can be a valuable addition to faculty members' instructional efforts" (Alhadabi & Karpinski, 2019, p.533). In a similar study, researchers found that academic self-efficacy and perseverance were significant predictors of final grades (Muenks et al., 2018).

As more research is conducted on what noncognitive factors help students succeed, the relationship between self-efficacy, grit, and perseverance will be investigated further. The influence of self-efficacy and grit on each other is still being determined and studied. Some researchers believe that grit is a trait that influences self-efficacy, while others believe that self-efficacy is a precursor to showing grit. Moreover, some hypothesize that combined grit and self-efficacy establish motivation and competence (Usher et al., 2019).

Mathematics Self-Efficacy and Career Field Choices

Research has identified that students with higher levels of self-efficacy have more positive outcome expectations, engage in higher interest in engineering-related activities, have stronger intentions to complete STEM degrees, and continue to persist in completing STEM programs, whereas students with lower self-efficacy doubt their abilities and are more likely to

transfer out of STEM fields (Hsu et al., 2021; Lent & Brown, 2019). In an exploratory study of first-year engineering students, faculty encouragement and student self-efficacy were addressed (Hsu et al., 2021). The study concluded that students' perceptions of faculty encouragement influenced students' intent to persist and statistically significantly contributed to students' self-efficacy (Hsu et al., 2021). Three other studies sought to determine the influence of students' perceptions of their instructors and the result of self-efficacy. They found that the more instructor support a student felt, the higher the self-efficacy in that course (Eakman et al., 2019; Hughes & Chen, 2011; Wei et al., 2022).

As with recent studies, Hackett and Betz (1989) found that the math track in high school played a future role in career choices later (Bahr et al., 2016; Park & Ngo, 2020). Math track can begin as early as eighth grade as students are placed in either eighth-grade mathematics or high school algebra. Students placed in high school algebra in eighth grade are more likely to take dual-credit, advanced placement, and honors classes in high school. These students are likely to be college-bound and not take developmental courses. Bandura (1997) summarized the findings of Hackett and Betz as "evidence that perceived efficacy is a central mediator through which socialization practices and experience influence educational and career choices (Bandura, 1997, p. 423).

Summary

Self-efficacy influences student academic experiences at all levels. Researchers have suggested that noncognitive factors such as self-efficacy may influence academic achievement as much as cognitive factors (Farrington et al., 2013; Tang et al., 2019; Yeager & Dweck, 2020). Research on developmental math students and how self-efficacy affects success may assist future students, especially first-generation, low socioeconomic, minority, and special education

students, to be successful in college (Akos et al., 2020; Han et al., 2017; Yeager & Dweck, 2020). Student experiences in the first year of college may determine the path that leads to success and continuance of their education or the path of quitting (Han et al., 2017; Ting, 2009; Wang et al., 2022). Students with higher levels of math self-efficacy with a growth mindset, grit, and perseverance who set learning and education goals, learn about learning, and seek opportunities to collaborate and connect with others are more likely to stay in college and attain their goals (Duckworth et al., 2007; Han et al., 2017; Wang et al., 2022; Wibrowski et al., 2016). Nevertheless, a gap in the literature exists about which part of self-efficacy influences student success in developmental math courses.

CHAPTER THREE: METHODS

Overview

The purpose of this phenomenological study was to discover the role of self-efficacy in a corequisite developmental math course for college students at a community college in South Central Texas. A student's math self-efficacy in a college developmental math course is generally defined as how one's belief in one's capacity in math influences the necessary behaviors to perform certain attainments in mathematics. The theory guiding this study was Bandura's (1977) self-efficacy theory.

The research design, procedures, and data analysis are explored in this chapter, beginning with the research design, questions, settings, and participants. The researcher's positionality includes an interpretive framework and philosophical assumptions. Next, the research procedures are discussed, including permissions and the recruitment plan. The data collection plan includes data triangulation between individual interviews, focus group interviews, and journal prompts. Each data collection method includes a data collection analysis plan. Finally, the study's trustworthiness is described using credibility, transferability, dependability, confirmability, and ethical considerations.

Research Design

The research design chosen for this study was qualitative, as the problem was explored to help understand how one's self-efficacy influences student experiences, perceptions, and performance in a developmental math course (Creswell & Poth, 2018). Qualitative research "begins with assumptions and the use of interpretive/theoretical frameworks that inform the study of research problems addressing the meaning individuals or groups ascribe to a social or human problem" (Creswell & Poth, 2018, p. 42). Thus, a phenomenological study was utilized to

understand and develop the essence of student experiences and the reality and perceptions students face (Creswell & Poth, 2018; Gall et al., 2007). Phenomenological studies involve participants who have all experienced a similar phenomenon. In this case, it was an appropriate choice to study students enrolled in developmental math courses (Moustakas, 1994).

Research Questions

Central Research Question

How does self-efficacy influence the experiences and perceptions of students in corequisite developmental math courses?

Sub-Question 1

How do personal experiences with mathematics instructors influence student self-efficacy in corequisite developmental math courses?

Sub-Question 2

How does experience with peers influence self-efficacy in a corequisite developmental math course?

Sub-Question 3

How do experiences with others outside of the classroom influence corequisite developmental math students' self-efficacy?

Sub-Question 4

How do prior math experiences influence student perceptions about math self-efficacy in corequisite developmental math courses?

Site and Participants

The site of this transcendental phenomenology study was a 2-year community college with an enrollment of over 10,000 students. The site was one of five community colleges in a

greater metropolitan area. The study included participants enrolled in a developmental corequisite college algebra course during the 2023–2024 academic school year.

Site

The site was at a 2-year community college in South Central Texas, with a diverse population of over 10,000 students. A 2-year community college was the site because, according to data released by the United States Department of Education, these students are more likely to enroll in developmental courses than 4-year universities (Chen, 2016). The passing rate of students participating in developmental courses at 2-year community colleges is 49% compared to 21% at 4-year universities (Chen, 2016). Including a community with a diverse student population was crucial, as the data have shown that participation in developmental courses is greater among several demographic groups: Black, Hispanic, low-income, first-generation, and female students. The site was a Historically Black College and Hispanic Serving Institution. The organizational structure at the chosen community college included student support services to help students enrolled in developmental courses, tutoring opportunities, and availability.

Participants

Participants in this study included students enrolled in corequisite college algebra during the 2023–2024 academic school year. Twelve students participated. Participant demographics were relative to the college's diversity with Black, Hispanic, low-income, first-generation, and female students. The age range for this study was 19–63, as some student participants enrolled in college right after high school, while others started later in life.

Recruitment Plan

Convenience sampling was used at the community college offering developmental and corequisite math courses. The target population was students enrolled in developmental

Corequisite College Algebra during the 2023–2024 academic school year. The recruitment plan included emailing students currently enrolled in Corequisite College Algebra who specifically meet the criteria for enrolling in Corequisite College Algebra during the 2023–2024 academic school year. The email included a recruitment letter and consent document. The sample size for a qualitative study to achieve saturation is 12–15 students; therefore, 12 participants were included in this study. The first 12 participants who responded to the email were included.

The recruitment letter included an introduction, the purpose of the study, participant criteria, details about the individual interview, a journal prompt, focus group interviews, and time requirements. It also explained the next steps if the students were willing to participate. The consent form outlined frequently asked questions regarding many components of the study, including why, the procedure, the benefits, risks, how personal information would be protected, the voluntary component, and withdrawal at any time. It also included whom to contact with questions and a place for consent and signature. Participants were given full disclosure about the study to ensure they knew the research methods and time commitment and could withdraw from the study at any time.

Researcher's Positionality

My motivation for conducting this research study was to make a difference in the lives of students participating in developmental math courses. I wanted to know more about their lived experiences at the community college to determine solutions and strategies to help them be more successful in college, specifically in addressing self-efficacy. In Texas, incremental percentages of student enrollment in developmental courses had to include corequisite courses by 2023. I wanted to learn more about the influence of math self-efficacy in corequisite courses, as students simultaneously receive credit for the developmental and college courses.

Interpretive Framework

The interpretive framework that fit my mindset best was transformative because I wanted to improve society and hoped my research could help solve injustices in the real world. As Creswell and Poth (2018) explained, this type of qualitative research contains reform that may influence and change participants' lives, where they work, and institutions. During this study, I worked at a community college where most students were minorities, and many were first-generation students. Students were often placed in remedial courses before taking college courses. My goal was to learn more about how math self-efficacy influenced students in the classroom by hearing from the students and their experiences so that interventions could help raise math self-efficacy in future courses.

Philosophical Assumptions

Three philosophical assumptions explored in this research were ontological, epistemological, and axiological. Ontological assumptions concern the nature of reality. Epistemological assumptions are based on what counts as knowledge. Axiological assumption explains the researcher's values and how they are brought into the study. These assumptions were central to values and belief systems as they were consistent in my life and impacted the research.

Ontological Assumptions

Ontological assumptions deal with the nature of reality and different perspectives and views concerning it (Creswell & Poth, 2018). As a Christian, I must remember that everyone is unique. God created everyone to be unique, so everyone has a unique perspective. As an educator, I think about the students who walk into my classroom with a wide variety of life and math experiences. Some students tell me right away that math is not their favorite subject. I aim

to help them find a love for math and help change their perspectives. As a researcher, my ontological position is to study others, learn about them, listen to them and their perspectives, and report these perspectives.

