

A TRANSCENDENTAL PHENOMENOLOGICAL STUDY OF DEVELOPMENTAL MATH
STUDENTS' EXPERIENCES AND PERCEPTIONS

by

Megan LeeAnn Cordes

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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APPROVED BY:

Jennifer Courduff, Ph.D., Committee Chair

Brian Yates, Ed.D., Committee Member

Lorae Roukema, Ed.D., Committee Member

Scott Watson, Ph.D., Associate Dean, Advanced Programs

ABSTRACT

Current literature suggests the rise of enrollment among United States (U.S.) postsecondary institutions but the decline in graduation rates. While there is extensive quantitative data examining course redesigns and increasing student achievement in developmental math courses, there is limited research examining students' experiences and perceptions within these courses. The purpose of this transcendental phenomenological study was to examine the experiences and perceptions of developmental math students. This study utilized the theoretical framework of Bandura's (1997) social cognitive theory and Tinto's (2012a) retention theory. Research questions focused on the lived experience of struggling within a developmental math course, past math experiences and attitudes, and current perceptions of developmental math placement and math emporium model. Purposeful sampling was used to identify 13 students who did not pass a developmental math course at a private four-year postsecondary institution. Data collection included formal response questions, interviews, and Self Description Questionnaire III (SDQ III). All data were analyzed through traditional phenomenological analysis methods of bracketing, horizontalization, clustering into themes, textural descriptions, structural descriptions, and textural-structural synthesis (Moustakas, 1994). Provisional codes were used for the initial review of the interview data to cluster significant statements into themes. The study revealed themes of (a) isolation, (b) self-doubt and negative attitudes towards developmental math, (c) success clouded by inability to progress, (d) fixed mindset, (e) experiences with teachers, (f) expected placement, (g) good placement, (h) desire for change, (i) overall positive experience with staff, and (j) change in math confidence.

Keywords: developmental math, prerequisite courses, remedial education, self-efficacy, Bandura, Tinto's retention theory, transcendental phenomenology, Self Description Questionnaire III (SDQIII), math emporium model

Dedication

I dedicate my dissertation to my husband, Jason, with gratitude and love. May you always know how much I love you and how thankful I am to do life with you. You put up with a lot of crazy. Thank you.

Acknowledgements

“Look at the nations and watch – and be utterly amazed. For I am going to do something in your days you would not believe, even if you were told” (Habakkuk 1:5; New International Version). Lord, you gave me these words as a junior at Campbell University when I started my journey into the world of education. Never did I dream that You would fulfill a young girl’s dream of becoming a doctor through the avenue of education! You have constantly supplied all of my needs by giving me strength to begin, encouragement to persist, and determination to finish. Thank You for loving me and for providing me with your abundant grace through Jesus Christ. May You receive all glory and honor.

To Jason Aric, thank you for your unending support of my dreams and for being my very best friend. I know you have sacrificed greatly and for that, I am humbled and honored to call you my husband. To Luke Benjamin and Kate Alivia, you are the very best of me. May the Lord richly bless your lives for His kingdom and may you always know that “his glorious, unlimited resources...will empower you with inner strength through his Spirit” (Ephesians 3:16, New Living Translation). Luke and Kate, “may you have the power to understand, as all God’s people should, how wide, how long, how high, and how deep his love is” (Ephesians 3:19). To my parents, perhaps we can look back at my younger days when I was stubborn and verbally rebellious and agree that I turned out all right. Thank you for always encouraging and supporting me and most of all, pointing me to Jesus. To my Cordes parents, thank you for always encouraging me and enveloping me in your prayers.

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List of Abbreviations

Achieving the Dream (ATD)

Adequate Yearly Progress (AYP)

American College Testing (ACT)

Center on Educational Policy (CEP)

Centre for Positive Psychology and Education (CPPE)

College Placement Test (CPT)

Electronic Books (E-books)

Elementary and Secondary Education Act (ESEA)

End-of-Grade (EOG)

General Equivalency Diploma (GED)

Government Issue Bill (GI Bill)

Grade Point Average (GPA)

Graduate Record Examination (GRE)

Higher Education Act (HEA)

Institutional Review Board (IRB)

Kindergarten through 12th Grade (K-12)

My Math Lab (MML™)

Mountain University (MU)

National Assessment of Educational Progress (NAEP)

National Center for Academic Transformation (NCAT)

National Defense Education Act (NDEA)

Navy Academy Preparatory School (NAPS)

No Child Left Behind (NCLB)

Race to the Top (RTTP)

Research Question (RQ)

Scholastic Achievement Test (SAT)

Self Description Questionnaire (SDQ)

Self Description Questionnaire III (SDQ III)

United States (U.S.)

United States Military Academy Preparatory School, West Point Prep (USMAPS)

World War II (WWII)

CHAPTER ONE: INTRODUCTION

Conservative research estimates that 20% of incoming United States (U.S.) college freshmen require at least one remedial course (Bautsch, 2013; Diploma to Nowhere, 2008; Remediation: Higher, 2012). Traditionally, this conservative percentage reflects the number of freshman requiring remediation entering a four-year post-secondary institution (Remediation: Higher education's bridge to nowhere, 2012). The majority of students requiring remediation attend a two-year postsecondary institution (Kilian, 2009) and over 50% of incoming community college students require remediation (Remediation: Higher, 2012). Bettinger, Boatman, and Long (2013) estimate all incoming two-year students and 80% of four-year students need remediation. Regardless of the differing numbers, researchers all conclude there are millions of incoming college freshmen needing remediation. Fortunately, most post-secondary institutions in the U.S. offer developmental education courses for underprepared students. Literature refers to underprepared students when students entering college cannot immediately enroll into college level courses due to an academic deficiency in math, English, or writing. Underprepared students are identified through placement exams offered by the institution, national scholastic achievement exams, and/or transcripts. When prior high school performance or low testing scores indicate the need for developmental math placement, students are enrolled in remedial math courses before they can start taking college-level math courses. Students enrolled in developmental math courses do not receive math credit for completing the course nor do the courses count towards the math requirement for any major. Students must successfully complete the developmental course before registering for any collegiate level, credit-bearing math course. Depending on the severity of the math skill deficiency, some students must successfully complete more than one developmental math course.

Unfortunately, there are many students who are flagged through one or more of the aforementioned placement indicators who do not enroll in the course or complete the developmental course sequence (Bailey, Jeong, & Cho, 2010). The retention and graduation rates among students placed in developmental education courses are substantially lower than students who are academically prepared to immediately begin college-level math courses (Bahr, 2008; Bahr, 2013; Bailey et al., 2010; Bettinger & Long, 2009; Boylan, 2002; Calcagno & Long, 2008; Diploma to Nowhere, 2008; Howard & Whitaker, 2011; Martorell & McFarlin, 2011; Parker, 2012; Remediation: Higher, 2012; Silverman & Seidman, 2011-2012).

The rates among developmental math students are even higher than developmental writing and developmental English students (Bonham & Boylan, 2011). Because of this, there are numerous studies dedicated to increasing student achievement in developmental math (Speckler, 2012; Twigg, 2011). Speckler (2012) published 77 different quantitative studies examining student achievement in developmental math courses. These studies aimed to alter a portion of the developmental math course and then, compare the new course outcomes (i.e. achievement rates) to the older course outcomes. Developmental math courses, changes in the format of the course, and the measurement tool for assessing the outcomes for the change were different in the 77 studies (Speckler, 2012). Within the past five years, many quantitative studies show the positive relationship of transitioning developmental math courses away from traditional lecture courses (Speckler, 2012; Twigg, 2011). This has led to a complete overhaul of U.S. developmental education courses at various postsecondary institutions. While universities and community colleges publish higher passing rates for developmental math students after the institutions undergo specific course changes, there are still students who do not pass developmental math courses. Unfortunately, there are limited studies examining the experiences

and perceptions of students who are struggling to pass or failing developmental math courses (Canfield, 2013; Howard & Whitaker, 2011; Koch, Slate, & Moore, 2012). The purpose of this transcendental phenomenological study is to examine the experiences and perceptions of developmental math students who do not pass their first developmental math course with an overall grade of 70% or higher. The following sections highlight important background information about the study, my personal interest in the study, the problem, purpose, and significance of the study, research questions and plan, and limitations to the study.

Background

Students attending U.S. post-secondary institutions are arriving on campus with academic deficiencies (Bahr, 2008; Bahr, 2013; Bailey et al., 2010; Bettinger & Long, 2009; Boylan, 2002; Calcagno & Long, 2008; Diploma to Nowhere, 2008; Howard & Whitaker, 2011; Martorell & McFarlin, 2011; Parker, 2012; Remediation: Higher, 2012; Silverman & Seidman, 2011-2012). Typically, these students require either developmental math, English, and/or writing courses. Over 50% of all students entering U.S. two-year colleges and 20% of students entering U.S. four-year universities are required to take at least one remedial course (Bautsch, 2013; Diploma to Nowhere, 2008; Remediation: Higher, 2012). According to the National Center for Education Statistics, 10.8 million students were enrolled in a four-year postsecondary institution in 2011 and 7.5 million students at 2-year institutions (Adu, Wikinson-Flicker, Kristapovich, Rathbun, Wang, & Zhang, 2012). That translates to 5.4 million students required to take a remedial course at a four-year institution and 1.5 million students required to take a remedial courses at a two-year institution. Together, there were roughly 6.9 million postsecondary students required to take one remedial course. Melguizo, Bos, and Prather (2011) assert that there is a larger proportion of high school graduates that require developmental courses than presently reported