Epistemological Assumptions

Epistemological assumptions include what knowledge is and how claims of knowledge are examined and justified (Creswell & Poth, 2018). I believe universal truths exist in Christianity, mathematics, and sciences. I also believe that understanding, listening, and learning about others' perspectives are crucial beyond these universal truths. Specifically concerning my students, I believe knowledge is obtained from within. Thus, considering my epistemological position as a researcher, I found subjective evidence, became close to the participants, and learned as much as possible about them. Quoting the participants, finding common themes, and learning more by spending time and asking questions were ways to build my research.

Axiological Assumptions

Axiological assumptions concern how the role of values affects the research. Thus, the values must be known (Creswell & Poth, 2018). As a Christian, I value many things, including my relationship with Christ, which may have influenced my research and should be disclosed. I value helping others succeed and go above and beyond in my classroom daily to help students succeed. Unlike some of my colleagues who believe that some students cannot learn what they are teaching, I believe all students can learn what I am teaching since they are children of God. Some students need extra time, a different process, or another approach to help them to understand. When I conduct research, I must clarify my values and report my biases, which is important because as I research community college mathematics students, my position as a

community college mathematics instructor has influence, so I need to be open about possible biases.

Researcher's Role

As the researcher for this study, I must explain my role as a human instrument. I have experience teaching various levels of college mathematics, including developmental math courses, corequisite model courses, and college courses. During this study, I was a full-time mathematics faculty at the community college where I worked. However, the students I taught were not part of the study. A phenomenological study was utilized with the methods of Moustakas (1994) to ensure that bias and assumptions were eliminated so that the research was fresh and indicative of the lived experiences of developmental math students.

As a researcher, to help reduce bias, as explained my Moustakas (1994), I used bracketing in the form of journaling. The epoché process included me putting life experiences, perceptions, and assumptions aside systematically so that the results were free and open, with fresh and new perceptions (Creswell & Poth, 2018; Moustakas, 1994). For bracketing, I journaled my perceptions, thoughts, and experiences to help separate my own experiences from what was studied. This was done before the interviews took place, as well as throughout the entire data collection process. I journaled my past experiences, as well as perceptions, to aid in this process. The journal consisted of 67 pages, and the first page which was completed before the interviews took place, is included in Appendix K.

Procedures

A transcendental phenomenological design was used because the focus was on the descriptions of the experiences of the participants versus my interpretation (Creswell & Poth, 2018). The research followed the systematic steps using Moustakas's (1994) approach, starting

with formulating and defining the research question, conducting a literature review, developing criteria for participant selection, and creating instructions and guiding questions for the research interview (Moustakas, 1994). The data were collected by creating an epoché process for the interviews and the entire research process. I went through the interview, journal prompts, and focus group questions as a self-reflection.

In-depth interviews occurred with the participants using open-ended questions with topical-guided interviews (Moustakas, 1994). After collecting the data, I analyzed it using horizontalization by diminishing the information to key statements and quotes (Creswell & Poth, 2018; Moustakas, 1994). This process included listing every response relevant to the experience, followed by a reduction and elimination (Moustakas, 1994). Subsequently, I formed clusters of meaning by grouping significant statements into themes, which were then validated (Moustakas, 1994). Textural and structural descriptions were created from the clusters of meaning describing what the participants experienced (Creswell & Poth, 2018; Moustakas, 1994). A composite description was then composed to report the phenomenon's essence and is presented in written form in this dissertation (Creswell & Poth, 2018).

Data Collection Plan

Data collection for this transcendental phenomenological study included in-depth interviews, journal prompts, and a focus group interview. While multiple methods of extracting data are important in a qualitative study, interviews for a phenomenological study serve as the main source of information, while the other sources are secondary (Creswell & Poth, 2018). Triangulation of corroborating evidence was used through multiple data sources to illuminate themes and perspectives (Creswell & Poth, 2018). The order of occurrence was the individual in-depth interviews, the journal prompts, and the focus group data.

Individual Interviews

The main data collection method was in-depth interviews that included questions to help determine the essence of developmental math students' college experience and journey. In a phenomenological study, in-depth interviews are the most robust data collection method since they include hearing people describe the phenomenon, which is crucial to gaining participants' perspectives (Creswell & Poth, 2018; Moustakas, 1994). The participants needed to feel comfortable in an informal interview with open-ended questions (Creswell & Poth, 2018; Moustakas, 1994). The interview procedure used for this study was from Brinkmann and Kvale (2014), with a logical sequence of seven stages of thematizing the inquiry, designing, interviewing, transcribing, analyzing the data, verifying, and reporting the study (Brinkmann & Kvale, 2014).

The interviews began with questions to help create a comfortable environment so that the participants felt at ease answering the questions (Marshall & Rossman, 2012). The interviews were offered in person or online based on student availability. Three students met in person, while the remaining nine met online via Zoom. The interviews lasted approximately 1 hour. The in-person interviews were conducted in a quiet, secure office. Online interviews were conducted securely via Zoom.

Table 1

Individual Interview Questions

1) Please describe your college experience, including courses in which you have or are currently participating. CRQ

2) Describe how you felt when you realized you would take a developmental math course. CRQ
3) Describe your confidence in passing the corequisite course before the course started. CRQ
4) Describe your personal experience in the previous math course you took prior to the developmental math course. CRQ
5) Explain how taking a developmental math course has impacted your collegiate journey. CRQ
6) Describe experiences that were challenging while taking your developmental math course. SQ1
7) Explain how you utilized the supports that were in place while you were in a developmental math course. SQ1
8) Describe your attitude towards mathematics. SQ1, SQ4
9) How did experiences with peers during your developmental math class contribute to your current attitude about mathematics? SQ2
10) How did your experience with peers influence your perception of learning math in your developmental math course? SQ2
11) What outside challenges did you face during your developmental math course? SQ3
12) During your developmental math course, what influence did your professor have on your perception and motivation regarding learning math? SQ3
13) How did prior mathematics learning experiences influence your perception of the ability to learn math during your developmental math course? SQ4

14) What else would you like to add to our discussion of your experiences of participating in a developmental math course and your perception of learning mathematics? CRQ

The first five questions served to make the participants feel comfortable while helping to answer the central research question. Participants described their experiences regarding participating in a developmental math course and how they impacted their collegiate journey. Questions 6, 7, 8, and 9 asked about their math attitudes. Questions 10 and 11 dived deeper into participants' experiences in a developmental math course and the influence of peers and perceptions of learning mathematics. Questions 12 and 13 focused on experiences participants faced in which they overcame obstacles attributed to their success and the influences of others besides peers. The final questions included past experiences regarding learning mathematics and anything participants wanted to add.

Journal Prompts Data Collection

Journal prompts were emailed to the participants directly after the interviews were transcribed to check for confirmability. Journal prompts were used for data collection, including several prompts allowing participants time to think and reflect on their answers. Journal prompts were more appropriate for this study than observations because the participants were in many different settings, which would be difficult to observe (Creswell & Poth, 2018). Journal prompts were emailed to participants the day after the interviews, and they had 1 week to complete three prompts. Four participants did not complete the journal prompts within 1 week and were emailed and given 1 extra week. Journal prompts were analyzed for significant statements to triangulate the in-depth and focus group interviews. Moustakas' (1994) structured analysis method was used to analyze the data.

Table 2

Journal Prompts

1) Explain how two or more past mathematics learning experiences have influenced your current perceptions about learning mathematics.
2) Describe two occasions when peers influenced your learning in mathematics during your corequisite math course.
3) How did your mathematics instructor/professor influence your perception about learning mathematics during your corequisite math course?

Focus Group Data Collection Approach

The focus group interview aided in data collection because it allowed participants who had experienced the same phenomenon to be interviewed simultaneously, which could aid in encouraging dialogue from the participants (Creswell & Poth, 2018). While the intention was two focus groups consisting of four to six participants, due to the limited scheduling availability of the participants, only one focus group interview was held. Nine of 12 participants were included in the focus group interview. One notified me about a scheduling conflict through email, and two participants did not respond to the focus group interview requests. The interview protocol was used, and the focus group data assisted in triangulation (Creswell & Poth, 2018). The focus group interview followed Brinkmann and Kvale's (2014) process and occurred as the last of the data collection approaches to allow for needed modifications based on the other data collections. The focus group interview lasted 1 and 20 minutes.

Table 3

Focus Group Interview Questions

1) Explain your perceptions about mathematics before your developmental math course. CRQ, SQ4
2) Describe your learning experiences during your developmental math course. CRQ, SQ1
3) Explain the characteristics of your coursework and the role of small groups. SQ2
4) Describe moments when your instructor/professor influenced your beliefs about your mathematics learning. SQ3
5) What other information regarding your perceptions about learning mathematics would you like to add?

Data Analysis

Data from the one-on-one personal interviews, the journal prompts, and the focus group interviews were triangulated to develop the phenomenon's essence with a textural description of how the phenomenon was experienced (Creswell & Poth, 2018). Data from the interviews were analyzed and synthesized using a data analysis spiral (Creswell & Poth, 2018) following Moustakas (1994). The interviews were transcribed by hand directly after they occurred. Participants were emailed transcripts to ensure credibility and asked to email back if they felt they wanted any changes made. The data were organized into password-protected files that included naming systems and organization.