and compared to the 1980s. Due to this increase, all two-year colleges and 75% of four-year colleges offer developmental courses to remediate underprepared students for college level academics (Howell, 2011; Melguizo et al., 2011).

Current research indicates that some students who test into developmental courses never even enroll in the course. According to researchers Bailey, Jeong, and Cho (2010), 30% of students who test into developmental courses do not take the courses. Furthermore, only 60% of students enroll in the referred course (Bailey et al., 2010). Students who do enroll in the developmental course, typically do not progress to college level math. In fact, less than one in four students who successfully complete a remedial course will successfully complete a college-level math course (Bahr, 2010). Unfortunately, less than 10% of developmental students graduate from two-year colleges within three years and roughly 30% graduate from a four-year college within six years (Remediation: Higher, 2012). Table 1 shows the low graduation percentages of developmental students and the increased amount of time developmental students spend earning a degree.

Table 1

Developmental Student Graduation Rates

<u>Postsecondary Institution</u>	<u>Graduation Percentage</u>	<u>Time it take to earn degree</u>
2-year college	10%	3 years
4-year college	30%	6 years

College completion rates in the U.S. are continuing to decrease (Trends and tracking charts: 1983-2010, 2010). In 2006 and 2010, the American College Testing (ACT) indicated that less than 40% of college students enrolled in a public four year university complete a degree in five

years (Trends and tracking charts: 1983-2010, 2010). This shocking percentage reflects the lowest completion rates in the past 27 years of data collection.

Situation to Self

This study is important to me because I taught postsecondary developmental math courses. Developmental math courses are offered to academically underprepared college students to remediate math concepts necessary for college level mathematics. Developmental math courses at my past university do not count towards math credit in college; however, these courses are necessary for students who lack the basic math skills necessary to complete college math requirements for a degree. Students receive elective credit for successfully completing developmental courses and gain the math skills necessary to enter college level algebra. Academically underprepared students were identified through two ways at my university. First, they were screened through academic records and testing scores from the ACT or Scholastic Achievement Test (SAT). After the initial screening, potential developmental math students were given a departmental placement exam. The score on the placement exam determined the math course the student needed to enroll in to start their mathematic sequence at the university. The math department felt the pressure to continually redesign courses to increase student achievement and progression rates due to low developmental math student passing rates at the university.

Retaining students is a priority at most universities to keep the cash flow from tuition and fees at the school. Although these course redesigns are monetarily costly and time-consuming, increasing student achievement and graduation rates take precedence over cost. Even with course redesigns, students are still struggling to successfully complete courses. I was interested in learning more about students' experiences within developmental courses. More specifically, I

was interested in learning from the students who are not experiencing success within a developmental math course. I hoped to gain a better perspective of the students and a fuller understanding of the complexity of the situation. The perspectives of developmental math students are missing from current literature. Schools are spending billions of dollars redesigning existing developmental math courses to increase student achievement without any published literature reporting first-hand from the students. Students can give insight that numbers and averages cannot give. I was interested in hearing the stories behind the numbers and using the voices of developmental students to challenge educators to redesign developmental math courses based on developmental math students' experiences and perceptions. I hope that universities read this study and start investigating ways to use both quantitative and qualitative data together to devise a more holistic plan to increase developmental math student completion, retention, and graduation rates. Using a transcendental phenomenological approach, I used an ontological philosophical assumption in order to understand the participant's reality within developmental math courses and describe the different perspectives of the participants. The participants' environments and realities were studied and I relied on the participants' views of the situations through a social constructivism framework paradigm (Creswell, 2007).

Problem Statement

The problem of the study is the high enrollment rate of postsecondary students into developmental math courses (Bahr, 2008; Bahr, 2013; Bailey et al., 2010; Bettinger & Long, 2009; Boylan, 2002; Calcagno & Long, 2008; Diploma to Nowhere, 2008; Howard & Whitaker, 2011; Martorell & McFarlin, 2011; Parker, 2012; Remediation: Higher, 2012; Silverman & Seidman, 2011-2012) coupled with low successful completion, retention, and graduation rates of students enrolled in developmental courses (Bailey et al., 2010; Seidman, 2005; Silverman &

Seidman, 2011-2012). Bailey et al. (2010) using Achieving the Dream: Community Colleges Count, an initiative intended to increase community college student outcomes and Bailey (2009), revealed that only 30-33% of students enrolled in developmental math sequences successfully completed the sequence and could enroll in college-level mathematics; therefore, over 60% of students enrolled in developmental math courses do not enroll into college-level math courses. Some postsecondary institutions provide more than one level of developmental math courses to students. The higher number of developmental math courses required by a student, the less likely the student will successfully complete all the prerequisite courses in order to enroll in college level math (Bailey et al., 2010; Bahr, 2010; Bahr, 2012). Furthermore, the lower a student places in the developmental math sequence, the less likely a student will successfully complete all the necessary developmental math courses (Bailey et al., 2010; Bahr, 2012).

There is a push in post-secondary education to redesign existing developmental courses in order to increase completion, retention, and graduation rates among developmental math students. Completion rates refer to the number of students who successfully complete their developmental math course with an overall passing grade. For my study, this grade is set by the university at 70% or higher. Retention rates refer to the number of students who remain at a postsecondary institution each year. Graduation rates refer to the number of students who earn a degree at a postsecondary institution. Postsecondary institutions aim to increase successful completion rates among developmental students, in order to increase retention rates. Increased retention rates lead to increased graduation rates. Increasing graduation rates at postsecondary institutions are the basis for attracting more students and a source of prestige among postsecondary institution (Berger, Ramirez, & Lyons, 2012). Figure 1 illustrates this cycle.

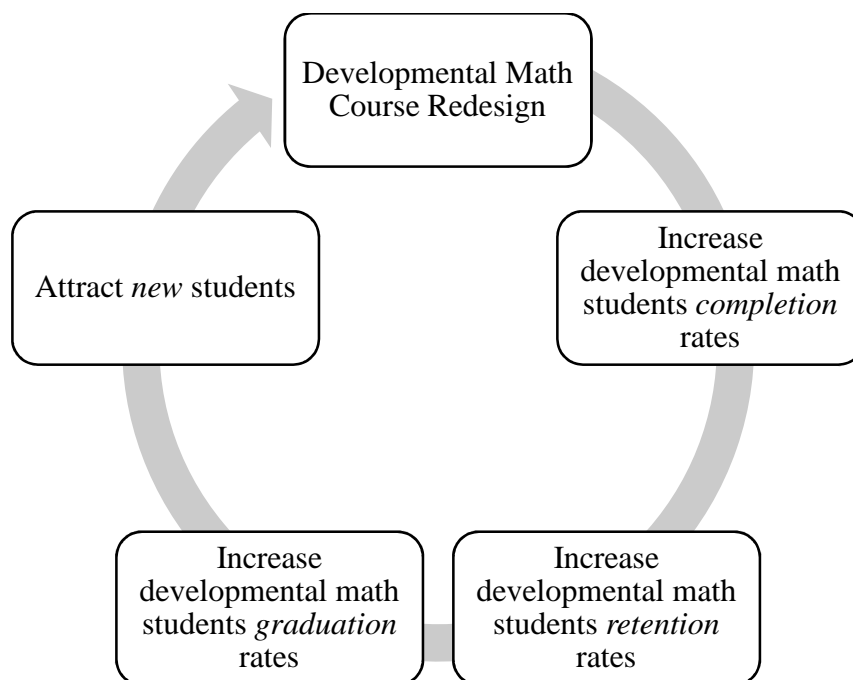


Figure 1. Postsecondary institutions rationale for developmental math course redesigns created through an extensive review of the literature.

Post-secondary institutions spend substantial funds on developmental education and course redesigns in hopes of increasing completion, retention, and graduation rates (Bailey et al., 2010; Melguizo, Bos, & Prather, 2011; Speckler, 2012).

There are quantitative studies that focus on the racial, gender, and economic disparities in developmental education, calling for more attention to students with lower rates of completion within developmental math sequences (Bahr, 2008; Bahr, 2010; Bailey et al., 2010). Using the National Center for Education Statistics (NCES) datasets, researchers (Lee, 2010; Lee, 2012; Lee, Finn, & Liu, 2011) show how the national growth trajectory indicates lower math achievement rates in K-12 education among African-American students, low socioeconomic students, and female students. Bahr's (2010) research indicated lower math achievement rates

among different races, ethnicities, genders, and socioeconomic statuses in developmental math courses at postsecondary institutions.