Moustakas' steps were followed, beginning with listing and preliminary grouping. Reduction and elimination took place to determine the invariant constituents. Clustering statements and thematizing occurred from the invariant constituents, which aided in code development and memoing of emergent ideas (Creswell & Poth, 2018). Subsequently, describing

and classifying codes into themes occurred (Creswell & Poth, 2018) by naming initial codes, listing code categories and descriptions, assigning codes to units of text, and developing and accessing interpretations, followed by relating the themes to the framework in the literature (Creswell & Poth, 2018). The individual textural description happened after the triangulation with the other data collection methods.

The data analysis plan for the journal prompts was like the data analysis plan for the interviews. The data were stored in an organized filing system. The journal prompts were collected by email and typed into a file. The journal prompts were read, notes were taken, including written memos, and emergent themes and ideas were synthesized. The development of significant statements was exhausted with the horizontalization of the data. Codes were identified and applied to create common themes and develop and assess interpretations (Creswell & Poth, 2018). The data from the interviews and journal prompts were used to triangulate the data from the focus group interview.

The focus group interview was transcribed by hand and placed into organized files. The data were read, and notes were taken in the margins to form initial codes. Next, describing and classifying codes into themes was developed. Significant statements were developed from the notes and transcription of the focus group interview. The statements were then grouped into meaning units. The data were triangulated using the one-on-one interviews, the journal prompts, and the focus group interviews.

Moustakas' (1994) seven-step approach was used. To begin this process, the listing and preliminary grouping of every expression relevant to the experience, also known as horizontalization (Moustakas, 1994), occurred. The next step was reduction and elimination, in which each expression had to meet two requirements: a moment of the experience necessary to

understand it and the ability to be abstracted and labeled (Moustakas, 1994). Subsequently, clusters of meaning were developed into significant statements into themes, which were then validated by triangulation between the data collection methods (Moustakas, 1994). Textural and structural descriptions were created from the clusters of meaning to describe what the participants experienced. A composite description was then composed that reported the phenomenon's essence and is presented in written form in this dissertation (Creswell & Poth, 2018; Moustakas, 1994).

Trustworthiness

The trustworthiness of a qualitative study includes foundational concepts of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Both qualitative and quantitative studies include implications on rigor and quality. A description of each is explained in detail for this qualitative study.

Credibility

Credibility in this study refers to internal validity. Credibility includes that the study's findings accurately describe the reality of the lived experience through the lens of the participants' perceptions (Lincoln & Guba, 1985). This study's credibility was achieved using triangulation of the three data collection and member checks (Crabtree & Miller, 1999). Triangulation ensured that participants were given ample opportunity to discuss and describe their experiences in the college environment. After the interviews were transcribed, I emailed the participants to ensure the transcripts' representations were accurate from their perspectives.

Transferability

Transferability regards the findings' transfer to other contexts, including being applied or replicated, while providing the same results at different times (Lincoln & Guba, 1985). Rich and

thick language was used to describe the research findings to ensure transferability (Lincoln & Guba, 1985). The descriptions I used to describe developmental math students' lived experiences during their collegiate journey can transfer to other locations that offer developmental math courses, aligning with the findings of other studies.

Dependability

Dependability refers to consistency so that the study can be repeated and result in similar findings (Lincoln & Guba, 1985). My procedures, explanations of data collection, data analysis method, and descriptive findings were thorough enough that this study could be replicated for students at other community colleges enrolled in developmental courses. The dissertation process included a committee that reviewed my methods and procedures to qualify the study as sufficient for demonstrating mastery.

Confirmability

Confirmability refers to objectivity and neutrality, referring to the study's findings from the participants and data collected, not from the researcher's bias, motivation, or interest (Lincoln & Guba, 1985). One method to ensure confirmability was an audit of data collection, storage, and methods. I kept accurate data collection records, including my thought process to preserve the original data, and an outside researcher audited the study for appropriateness in design and analysis. Another method used for confirmability was triangulation between the three data collections. Reflexivity was achieved by creating a reflexive journal at every study stage to bracket my bias and systematically adhere to the context of knowledge construction.

Ethical Considerations

Ethical considerations were followed to establish the study's highest level of integrity and ethicality. I gained approval from the IRB, the community college, and the participants with full

disclosure about the study. The participants' anonymity and the data's security were paramount. The data were stored on a password-protected external hard drive and will remain in a locked cabinet in my locked office. I disclosed to my participants the list of others involved in reviewing the research and potential risks that could arise.

Permissions

I obtained participation access through Liberty University's IRB process and the site's IRB. The process for the site permission was to first obtain conditional approval through Liberty's IRB before site approval. The IRB approval letter appears in Appendix A, with consent letters and other permissions needed.

Other Participant Protections

I informed the participants of the voluntary nature of the study and their right to withdraw at any time in writing, which was verbally explained to each participant. I ensured the confidentiality of the site participants by using pseudonyms for the site and the participants. I stored physical data in a locked office in a locked cabinet while I alone possess the keys to ensure the security of the documents for 3 years. Electronic data were stored in file folders requiring a password for 3 years. After 3 years, the data will be destroyed. While potential risks for this study were low, they were discussed with participants in writing and verbally. Potential benefits were also discussed in writing and verbally.

Summary

This study incorporated a transcendental qualitative research design to gain data on student experiences in corequisite developmental math courses. The procedures consisted of utilizing Moustakas's approach (1994). Data were collected through individual interviews, journal prompts, and a focus-group interview. Next, triangulation was used to determine themes

and perspectives. Trustworthiness was upheld by employing credibility, transferability, dependability, and confirmability. Ethical considerations were followed to the highest level to ensure participant information safety and security.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to discover the role of self-efficacy in a corequisite developmental math course for college students at a community college in South Central Texas. This chapter describes the participants, themes, and subthemes that emerged from the data, including the responses to the research questions. The chapter ends with a concise summary.

Participants

The study included 12 participants, 19–63 years old, with three males and nine females. One was Asian, two were Black, two were White, and seven were Hispanic. Eight were freshmen, and four were sophomores. Eight had been enrolled in college algebra more than once.

The participants responded to an email to students enrolled in Corequisite College Algebra in Fall 2023. The first 12 participants who responded participated in the study. This sample worked well based on the requirement that students were enrolled in Corequisite College Algebra during the 2023–2024 school year. The demographic in this sample was similar to the overall demographics of the college. Table 4 overviews the student participants, including their ages, specific majors, classifications, and the number of times enrolled in College Algebra. Each participant received a pseudonym to ensure confidentiality.

Table 4

Student Participants

Student Participant	Age	Classification	Major	Number of times enrolled in College Algebra
Alexandria	29	Freshman	Vocational Nursing	2
Chloe	19	Freshman	Undecided	1
Crystal	32	Sophomore	Diagnostic Medical Sonography	3
Diego	24	Freshman	Aircraft Technician	1
Felicia	26	Sophomore	Radiography Technologist	4
Janessa	33	Sophomore	Culinary Arts	2
Jared	20	Freshman	Cybersecurity	1
Maricela	30	Freshman	Radiography Technologist	2
Miguel	21	Freshman	Vocational Nursing	2
Siara	63	Freshman	Sonography	3
Tatiana	44	Sophomore	Physical Therapist Assistant	2
Victoria	20	Freshman	Undecided	1

Alexandria

Alexandria was a 29-year-old freshman majoring in vocational nursing. Alexandria was enrolled in Corequisite College Algebra the previous semester and did not pass the course. Alexandria explained that she took high school math over 10 years ago and felt stressed about retaking math. Alexandria did not prefer math; it was her least favorite subject. Failing the previous semester influenced her to feel less confident in her ability to pass her current Corequisite College Algebra course. Alexandria struggled with keeping up with the homework, as she had two children, one of whom was sick for 1 week. Caring for that child made it difficult to keep up with the homework assignments. Other outside influences included working full-time in the afternoons and evenings.

Chloe

Chloe was a 19-year-old freshman with an undecided major. It was her first time enrolled in College Algebra. Chloe did not realize her Corequisite College Algebra course included developmental and college math until the interview. Chloe explained that she had never liked math, had always struggled with it, and did not understand why she needed to take it. Chloe explained that in her Corequisite College Algebra course, many people around did not understand what they were doing, so she did not feel alone in the struggle. Chloe had a hard time on the first College Algebra test and felt that the test review did not match the test. Chloe worked part-time at a restaurant and verbalized that it was a challenge to keep up with homework due dates, partly because of her job.

Crystal

Crystal was a 32-year-old sophomore majoring in Diagnostic Medical Sonography. Crystal was taking Corequisite College Algebra for the third time. Crystal successfully

completed several other courses in college in other subjects. Crystal felt that math was a lifelong struggle and was holding her back from graduating on time. Crystal insisted that College Algebra was the only math class she needed for her degree. The other times Crystal was enrolled in College Algebra, she took the course online and felt it was too fast-paced and difficult to learn from videos. Crystal was taking Corequisite College Algebra face-to-face while working with the math tutoring center. Crystal had two children, one 6 months old, and worked part-time.

Diego

Diego was a 24-year-old freshman whose major was Aircraft Technician. It was the first time Diego enrolled in Corequisite College Algebra. Diego felt confident in his ability to pass the course because math had always been his strong suit. Diego was in three classes that semester and noted that he had all As. During the interview, when Diego was asked about challenges, he talked about specific concepts such as logs and factoring. Diego mentioned that while others around him were confused and did not understand what the instructor was teaching, he could understand it easily. He attributed part of his success to purchasing a hard copy of the textbook instead of just using the e-book. Diego was considering switching his major and taking advanced math classes.