One way to address these disparities within developmental math courses is to introduce a specific treatment (i.e., different learning environment, mode of instruction, learning model) to investigate if there is a positive and significant difference between the treatment and control group. Numerous quantitative studies (Ashby, Sadera, & McNary, 2011; Bettinger & Long, 2009; Hooker, 2011; LaManque, 2009; Mireles, Offer, Ward, & Dochen, 2011; Silverman & Seidman, 2011-2012; Speckler, 2012; Trenholm, 2009; Twigg, 2011) have investigated increasing developmental course completion rates through the introduction of a treatment. While identifying students who are more likely to unsuccessfully complete a developmental math course and investigating different treatment options to increase successful completion rates are important, they provide only a partial picture of the problem. Student perceptions and experiences within the developmental math sequence are crucial to understanding the low completion, retention, and graduation rates among students enrolled in developmental math courses. Very few studies (Canfield, 2013; Howard & Whitaker, 2011; Koch, Slate, & Moore, 2012) inquire about students' perceptions and experiences in developmental math placement or reasons for low success rates in developmental math courses.

Purpose Statement

The purpose of this transcendental phenomenological study was to examine the experiences and perceptions of developmental math students who did not meet the university's standard of passing a developmental math course. The study focused on collegiate students enrolled in a developmental math course who struggled to complete a developmental math course and earned a final grade less than 70%. For this study, the university's standard of

passing a developmental math course is defined by a grade higher than 70% and completion of all course assignments, quizzes, and tests. Bandura's (1997) self-efficacy and Tinto's (2012) retention theory provided the theoretical framework of the study.

Significance of the Study

There is a definite push for post-secondary institutions to redesign existing developmental courses to increase student passing and completion rates through U.S. Federal mandates and increased grant funding monies for schools (Diploma to Nowhere, 2008; Remediation: Higher, 2012). Due to different standards at different postsecondary institutions, passing rates for developmental math courses are set by the institutions. There is no standard passing percentage for all developmental math courses. Regardless of the passing score, post-secondary institutions are attempting to increase student passing rates through course redesigns. Course redesigns may include accelerated programs (Rodgers, Posler, & Tribble, 2011), module courses (Silverman & Seidman, 2011), technology integration (Ashby et al., 2011), peer-tutors (Hooker, 2011), summer bridge projects (Navarro, 2007) and blended classrooms (Trenholm, 2009) to the direct placement of borderline developmental students into college level courses without remedial coursework (Bettinger & Long, 2009). There are numerous quantitative studies investigating specific course redesigns and student outcomes and achievements (Ashby, Sadara, & McNary, 2011; Bahr P. R., 2008; Bettinger & Long, 2009; Hooker, 2011; LaManque, 2009; Mireles, Offer, Ward, & Dochen, 2011; Silverman & Seidman, 2011-2012; Speckler, 2012; Trenholm, 2009). In 2012, Speckler compiled 77 quantitative studies completed by post-secondary institutions across the United States using course redesign tools published by Pearson. In each of these studies, post-secondary institutions noted increases in student enrollment, achievement, and progression rates (Speckler, 2012). Twigg (2011) examined multiple

postsecondary institutions that utilize the math emporium model to increase student achievement in developmental math. While the quantitative studies indicate that course redesigns can be successful for some students, there are limited qualitative studies investigating students' perceptions of developmental math courses (Barfield, 2013; Howard & Whitaker, 2011; Koch et al., 2012). Furthermore, there are no qualitative studies examining struggling developmental math students before or after the course redesigns. This specific type of research is necessary to understanding struggling developmental math students and has been identified as an area of future research (Howard & Whitaker, 2011). Post-secondary institutions need to have a complete and well-rounded view of developmental students. This requires more qualitative studies in developmental math.

Deeper knowledge of the struggles of students enrolled in developmental courses through a qualitative approach will allow universities to examine current course practices. This study's findings can help postsecondary institutions understand the lived experience of developmental math students who are struggling. In addition, the study's findings can assist postsecondary faculty in addressing concerns and problems identified by developmental math students in the study.

Utilizing Bandura's (1997) social cognitive theory will allow students to explain how they perceive themselves in the developmental math course. Knowing how students feel about their own abilities can identify specific areas within the developmental math course that need to be addressed. Students may express a faulty knowledge of their misbeliefs and may not fully understand the link between self-efficacy and task completion (Bandura, 1997). Identifying and addressing misperceptions can help students who are struggling become more self-aware about their strengths instead of focusing on feelings of inadequacies. Furthermore, Bandura (1997)

explains high self-efficacy does not guarantee success, but self-doubt leads to failure. Students in this study will share experiences of success and failure in previous math courses. This could show a pattern of self-doubt that could be attributed to students' struggles within the present developmental math course. For post-secondary institutions, knowing how self-efficacy influences the academic abilities of struggling students will help institutions address these concerns for future developmental math students.