Felicia

Felicia was a 26-year-old sophomore whose major was Radiography Technologist. It was the fourth time Felicia had enrolled in College Algebra. Felicia said that she had a hard time learning and understanding the material. She watched the instructor's videos that semester, sometimes three times, to understand the material. Felicia went to the math tutoring center and took advantage of the 24-hour, 7-day-a-week tutoring the college offered. Felicia explained that she struggled with multiplication tables in elementary school, which still affected her. When

Felicia took a test, she felt like her mind went blank, so it was not easy to focus. Felicia worked full-time and helped care for her nephew, which sometimes detracted from studying math.

Janessa

Janessa was a 33-year-old sophomore majoring in Culinary Arts. It was the second time Janessa had enrolled in College Algebra. She took Elementary Algebra twice. During the first semester of her freshman year, Janessa did not understand that she was not earning college credit for Elementary Algebra. She said that she took the placement test but did not realize it would place her in a course that did not earn college credit. Janessa would have prepared for the placement test if she had realized that not earning credit was possible. Janessa felt her confidence in math was low since she had always struggled with it, and it was never easy to understand. She found some success at the tutoring lab on campus and working with her partner in her current course. However, she felt anxious during tests, but her current instructor allowed students to use a page of notes, which she said was an immense help because when her mind would go blank during the test due to stress, she could refer to her note page. Janessa had worked last semester but was not working currently. Janessa moved back in with her parents for more time to focus on school.

Jared

Jared was a 20-year-old freshman whose major was Cybersecurity. It was the first time Jared enrolled in Corequisite College Algebra. Jared learned what Corequisite meant during the interview. He did not know that there was a developmental part of the course, but he wondered why the class was so long. Jared believed from the beginning that he could pass the course if he worked hard. Jared said that his favorite subject was math and that he has always felt good at it since childhood. He explained that while in his high school algebra class, he helped his friends.

Jared worked full-time and felt that it was sometimes difficult to keep up with the lengthy homework assignments and struggled to turn them in on time. He did not utilize the math tutoring lab because he felt he did not need it. Jared explained that he did very well on his tests, which helped his overall average. He shared that he had a B in the course.

Maricela

Maricela was a 30-year-old freshman whose major was Radiography Technologist. Maricela was taking Corequisite College Algebra for the second time and stated that she did not pass the first time because she felt overwhelmed and anxious during her tests. Maricela spent much time at the tutoring center during the previous and present semesters but still struggled with anxiety during testing. Maricela did not feel confident that she could pass the course because of her testing anxiety and realized that the tests were a big part of her grade. Maricela completed her homework on time and spent long hours finishing her assignments. Outside challenges for Maricela included working part-time and caring for her 2-year-old son. Maricela felt she did not learn much math in high school, impacting her in college.

Miguel

Miguel was a 21-year-old freshman majoring in Vocational Nursing. It was Miguel's second time enrolling in Corequisite College Algebra. Miguel said that he did not like math and struggled with solving equations. Miguel explained that it was a challenge when his son was sick, but his instructor allowed him to remote into class, so he was grateful that he did not miss it. The instructor posted videos on the lessons, and Miguel thought they helped him learn the content because he could watch the videos as needed for certain parts of the homework. Miguel worked the weekend night shift, so getting all his assignments in on time was challenging, but

his instructor allowed late work. Miguel felt it was worth his time to complete the homework even if it was late because the instructor gave him full credit.

Siara

Siara was a 63-year-old freshman majoring in Sonography. It was Siara's third time enrolled in Corequisite College Algebra. The other times Siara was enrolled, she struggled with the pace of the course and the technology. Siara explained that it was very time-consuming to figure out the technology part of the course and felt it put her behind in the class. When Siara took the course previously, she failed the corequisite part and was told to withdraw because she did not pass the corequisite required to move into College Algebra. At the beginning of the term, Siara did not feel confident about passing the course. However, she explained that her confidence had increased throughout the course because she did well on her tests, partly due to a private tutor who helped her study for them.

Tatiana

Tatiana was a 44-year-old sophomore whose major was Physical Therapist Assistant. Tatiana had enrolled in College Algebra twice. The first time was over 10 years ago. Tatiana withdrew from college after not passing College Algebra and English 1. Hence, Tatiana enrolled in Corequisite College Algebra alone to focus solely on it because she felt math was not her strongest subject and wanted to devote more time to it. Tatiana worked part-time and had a daughter in high school. Tatiana and her daughter spent time together doing math homework, which she felt raised her confidence because sometimes she helped her daughter.

Victoria

Victoria was a 20-year-old freshman with an undecided major. It was Victoria's first time taking Corequisite College Algebra. Victoria explained that her math anxiety began in

elementary school, and she did not feel confident she would be successful in the course. Early in the course, Victoria felt overwhelmed by the number of homework assignments and how long each took her to complete them. A challenge Victoria faced was being in high school during COVID-19, so she felt she did not learn much math. She felt that she would have done better on the placement test and would have had to take Elementary Algebra before taking Corequisite College Algebra. Victoria used the math tutoring lab to work on her homework but rarely asked for help.

Results

This study captured the phenomenon of lived experiences for community college students in Corequisite College Algebra. After the data were analyzed, three themes emerged with subthemes: 1) Students voiced that their beliefs about their ability to learn math were based mainly on past experiences. 2) Students agreed that outside stressors such as working part-time and full-time and family obligations affected the time needed in the course. 3) Students' beliefs and attitudes about math influenced their math self-efficacy and self-confidence. Three themes and six subthemes were determined after data triangulation. Appendix J shows a sample of the coding, clusters, and themes.

Table 5

Themes and Subthemes for Data

Theme	Subthemes
Past experiences in math influence math self-confidence	Previous failures Lifelong struggles Subsequent course enrollment
Outside stressors	Dislike for math
Beliefs and attitudes about math	Math anxiety

Past Experiences With Math Influenced Math Self-Confidence

All 12 students described their attitudes and beliefs about math during the interviews. When asked about their confidence in passing Corequisite College Algebra before it started, all 12 students used the follow-up question to explain their past experiences. Ten of the 12 participants described having low confidence in passing the course before it started. All ten voiced their math struggles and verbally attributed them to past experiences.

For instance, Chloe stated, “I have struggled with math my whole life, and to this day, I still struggle.” In her interview, Crystal had a similar statement: "Math is holding me back from graduating on time. It has been a lifelong struggle for me, ever since elementary school and then high school, and I just don’t remember anything.” Miguel explained, “I had to retake Algebra in high school, and I just felt frustrated because, for some of my friends, it was easy, and I always had a hard time understanding it.”

Two students showed high confidence in passing the course based on prior successful math experiences. Jared explained in his journal prompt, “I scored higher than my friends in Algebra 2 in high school, so I knew that I am good at math.” Jared answered with confidence that he felt he would pass the course. Diego expressed a successful past math experience: “I love math, and you know I have always been good at it since elementary school.” Diego shared that after that semester, he planned to change his major to STEM since others in his class had struggled, so he realized that math came easier to him.

Lifelong Struggles

During the interview, seven students voiced their math struggles that began in elementary school. During the interview, Tatiana shared:

> The truth is, I have never been good at it. Never truly understood it. I think because, you know, I never actually learned it. Year after year, I just kept struggling, but I got through it somehow, and now here I am still struggling.

Three students referred to specific moments in grade school in their journal prompts. Felicia's journal response explained, "When I was in maybe third grade, I had the hardest time learning multiplication. I felt behind even back when I was younger." This idea was also addressed during the focus group interview. Participants spent most of the time on the first question about their perceptions of math before the course began. For instance, Janessa said, "I just never been good at math, and I remember crying one time when I was younger and was taking a math test. I feel nervous now when I take a math test to this day."

Other participants agreed that they also struggled with math at an early age. Miguel, Siara, and Chloe agreed about using a calculator for even simple computations, but they felt that they never understood fractions when it was first taught. Siara said, "Well, there is one thing, and that is I never understood fractions, and I still don't. What grade was I supposed to learn that in? Well, I didn't!"

Subsequent Enrollment in the Course

Eight of the 12 participants shared that they had enrolled in Corequisite College Algebra more than once. During the interview, Felicia said, "I am having to take this class again, this is my fourth time." Moreover, Crystal explained,

> I failed this course two times, but it was not my fault! First time, I tried online, that was a mistake. Then I got to enroll in a summer class in person, and well, umm, that was just too fast because, like, you had to do the work in shorter amount of time.

Four other students shared similar experiences during the focus group interview, attributing part of the issue of not passing to enrolling in an online course. Janessa enrolled in Elementary Algebra twice before taking Corequisite College Algebra. Janessa explained that she took the course via Zoom the first time, so concentrating was hard for her.

Outside Stressors

Most participants voiced that they faced stress and pressure outside the classroom. Eleven of the 12 students identified an outside stressor that influenced their ability to keep up with the homework assignments and be prepared for their tests. These stressors included working part-time, full-time, and caring for children. Nine worked while going to school: five worked full-time, while four worked part-time. Six had family obligations that consumed their time.

Of the nine students who worked, seven verbalized the time it took to complete homework assignments and the difficulties of maintaining a job. Alexandria said,

> The time it takes to complete homework is a lot. This has been a challenge to me because I have a job and two kids, and sometimes, I am so tired and staying up very late hours to complete homework.

Miguel said, “I barely passed my first test, but I had no time to study for it. My son was sick, and I was working.” Crystal, who had two children, one 6 months old, explained she had to sacrifice much time with her baby to keep up with the course. She said, “One time, I spent 4 hours on one assignment. Why do they make the assignments crazy?” Several students voiced during the focus group interview that they fell behind when they missed class for work or family obligations, and it was difficult to get caught up on topics.

Time Management

Eleven of the 12 students agreed that time was a challenge. During the interview, Janessa said, “I go to the math tutoring center often to help me on the homework; otherwise, I might not do it at home.” Ten students voiced that they used the math tutoring lab for support and help. Tatiana dropped out of college 10 years ago when she did not pass College Algebra and English 1. This time, Tatiana was only enrolled in Corequisite College Algebra to have more time to devote to it. Tatiana explained, “Last time, I was doing too many things, and I couldn’t focus on math.”

Felicia explained how she managed her time by utilizing many supports: “My instructor posts the videos from the lectures, and I go home, and I watch them, sometimes, three times.” Siara, a veteran, secured a private tutor from the college’s veteran center. Siara said that some weeks, she spent 4 hours a week just with private tutoring, helping her understand concepts before her tests. Siara said, “I was working part-time, but, oh no, not now, because if I am going to make it through this class, I need more time with my tutor.”

Beliefs and Attitudes about Math

Participants were asked directly in the interviews about their attitudes toward math. Ten of the twelve had negative attitudes: words like “hate,” “dislike,” and “sucks” were used often. In contrast, two participants had positive attitudes and used words such as “like,” “fun,” and “easy.” Diego said during the interview, “Math is fun; it is easy for me.” Diego elaborated, “During class, everyone around me has no clue what we are doing, but I do know.” Jared had similar sentiments, “My attitude for math is it’s easy; I like it.” Diego and Jared both showed higher levels of self-confidence in passing the course. Diego wanted to talk about specific concepts

when asked about challenges. During the interview, Diego said, “A challenge for me was logs, but I still figured out how to do it.”

Dislike For Math

When asked about their attitudes toward math, ten participants did not like it. They were the same ones who said they had low confidence in their ability to pass the course. Maricela said, “I don’t prefer math. It is my least favorite subject, and I have never liked doing it.” In the focus group interview, students spoke up about their struggle with and dislike for math. At one point, Felicia explained, “I just don’t understand why I need to even take College Algebra; it has nothing to do with my life. I doubt I’ll even use it for my degree.” At this point during the interview, Chloe chimed in, “Yes, I agree, it seems like a waste of time.” Other students voiced this opinion and included their frustrations about the College Algebra course, including much time spent discussing the lengthy homework assignments.

Math Anxiety

Three students explained that they felt anxious, nervous, and worried during tests throughout the course. Janessa said during the interview, “It was a challenge to keep up with homework and study for exams. I have really bad test anxiety, and sometimes my mind just goes blank when it is time for the test.” Maricela also used the word anxiety during the interview, which had to do with testing. Maricela explained, “I know it’s a big part of my grade, and I get bad anxiety. I feel overwhelmed and uncomfortable. I worry I am not going to pass before the test even starts.” Felicia did not use the word anxiety, but she did talk about how her mind goes blank during testing: “My mind goes blank, and it is hard to focus.”

Research Question Responses

Participants for this study enrolled in Corequisite College Algebra shared their experiences through interviews, journal prompts, and a focus group. Personal interviews gave the most insights into the relationship between self-efficacy and student experiences in Corequisite College Algebra. The journal prompts allowed participants to elaborate on specific examples, while the focus group showed connections participants had with each other. The personal interviews, journal prompts, and focus group gave insight into the phenomenon of being a community college student enrolled in Corequisite College Algebra and showed consistent data among the participants.

Central Research Question

How does self-efficacy influence the experiences and perceptions of students in corequisite developmental math courses? All participants showed that their perceptions and self-efficacy of math relied heavily upon past experiences. When asked how they felt about passing the course before it started, every student talked about past math experiences. Siara said, “When I was younger, I did not pass algebra the first time, then now, in college, the same thing is happening to me.”

The data were consistent with the journal prompt’s first question about how two math experiences influenced their current perceptions about learning math. Participants who explained past failures had negative perceptions about their ability to learn math. In contrast, Jared and Diego shared positive past experiences and wrote about specific instances when they were successful and how they knew they would be successful in their course. Diego said, “At one point, I got to help people around me understand what we were doing, like high school, that is what I did.”

Sub-Question 1

How do personal experiences with mathematics instructors influence self-efficacy in corequisite developmental math courses? The answers to this question varied based on the individual participant, an inconsistent theme among all students. Some participants explained that they did not have personal experiences with the instructor. Six felt the instructor influenced their ability to learn math. For example, Maricela stated, “My professor showed us more than one way to solve a problem, and there was one way I really understood. It made me think I can do this.” In her journal prompt, Chloe explained,

> I got the problem wrong, and so I asked for help, and my instructor explained my process was right. I just wrote the wrong number down. This helped me because I was doing it right in the first place, but I need to be careful when I write the problems down.

During the interviews, journal prompt question 3, and focus group interview question 4, several participants noted that they did not feel that the instructor influenced their perceptions about learning math. However, these students voiced that instructors who allowed late work and flexibility helped them persist with the course.

Several students voiced that when the instructor allowed flexibility for late or missing assignments, it helped them stay on track. For instance, Miguel said,

> When my son was sick, I was behind on my homework, and I missed class. The instructor gave me more time and told me to watch videos on Canvas. That helped me to feel less worried about everything and made me feel like I could still do my work.

Alexandria agreed, “When my son was sick, I missed class, and I was able to go into the math tutoring center to make up my missed time in class.” Other students explained that their instructor took late points off even during a family emergency, which caused Victoria to be

"stressed out! I was very stressed when I had to miss class, and my instructor held it against me. Then, I do all of my homework assignments, but the highest I can score is a 70."

Sub-Question 2

How did experience with peers influence self-efficacy in a corequisite developmental math course? This question was not answered consistently, as some participants mentioned they did not interact with their peers, while others had high levels of interaction. Those with elevated interactions with peers showed signs of self-efficacy being influenced. During the focus group interview, Janessa said,

> My partner influenced the way I figured out how to look over my work and see where a mistake was made. I felt a connection because my partner also struggles with math, and she helped me to find my mistakes.

Diego stated, "My class, we did a lot of partner work. I was able to help my classmates out, and I, um, got to teach them sometimes. It made me feel more confident in my ability to do math." During the focus group interview, Chloe stated, "Yeah, we didn't do any group work or partner work," which was consistent with journal prompts and interview questions about peers and their influence since many participants did not interact with their peers in their course.

Sub-Question 3

How do experiences with others outside of the classroom influence corequisite developmental math students' self-efficacy? For this question, most participants focused on their family obligations and their effects during the course. Six had children and talked about the challenge of the time it took to complete homework assignments. Three of these six gave specific examples of how caring for their children affected their ability to stay on track with the coursework and understand the material. For instance, Crystal said, "I don't know what I was

thinking enrolling in this class with my young ones at home. I am working you know, and I just have no time for math homework outside of when I am on campus."

Moreover, participants explained how using the math tutoring lab was important and helped them to stay on track in the course. Ten of the 12 verbalized that having a place to go to work on homework and getting help when needed encouraged them to continue the course. Alexandria explained, "When I go into our math tutoring lab, I get help when I need it, and that makes me feel less stress." Janessa agreed that by going into the math tutoring lab, specifically before a test, she could get "immediate help when I didn't understand a question on the review." Janessa felt more confident about her successful experiences in the math tutoring lab.

Sub-Question 4

How do prior math experiences influence student perceptions about math self-efficacy in a corequisite developmental math course? In all data sources, self-efficacy was influenced the most by past experiences with math. All participants used past experiences to explain their confidence in passing the course.

During the focus group interview, Chloe, Alexandria, Crystal, Janessa, Siara, and Tatiana described moments when they were younger and felt they did not understand math in elementary school. Tatiana said, "I have always struggled with math since I was a child; it was hard." Other students described the last math course they took in which they "withdrew," "failed," or "dropped" the course and had to retake it. Diego and Jared, both of whom showed strong self-efficacy, talked about prior experiences in which "math was easy for me." Siara improved math self-efficacy during the course when she did well on her first test. She said, "I got a B on my first exam, and I felt real good about that, and now I feel like I got this."

Summary

Corequisite College Algebra students who participated in this study elaborated on their feelings about math based on past experiences. The data showed that past experiences influenced math self-confidence and beliefs. The data also showed that outside stressors included working part-time or full-time while trying to spend time on lengthy homework assignments and studying for tests. Family obligations included caring for children and relatives, which impacted students' experiences in their Corequisite College Algebra course. Participants in this study showed strong attitudes and beliefs toward mathematics.

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this transcendental phenomenological study was to discover the role of self-efficacy in a core developmental math course. I hoped to learn how math self-efficacy influenced student experiences and perceptions in their corequisite course. This final chapter discusses the findings, the implications for policy and practice, theoretical and methodological implications, the limitations and delimitations, and recommendations for future research.