Tinto's (2012) theory of retention focuses on the four conditions for post-secondary institutions to meet in order to increase student retention. The conditions are (a) expectations, (b) support, (c) assessment and feedback, and (d) involvement (Tinto, 2012). While post-secondary institutions may provide some of these services to all students, examining students who are struggling can provide more specific strategies within these conditions to further develop or promote within the developmental math classroom. Students who are struggling may indicate areas of weakness within the developmental math course that discourage them from successfully completing the course. This is very significant information for postsecondary institution to use and address to increase developmental math student completion, retention, and graduation rates.

Research Questions

There were four main research questions that guided this study. The research questions were grounded in the theoretical framework of Bandura (1997) and Tinto (2012). The research questions provided the foundation to examining student perceptions and experiences within a developmental math course. The research questions were:

1. What was the experience of students who did not pass a developmental math course?

2. What experiences and attitudes impact struggling developmental math students' mastery of basic math skills?
3. What are developmental math students' perceptions of developmental math course placement in an emporium model at a four year institution?
4. How do developmental math students perceive the university's Mathematics Emporium model?

Research Question Discussion

The first research question was the driving force of the study that encompassed the phenomenon of interest (Moustakas, 1994; Van Manen, 1990). Van Manen (1990) explained that phenomenology is questioning something by addressing the question of what something is truly like. Moustakas (1994) described the research question as a guide and focus of an investigation, where the entire process points back to the research question. Furthermore, the research question must be at the very core a focal point of the study that can provide a vitally rich and layered foundation for the development of the study. The formulative suggestion of “what is it like?” question was recommended by researchers (Englander, 2012; Giorgi, 2009; Gallagher & Zahavi, 2008; Nagel, 1974). This basic question focused the research on the lived experience of students who are struggling within their first developmental math course and allows the participants to give voice to their perceptions and experiences. Also, this question helped define the selection of participants by focusing on whether or not the potential participants have experienced the phenomenon under investigation (Englander, 2012). The main source of data collection for this question was the one-on-one interviews and the formal response questions.

Prior literature reveals that successful developmental math students indicated a negative turning point during elementary, middle, or secondary math courses that impacted the students' ability to learn new math concepts (Howard & Whitaker, 2011). These negative turning points were often followed by a positive turning point that occurred during the developmental math course (Howard & Whitaker, 2011). The second research question seeks to examine whether or not present developmental math students in my study identify with a past negative experiences in math. In addition, the question allows the researcher to investigate whether or not present developmental math students in my study experienced a positive turning point during the developmental math course. Bandura's (1997) social cognitive theory explained that self-efficacy is influenced by current and past experiences. More specifically, the three causations of behavior, personal factors, and external factors interact to formulate the feelings of self-efficacy (Bandura, 1977). Self-efficacy can motivate student action or impede student progress. Past positive and negative experiences could have an impact on present levels of academic self-efficacy. This question examined qualitative factors of behavior and experience within the phenomenon of students struggling within developmental math courses (Moustakas, 1994). Data collection for this research question included one-on-one interviews, formal response questions, and Self Description Questionnaire III (SDQ III) results for present levels of academic self-efficacy.

The third research question was designed to address Bandura's (1997) idea that faulty misbeliefs can block further development of basic skills. Students cannot build more complex skills when basic skills have not been perceived as mastered. This question was rooted in Tinto's (2012a) retention theory and Bandura's (1997) social cognitive theory. This question examined the perception of the developmental math course placement. Prior research indicated

that developmental math students who question their own math abilities will not be capable of success (Kilian, 2009). In addition, students who doubt their abilities tend to give up and drop out of college compared to students who have higher math self-efficacy beliefs (Kilian, 2009). Tinto's (2012a) retention theory warned that low expectations of students at postsecondary institutions can lead to low achievement and success rates. This included students being labeled by the postsecondary institution as developmental or remedial students. Regardless of whether or not postsecondary institutions labeled students developmental or remedial, students might perceive themselves as less than their peer who do not require developmental courses. This question sought to examine how the students perceive their developmental math placement and if that placement influenced their self-belief and performance in the course.

The last research question examined the university's math emporium model and technology integration. While the math emporium model has been touted as "a silver bullet for higher education," this question examined the students' perception of the emporium model (Twigg, 2011). The emporium model's four core principles identified the reasons why the emporium model is successful within higher education. These four reasons were a) increased time on math problems, b) increased time on difficult problems and less on mastered concepts, c) immediate assistance, and d) students must do math (Twigg, 2011). While these reasons are backed by 11 years of experimental, quantitative research studies (Twigg, 2011), this question asked students to reflect on their experiences within the emporium model and gave voice to their perceptions of the model. Tinto's (2012) retention theory hinged on four ideals for student retention: expectation, support, immediate feedback and assessment, and involvement. Theoretically, the mathematics emporium model addressed two of the four ideals for student retention: a) support, and b) immediate feedback and assessment.

This last research question was rooted in Tinto's (2012) retention theory. Students' perceptions of the math emporium model coupled with Tinto's (2012) retention theory can identify areas of improvement for institutions in order to progress and retain students enrolled in developmental math courses. In addition, this question identified areas that universities may overspend or over-utilize, according to Tinto's (2012) retention theory, that do not positively influence struggling developmental math students nor help them successfully master the content. Data collection for this research question was one-on-one interviews and SDQ III results.

Definition of Terms

Academic deficiencies refers to students who arrive to postsecondary institutions, albeit a high school diploma or passing score on the Graduate Record Examination (GRE), and are not ready to take college-level courses due to poor writing abilities, lack of basic math and/or writing skills (Bailey, Jeong, & Cho, 2010). Academic deficiencies are determined differently at each postsecondary institution, but normally use grade point averages (GPAs) from high school, college entrance exams, and/or college placement exams.

Accelerated courses are a specific type of developmental course redesign where students can complete more than one developmental course in a traditional 16-week semester (Bailey, 2009). Accelerated courses can also include intensive two-week summer courses to remediate basic skills before fall semester (Navarro, 2007).

Attrition refers to the retention rates of college students at the university (DeWitz, Woolsey, & Walsh, 2009). Schools with high attrition rates have high numbers of students leaving the university without a degree.

Blended courses are a type of course which combines traditional teaching with technology integration (Ashby, Sadara, & McNary, 2011). The technology integration uses a

software publisher to host homework, quizzes, and/or tests online. Some schools integrate video media into blended courses, too.

College-level math course refers to a course that carries college-level credit for math to apply towards a two- or four-year degree (Bailey et al., 2010).

Computer-based learning is where students work through mathematics content delivered through technology. Instructors in this method of learning can provide some instructional delivery face-to-face, but for the majority of the time, the learner is self-pacing through content on a computer. Most course redesigns replace traditional face-to-face instruction with computer-based learning (Hodara, 2011).

Developmental education encompasses all pre-requisite courses that college students must take in order to remediate basic skills to get into college level courses (Bailey et al., 2010). Developmental education normally includes English, math and writing. There are various levels of developmental education courses. Typically, developmental education courses do not carry any academic credits (Martorell & McFarlin, Jr., 2011). Elective credits are given to the successful completion of developmental education courses.

Developmental math course is a remedial math course designed to teach basic math skills that are necessary to gaining entrance into college level, credit-bearing math courses. Typically, developmental math is the umbrella in which remedial math courses fall; however, research uses both terms interchangeably (Bailey et al., 2009).

Math emporium model is a type of redesign that places students in a computer lab for most of the class time. Students are self-paced and the assignments are individualized based on pre-tests for each of the modules. Instructors and tutors are in the computer lab to answer questions and provide immediate assistance (Twigg, 2011).

Modules are course objectives and curriculum divided into hierarchical units that must be sequentially mastered (Silverman & Seidman, 2011). The amount of information contained in each module is unique to each postsecondary institution. Modules can contain pretests, video lectures, homework assignments, quizzes, and unit tests. Students must sequentially complete all the necessary components in one module before moving on to the next module.

Online courses are accessed strictly using the internet. Students and instructors never physically meet. All course material is presented online, typically using a software server that organized the objectives, activities, quizzes, and tests for each course (Ashby et al., 2011).

Pedagogy is the art of teaching children and/or adolescents. This refers to method of teaching or instruction (Groen, 2012).

Redesign refers to postsecondary institutions' process of designing new curriculum for whole courses of developmental math, not just one section or course, to increase learning outcomes through low-cost technology integration (Twigg, 2011).

Remedial course is used in literature to refer to a developmental course. Remedial courses attempt to rectify the academic disadvantage among students with basic math deficiencies (Bahr, 2008).

Retention rate is the percentage of students who persist and progress at a postsecondary institution to attain a college degree (DeWitz, et al., 2009).