Discussion

This section discusses the findings of this study regarding the developed themes and subthemes found using Moustakas' (1994) transcendental phenomenological data analysis. Participants shared their experiences in a corequisite developmental college algebra course, and data were collected through individual interviews, journal prompts, and a focus group. A summary of the thematic findings and a critical discussion is included.

Summary of the Thematic Findings

Three themes and six subthemes emerged from the data collection. The first theme was past experiences in math influencing math self-confidence, including three subthemes: previous failures, lifelong struggles, and subsequent course enrollment. The second theme was outside stressors, which included a subtheme of time management. The third theme was beliefs and attitudes about math with subthemes of dislike for math and math anxiety. The following narrative includes a critical discussion of the findings linked to the literature.

Critical Discussion of the Findings

The purpose of this study was to discover the role of self-efficacy in a corequisite developmental math course. The literature review showed that students enrolled in

developmental math courses are influenced by their past math experiences and face many challenges and setbacks during college, as also shown in this study. One of the first experiences students face when registering to enroll at a Texas community college is taking the TSIA (Humes, 2023). The assessment gauges whether a student is college-ready for English and mathematics. Much debate has surrounded placing students in math courses based on testing (Kosiewicz & Ngo, 2019).

For this study, Corequisite College Algebra students were enrolled in the course based on an entry test on the TSIA that examined their math ability. Students who scored within certain ranges were enrolled in Elementary Algebra (purely developmental), Corequisite College Algebra, or College Algebra. This testing alone to enroll students in developmental or corequisite math courses influenced self-efficacy before the class started.

During the interview, two students shared their dislike of the initial placement testing and how it made them feel stupid. The literature suggests that since initial placement testing is one of the first experiences for students in college enrollment, it results in poor academic outcomes and less motivation (Kosiewicz & Ngo, 2019). Other students explained that they did not realize what the test meant and did not take it as seriously as they would have had they known. This response mirrors the literature that some students who take the placement test do not understand what it is for and what impact the results will have, so they do not prepare for it, resulting in incorrect placement (Cox & Dougherty, 2018).

Shockingly, most participants in this study were taking Corequisite College Algebra for a second, third, or fourth time, as found in the current literature. Data have shown that students who enroll in developmental courses have lower grade point averages, take the same developmental courses multiple times, and are less likely to finish their degree plans on time

compared to others not enrolled in developmental math courses (Browne, 2022; Skuratowicz et al., 2019; Soland, 2019; Stewart et al., 2020). Students enrolled more than once have past failures and issues that are unaddressed. According to the literature, these students are at substantial risk of not graduating on time, not finishing their degree plans, and dropping out altogether (Brown, 2022; McKinney et al., 2018; THECB, 2018; Zhao et al., 2022).

During this study, participants shared their thoughts about understanding math; for many, it was a lifelong struggle. The struggle continued in college without much assistance to break the cycle of negative math experiences. In a longitudinal study and similar studies, the data showed that math anxiety in previous years predicted lower math achievement in subsequent years and that poor math achievement appeared to be the cause of later math anxiety (Gunderson et al., 2017; Ma & Xu, 2003). This outcome included students with negative thoughts and anxiety about math. The current literature has noted that math anxiety at younger ages can relate to avoidance and mastery avoidance at older ages (Barroso et al., 2021; Cribbs et al., 2021). For new college students, the first semester crucially influences their success and persistence in community college (Zientek et al., 2017).

Several participants showed math anxiety, especially during testing. Two participants described how their minds went blank during testing, making concentrating difficult. Three other students explained that testing stressed them out: they became nervous and felt like they could not do their best. Physiological affective states influenced student's abilities to concentrate, focus, and learn. These comments echoed the literature about students with math anxiety having difficulties with focusing, memory recall, and fear (Engle, 2002; Shah & Miyake, 2012; Ramirez et al., 2018).

Most participants in this study faced many outside challenges, including working while going to school and caring for their families. Data have shown that students who are racial minorities, below the poverty line, and first-generation students are more likely to be required to enroll in developmental courses than other student groups (Browne, 2022; Daugherty et al., 2021). Most participants in this study voiced their need to work part- or full-time while attending school. Participants voiced that when a challenge arose, such as picking up an extra shift at work, when they needed the money, they missed class, affecting their ability to learn the material.

For those with supportive instructors who worked with stunting on what they missed, posting lecture videos, and showing empathy, these students felt they could still be successful and persist in the course. However, the participants with unsupportive instructors felt that what they missed put them behind in their learning, so it was difficult to get caught up. While the participants were all enrolled at the same college, they faced diverse experiences in challenging times based on their specific instructors.

Implications for Policy and Practice

Students need support to help them raise their math self-efficacy and deal with outside challenges. Instructors need support on best practices to help raise students' math self-efficacy and mindsets in their classrooms. Departments may consider course flexibility as students deal with outside pressures and situations beyond their control. College policymakers must examine ways to offer support to students and instructors in corequisite courses and should consider student placement policies. Implications for policy and practice are further discussed below.

Implications for Policy

Recently, many states have written reforms on developmental course requirements requiring colleges to offer instructional strategies, corequisite models, and other strategies

(Skuratowicz et al., 2019; THECB, 2018; Zhao et al., 2022). However, these policies lack ways to improve students' self-efficacy and mindset. Almost every participant in this study came into Corequisite College Algebra with low self-confidence about passing the course. This cycle continued during their courses and needed to be broken.

Research has suggested that students are more likely to stay in college after their first year when they have strong academic mindsets. Moreover, self-efficacy and academic mindsets can positively influence student experiences (Campbell et al., 2019; Farrington et al., 2013; Farruggia et al., 2018; MacCann et al., 2020). Hence, policymakers for college should create ways to help students incorporate a growth mindset and improve self-efficacy, which should begin in the classroom during individual courses as instructors have the tools needed to help improve student mindsets. This paradigm could result in a requirement for all instructors to teach developmental and corequisite courses. Colleges should provide professional development on self-efficacy, time to meet and collaborate with other faculty across disciplines, and time for meetings throughout the semester to reflect and revise best practices. Policy reform should include placement testing and be reexamined since, for many students, it is their first college experience—and a negative experience at that.

College policymakers should consider different placement options for students during college enrollment. Assessment reforms should include multiple measures to determine college readiness, such as growth mindset assessments. Another possible reform could be allowing students to choose their first course. One study showed that allowing students to choose the course they started with improved their success in the course and self-efficacy (Kosiewicz & Ngo, 2019). If college policymakers cannot change their entry-testing policies, they should consider boot camps or review sessions before students take the test. At the very least, students

should be informed about the implications of the tests, as many students in this study and the literature voiced that they did not know (Cox & Dougherty, 2018).

Implications for Practice

Self-efficacy theory highlights that the strongest influence of self-efficacy is mastery experiences (Bandura, 1977), so instructors should facilitate early mastery experiences in the classroom. As a result, students' math self-concepts could be improved, thereby influencing their achievement in mathematics (Hann, 2019; Huang et al., 2018; Peterson & Hyde, 2017). Bandura's (1977) self-efficacy theory indicates that once successful at completing a task, future successes follow. Hence, instructors could help students find success, reflect on it early in the course, and use it to influence future success during the course. Instructors should strive to include growth mindsets in the classroom because students must learn that difficulties and obstacles can be overcome.

Practices in the classroom should involve incorporating skills to help students with mindfulness, self-compassion, attitudes, and self-efficacy (Deshler et al., 2019; Leppma & Darrah, 2022). One way to do this would be to have time in the classroom to participate in growth mindset and interventions. Giving students a way to be heard about their feelings, allowing them to connect and talk with each other about past experiences, and providing activities that inform them about a growth mindset and ways to improve self-efficacy may help reduce math anxiety and increase math self-efficacy. Research has suggested that helping students increase their growth mindset may also increase self-efficacy (Samuel & Warner, 2019; Yeager & Dweck, 2020).

One model for such reform was completed in 2015–2018, where a university piloted a developmental mathematics intervention program that ensured delivery practices devoted to self-

efficacy theory in mathematics mindset (Morris et al., 2022). This pilot addressed the four sources of self-efficacy, and students enrolled in the intervention program were three times more likely to pass College Algebra (Morris et al., 2022). This model could be the standard for colleges to adopt as it addresses many ways to help students. For example, allowing students multiple attempts on low-stakes testing could improve mastery experiences.

Another practice could be incorporating group work during the course to promote vicarious experiences. In the above pilot study, the faculty mentored students about math mindsets and included positive and encouraging feedback that encouraged self-efficacy and perseverance (Morris et al., 2022). Students participated in reflection activities and goal setting and were assigned a math helper/tutor who met with them and provided positive reinforcement (Morris et al., 2022). While this pilot provided successful results and implemented many strategies, even just one of these strategies could help increase students' self-efficacy.

Another implication for practices should be to include instructor flexibility in developmental and corequisite courses. Many students have multiple challenges, so allowing flexibility in homework assignment due dates may help them persist when family and work emergencies happen. The instructor could drop the lowest homework score or give a final due date on assignments, allowing flexibility and more time for students. Numerous lengthy assignments may make it difficult for students to complete. Finding other ways to practice concepts and different ways to assess may be better for students with time challenges.

Empirical and Theoretical Implications

This section explores the empirical and theoretical implications of this research study. Bandura's (1977) self-efficacy theory served as the framework for this study. Bandura found that mastery experiences most influence self-efficacy, as seen in this study. The recent literature on

developmental education and self-efficacy is consistent with this study's findings. Hence, this study extends the research by focusing on students enrolled in a corequisite college algebra course.

Empirical Implications

This research coincided with the current literature research in many ways, such as the extant research on initial placement testing. Several participants in this study shared their negative experiences with initial placement testing. Research has suggested that initial placement testing is one of the first experiences students participate in, often resulting in lower motivation and poor academic outcomes (Kosiewicz & Ngo, 2019). In this study, several participants did not know what the testing meant, as aligned with previous research where students did not know what the results meant, did not do their best to prepare for it, and some did not receive the correct placement (Cox & Dougherty, 2018).

This study showed that students' math self-efficacy was most influenced by past mastery experiences, as reflected in the literature. The research includes several studies that showed students' belief about their success or failure in their current math course was determined by their success or failure in previous math classes (McKinney et al., 2022; Sinha et al., 2022). Participants in this study voiced their previous lifelong struggles with mathematics and their impact now. Similarly, the literature shows data supporting negative mastery experiences at a younger age impeding math self-efficacy and future positive outcomes in mathematics (Ahn et al., 2017; Ayotola & Adedeji, 2009; Butz & Usher, 2015; Chen & Zimmerman, 2007; Davis-Kean et al., 2021; Echeverría Castro et al., 2020; Ford et al., 2022; Kitsantas et al., 2011).

Participants in this study felt that when an instructor was supportive regarding outside challenges, it helped them with persistence in the course. Previous research echoed this

sentiment, as teachers providing emotional support increase student motivation, participation, connectedness, and emotional well-being in elementary, middle, and high school (Meyer & Tuner et al., 2007; Yang et al., 2021; Zhou et al., 2019). Research has suggested that the relationship between instructors and college students influences student success more than factors such as technology use and presentation skills (Parnes et al., 2020; Schneider & Preckel, 2017). For this study, instructors' impacts on self-efficacy were challenging to assess since many participants only had a few interactions with their instructors.

In this study, participants' physiological and affective states contributed to their thoughts about their ability to be successful. As with other literature regarding early mastery experiences, physiological and affective states in mathematics begin in primary and elementary grades, as shown in this study (Barroso et al., 2021; Harari et al., 2013). Participants explained how they felt anxious, stressed out, and nervous regarding math, which began at an early age.

Research has suggested that math anxiety can influence future education outcomes with mastery avoidance at older ages (Barroso et al., 2021; Cribbs et al., 2021). Students with math anxiety have physiological implications, including a racing heart rate, neural activation, and high cortisol levels (Ashcraft & Krause, 2007; Cho, 2022; Deshler et al., 2019). Math anxiety can impact working memory, focus, and concentration, as the participants felt their minds went blank (Engle, 2002; Leppma & Darrah, 2022; Shah & Miyake, 2012; Ramirez et al., 2018).

This study intersected the literature as many participants were reenrolled in Corequisite College Algebra, which meant they were unsuccessful during their first enrollment. Some participants explained that they were enrolled in purely developmental Elementary Algebra before taking Corequisite College Algebra. Two participants shared that it took multiple attempts to pass Elementary Algebra. This similarity was seen in the literature from the United States

Department of Education et al. (2016) in community colleges, where only 28% of first-time students in developmental courses earned a degree within 8 years. In mathematics, in a study of 63,650 students enrolled in three levels of developmental math, only 11% ended up completing College Algebra (Community College Research Center, 2014).

Theoretical Implications

The participants in this study voiced that their previous experiences influenced their beliefs about how they would do in their mathematics course before it began. Bandura's (1977, 1997) self-efficacy theory states that of the four influences of self-efficacy, mastery experiences are the strongest. This effect was seen in this study and found in the surrounding literature on this topic, especially regarding mathematics self-efficacy.

In this study, two participants showed a positive outlook about the course based on past mastery experiences. The two participants scored low enough on the TSIA (Humes, 2023) to be placed in Corequisite College Algebra. However, both showed higher self-efficacy than the ten other participants. Ten participants believed they would struggle and possibly not be successful in the course based on past failures. This finding begs the question of how we help students perform mastery experiences and change their mindsets before the course begins.

Bandura (1997) explained that starting with smaller successes in understanding a concept catalyzes bigger and more complex victories. Bandura's self-efficacy theory elaborates that people experience low self-efficacy based on early failures when their self-efficacy is not yet established. The extant literature and this study confirmed this assertion.

During this study, students voiced that physiological and affective states influenced their self-efficacy in the course. Bandura (1997) implied that depressive and sad moods can directly impact learning processes and memory. Ten of the twelve participants in this study shared

negative thoughts and attitudes about mathematics. Several participants explained that their minds went blank during testing. Others explained how they felt stressed, overwhelmed, and anxious when working on math problems.

Bandura (1977) highlighted that self-efficacy is influenced by mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states. This study showed that mastery experiences and physiological and affective states influenced student experiences in Corequisite College Algebra. However, based on the limitations of this study, it was difficult to determine the influence of vicarious experiences and verbal persuasion on students' self-efficacy.

Limitations and Delimitations

The limitations of this study were weaknesses that could not be controlled—there were several. The first was that the study was conducted at a specific location that might not reflect all community colleges across the United States. Another limitation was that scheduling the focus group interviews became difficult, resulting in only one focus group interview, which nine of the 12 participants attended. Two participants did not email back requests for the focus group but participated in the interviews and journal prompts. One participant emailed back, explaining the inability to attend the focus group due to scheduling. Only having one focus group interview with nine participants could have reduced the data collection.

The participants in this study came from different classes and instructors, which limited the study because some participants were in courses with no peer interaction. This disparity made it challenging to gauge vicarious experiences and social persuasion. Some participants did not feel they had enough interactions with their instructors to answer questions during the interviews and journal prompts. This absence limited the data on vicarious experiences, social persuasion,

and how instructors influenced self-efficacy during the course.

Delimitations included choosing a transcendental phenomenological study instead of a hermeneutic phenomenological study. A transcendental phenomenological study was chosen because it was important for the participants to tell their stories free of researcher bias since the goal was to describe the phenomenon of their experience in Corequisite College Algebra. Another delimitation was convenience sampling of students enrolled in the course for at least 6 weeks before the interviews so that students had enough time to discuss their experiences during the course.

Recommendations for Future Research

Several recommendations for future research are based on this study. Qualitative research on how self-efficacy influences student experiences in developmental math courses could be explored more in additional studies. A longitudinal study tracking students from their first enrollment into a developmental math course and their subsequent courses, with a chance to hear from the students about their experiences, could elaborate further on the essence of what it is like to be a student in a developmental course. A phenomenological study involving a corequisite math course including participants in the same class would also be useful, particularly a class with peer-to-peer interactions and active learning strategies.

A phenomenological study involving students who successfully passed their first enrollment in developmental math courses would help to learn more about how to positively influence self-efficacy for other students. Research at specific colleges implementing strategies to raise self-efficacy and growth mindset could help other colleges learn and understand best practices. This study was held at one college, so it might not have produced the same results at

other colleges. Therefore, another recommendation would be to complete more phenomenological studies with more participants at other community colleges.

Conclusion

The purpose of this phenomenological study was to discover the role of self-efficacy in a corequisite developmental math course for college students at a community college in South Central Texas. The theoretical framework for this study was Bandura's (1977) self-efficacy theory. Data were collected from individual interviews, journal prompts, and a focus group.

The results showed that students' past experiences in math influenced their current math self-confidence and self-efficacy. Most participants explained that their math struggles began at an early age and continued throughout their school years since they still struggled. Outside stressors, including working and family obligations, influenced students' abilities to persist during the course. Participants had strong feelings and beliefs about math that influenced their self-efficacy in the course, even before it started. Several students felt overwhelmed, anxious, nervous, and stressed regarding homework assignments and tests. Based on the results of this study, policymakers should incorporate professional development to help instructors improve student mastery experiences early on in their courses. Moreover, policymakers and instructors should use research-based best practices that raise self-efficacy and a growth mindset.

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Appendix A

IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

November 9, 2023

Jessica Edmiston
Larry Crites

Re: IRB Exemption - IRB-FY23-24-659 Self-efficacy and student experiences in a corequisite developmental math course

Dear Jessica Edmiston, Larry Crites,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:104(d):

Category 2.(ii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

For a PDF of your exemption letter, click on your study number in the My Studies card on your Cayuse dashboard. Next, click the Submissions bar beside the Study Details bar on the Study details page. Finally, click Initial under Submission Type and choose the Letters tab toward the bottom of the Submission Details page. Your information sheet and final versions of your study documents can also be found on the same page under the Attachments tab.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,
G. Michele Baker, PhD, CIP
Administrative Chair
Research Ethics Office

Appendix B

Site Approval Letter

[redacted]

1 December 2023

Jessica Edmiston
Mathematics Instructor
[redacted]

Dear Jessica Edmiston,

Please accept this letter as official notification that the Institutional Review Board at [redacted]has approved your team via exemption to recruit student participants at the College for the protocol "Self-efficacy and student experiences in a corequisite developmental math course."

Please note that, as the IRB of record for this research, Liberty University will be responsible for any adverse events or other issues that may arise during the study. The IRB a[redacted]indly requests that you notify us of any adverse events that may arise. Furthermore, please send us any amendments to the study approved by Liberty's IRB. If the study concludes before the expiration date, please forward us copies of the close out materials submitted to Liberty's IRB. I wish you luck with the project and hope you can collect the data you need.

Sincerely,

[redacted]

[redacted]

Appendix C

Consent Form

Consent

Title of the Project: Self-efficacy and student experiences in a corequisite developmental math course

Principal Investigator: Jessica Edmiston, Doctoral Candidate, School of Education, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be a student enrolled in corequisite College Algebra for the 2023-2024 academic school year. Taking part in this research project is voluntary.

Please take time to read this entire form and ask questions before deciding whether to take part in this research.

What is the study about and why is it being done?

The purpose of the study is to discover the role of self-efficacy in a corequisite developmental math course for college students. The study will explore how self-efficacy influences student outcomes in their corequisite developmental math course.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following:

1. Participate in an in-person, or online, audio-recorded interview that will take no more than 1 hour.
2. Complete three journal entries, one to two paragraphs in length, that will be online, and take approximately one week for completion.
3. Participate in an in-person focus group interview that will take no more than 1 hour.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include a better understanding of student experiences in developmental corequisite math courses using student voice. Faculty implementation of strategies that may help improve math self-efficacy for future students.

What risks might you experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses will be kept confidential by replacing names with pseudonyms.
- Interviews will be conducted in a location where others will not easily overhear the conversation.
- Confidentiality cannot be guaranteed in focus group settings. While discouraged, other members of the focus group may share what was discussed with persons outside of the group.
- Data will be stored on a password-locked computer and in a locked filing cabinet. After three years, all electronic records will be deleted, and all hardcopy records will be shredded.
- Recordings will be stored on a password-locked computer for three years and then deleted. The researcher will have access to these recordings.

How will you be compensated for being part of the study?

Participants will not be compensated for participating in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision on whether to participate will not affect your current or future relations with Liberty University or St. Philip's College. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, apart from focus group data, will be destroyed immediately and will not be included in this study. Focus group data will not be destroyed, but your contributions to the focus group will not be included in the study if you choose to withdraw.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Jessica Edmiston. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at [redacted] or. [redacted] You may also contact the researcher's faculty sponsor, Dr. Crites at [redacted]

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study

after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to audio-record me as part of my participation in this study.

_____

Printed Subject Name

_____

Signature & Date

Appendix D

Recruitment Letter

Dear Potential Participant,

As a doctoral candidate in the School of Education at Liberty University, I am conducting research as part of the requirements for a Ph.D. degree. The purpose of my research is to discover the role of self-efficacy in a corequisite developmental math course for college students. The study will explore how self-efficacy influences student outcomes in their corequisite developmental math course, and I am writing to invite you to join my study.

Participants must be enrolled in developmental Corequisite College Algebra during the 2023-2024 academic year. Participants will be asked to participate in an interview, complete three journal prompts, and participate in a focus group. It should take approximately one hour for the interview, a week time-frame for the journal prompts, and one hour for the focus group to complete the procedures listed. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

To participate, please contact me at jledmiston@liberty.edu to schedule an interview. If you meet my participant criteria, I will contact you to schedule an interview work with you to schedule a time for an interview.

A consent document is attached to this email. The consent document contains additional information about my research. If you choose to participate, you will need to sign the consent document and return it to me at the time of the interview.

Sincerely,

Jessica Edmiston

Doctoral Candidate

Appendix E

Individual Interview Questions

Individual Interview Questions

1. Please describe your college experience including courses you have or are currently participating in.
2. Describe how you felt when you realized you would be taking a developmental math course.
3. Describe your confidence in passing the corequisite course before the course started.
4. Describe your personal experience in the previous math course you took prior to the developmental math course.
5. Explain how taking a developmental math course has impacted your collegiate journey.
6. Describe experiences that were challenging while taking your developmental math course.
7. Explain how you utilized the supports that were in place while you were in a developmental math course.
8. Describe your attitude towards mathematics.
9. How did experiences with peers during your developmental math class contribute to your current attitude about mathematics?
10. How did your experience with peers influence your perception of learning math in your developmental math course?
11. What outside challenges did you face during your developmental math course?
12. During your developmental math course, what influence did your professor have on your perception and motivation regarding learning math?

13. How did prior mathematics learning experiences influence your perception of the ability to learn math during your developmental math course?
14. What else would you like to add to our discussion of your experiences of participating in a developmental math course and your perception of learning mathematics?

Appendix F

Journal Prompts

Journal Prompts

1. Explain how two or more past mathematics learning experiences have influenced your current perceptions about learning mathematics.
2. Describe two occasions when peers influenced your learning in mathematics during your developmental math course.
3. How did your mathematics instructor/professor influence your perception about learning mathematics during your developmental math course?

Appendix G

Focus Group Interview Questions

Focus Group Interview Questions

1.) Explain your perceptions about mathematics before your developmental math course.

2.) Describe your learning experiences during your developmental math course.

3.) Explain the characteristics of your coursework and the role of small groups.

4.) Describe moments when your instructor/professor influenced your beliefs about your learning in mathematics.

5.) What other information regarding your perceptions about learning mathematics would you like to add?

Appendix H

Sample of Transcript from Felicia Interview

Jessica: Describe how you felt when you realized you would be taking a developmental math course?

Felicia: Uh, I didn't know what that meant. I guess my advisor told me that, but I wasn't sure until I was in my class and my instructor told us. But I felt nervous, very nervous because I always felt math to be difficult.

Jessica: What do you mean by you always felt math to be difficult?

Felicia: I have struggles with learning math since uh elementary school. (Pause) I never understood it and my teacher told me I was slow when I was taking a test and it took me a long time, longer than people around me, but I just had a hard time. And, you know, it never went away. My entire life I struggle with math.

Jessica: Describe your confidence in passing the corequisite course before the course started.

Felicia: I am having to take this class again, it is my fourth time I, uh, I did not feel confidence in passing it. (Pause) I did not pass last time I took it so I felt nervous before the class started. I only need this one math class for my degree so I feel it is very much so holding me back and uh that makes it even harder for me.

Jessica: That leads me to our next question, describe your personal experience in the previous math course you took prior to the developmental math course.

Felicia: In the summer, I took this course. It was online and fast, and it was hard to keep up with the homework. You know I work full time, and uh sometimes take care of my nephew.

Sometimes though, I would stay up late study for tests for hours. Study the review given, then take test and nothing like the review you know. Tests make me nervous, my mind goes blank.

Appendix I

Sample of Journal Prompt Janessa

1.) Explain how two or more past mathematics learning experiences have influenced your current perceptions about learning mathematics.

Journal Response: In high school I failed algebra for the first time. I worried I would not graduate high school because of it. They made me retake that test maybe five times. I finally pass the class and test but I thought I never would.

In elementary algebra I took it online first and that did not work out. I learned I online class is not good for me. Then I enroll in person for that class and passed it.

2.) Describe two occasions when peers influenced your learning in mathematics during your developmental math course.

Journal Response: My partner influenced the way I figure out how to look over my work and see where a mistake was made. If I redo the problem again then I can figure out what went wrong in the first place. That helped me to check over my work.

3.) How did your mathematics instructor/professor influence your perception about learning mathematics during your developmental math course?

Journal Response: My first time I took college algebra the instructor was not helpful and rude. The second time was a kind instructor who even let me use page of notes on the test. This helped me because sometimes I feel nervous worried during the test and that makes it hard to focus but with the notes it helped me to remember things for the test.

Appendix J

Sample Code Table

Code	Clusters	Theme
Failed Retaking Did not pass Had to take again Dropped Withdrew Always Never Understood Never really learned Elementary School Lifelong/my whole life For a long time High School Middle School/Junior High Confidence	Previous Failures Lifelong struggles Subsequent Course Enrollment	Past math experiences influence math self-confidence
Working Full-time Part-time Time Homework takes forever Long assignments Four hours All night Have to work Family Child/Children/Kids Baby Nephew Taking care of my dad	Time Management	Outside Stressors
Hard Difficult Not easy Hate Sucks Dislike Not Fun Anxiety/Anxious Stress/Stressful Nervous Worried	Dislike for Math Math Anxiety	Attitudes and Beliefs about Math

Appendix K

Sample Journal Entry for Bracketing

Based on my past experiences, I am journaling to help bracket. I think it is important to clear my mind, so that I can hear the experiences of my participants through an unbiased lens. I have taught college math for over three years that includes developmental and higher levels. Before that, I taught high school math for sixteen years. The difference of ages in high school versus college is one of my favorite parts about teaching college. In my experiences I have learned that the students in my courses are hard workers and a lot of them are afraid of math or have a belief that they cannot do it or do not like it. Many of the students I have taught are first-generation students and some seem nervous to be in the course. I love that my students are of all different ages with different backgrounds. I like to find ways for students to make connections with each other by doing icebreakers the first week of class.

I take pride in helping my students learn math. One of my goals is for my students to like learning math. I feel that it is my job to inspire and motivate my students. This is a difficult task, but I do believe that I can help students change their minds about math, and I also believe that I am a determining factor in their success in the course. I like for my students to participate in partner work, small group activities, because I think they learn so much from each other and in my experiences, it makes math less scary. Several times, students have told me personally that they have always had difficulty learning math, but they finally understand it. I love seeing their confidence grow while they are in my course. I wonder how self-efficacy influences experiences in their math course. Some of the students that I teach have shown an increase in self-efficacy during the time from the beginning of the semester until the end.