Retention theory by Tinto (2012) gives a model for postsecondary institutions to use to increase student retention rates. The four core ideals are: expectation, support, immediate feedback and assessment, and involvement.

Self-efficacy refers to a subset of Bandura's (1997) social cognitive theory. Self-efficacy deals with one's perceptions and beliefs in their ability.

Social cognitive theory examines the process by which a person is able to perform or learn (Bandura, 1997). Bandura (1997) asserts that the social and cognitive abilities of a person influences their ability to learn.

Traditional courses refers to a course in which an instructor lectures every class period, students attend the lecture, and then, students complete homework assignments outside of the classroom. Quizzes and tests are given during class time. Traditional settings, also known as face-to-face, do not require the use of the internet for instruction, supplemental material, or assignments (Ashby et al., 2011).

Underprepared college students is synonymous with academically deficient students. Underprepared college students do not have the basic skills to immediately enter college-level courses. Underprepared college students require at least one developmental course which presents the opportunity to increase basic skill levels to complete college-level work (Bailey et al., 2010).

Research Plan

This qualitative study employed a transcendental phenomenological research design in order to encapsulate students' perceptions concerning the lived experiences of their struggles and challenges in a developmental math course. This research method allowed me to focus on student experiences, while intentionally removing any researcher bias (Moustakas, 1994). I used 13 participants enrolled in a developmental math course who had an overall final grade below 70% and were willing to participate in the study. I sampled participants until thematic saturation was achieved and no new themes emerged from the data. A description of the study allowed students to identify whether or not they met the criteria for participation in the study and allowed them to access the digital informed consent form (see Appendix D and Appendix E). Data

collection included formal response questions, semi-structured, open-ended interviews, and Self Description Questionnaire III (SDQ III) (see Appendix F, Appendix G, Appendix H, Appendix I, Appendix J and Appendix K). Data was analyzed using Moustakas' (1994) data analysis approach of (a) bracketing, (b) horizontalization, (c) clustering into themes, (d) textural descriptions of the experience, (e) structural descriptions of the experiences, and (f) textural-structural synthesis. The data analysis led to an essence of the phenomenon that answered the four research questions and ultimately, gave meaning to the experience of struggling within a developmental math course.

Delimitations

I limited participants to students who did not meet the university's standard of passing a developmental math course at one four-year private, nonprofit postsecondary institution. Participants did not have a diagnosed learning disability. The decision to limit the study to one private university was twofold. First, the math emporium model is highly researched and state-of-the-art. This type of course redesign was not at every university or postsecondary institution. Although, I could have found other postsecondary institutions that utilized an emporium model, I purposefully did not want to investigate more than one school for this study. Secondly, this setting was a convenience setting for me and assisted the university in future research and curriculum design. A description of the study assisted students in identifying whether or not they experienced the condition of not meeting the university's standard of passing a developmental math course (see Appendix D) and informed consent helped me identify whether or not the student was a potential participant (see Appendix E). This allowed me to focus only on students who experienced the lived phenomenon of struggling in their first developmental math course at one university.

It was very important that the sample of participants in the study reflected all the students experiencing this phenomenon in order to get a full essence of the phenomenon; therefore, the sample was thoughtfully and intentionally examined to reflect the typical developmental math population at the university. Unfortunately, the number of willing participants limited this intention.

Conclusion

The aim of this research study was to give voice to the students who are struggling to complete a developmental math course and subsequently, did not meet the university's standard of passing. Furthermore, this study was necessary due to the overwhelming number of quantitative studies on developmental math courses and lack of qualitative studies. Post-secondary institutions need to examine both quantitative and qualitative factors when redesigning developmental math courses. Bandura (1997) and Tinto (2012) provided the theoretical framework for the study and were instrumental in explaining academic self-efficacy (Bandura, 1977) and student retention at postsecondary institutions (Tinto, 2012).

CHAPTER TWO: LITERATURE REVIEW

In the last twenty years, U.S. postsecondary institutions have doubled enrollment rates, while graduation rates have only slightly increased (Tinto, 2012; Vigdor, 2013). In addition, math SAT scores have not improved from 1972 to 2011 (Vigdor, 2013). Because math aptitude has been linked to lifelong earning potential, this is a large and valid concern for the U.S. (Vigdor, 2013). The achievement gap, retention rate, and graduation rate among students enrolled in developmental courses due to academic deficiencies are significantly lower than college-ready and academically proficient students who enroll directly into college level courses (Grassl, 2010). Historically, enrollment rates at postsecondary institutions increase after major world events, migrations, during economic changes and legislation (Arendale, 2011). Within the U.S., changes in enrollment demographics from the traditional, white upper-class males to a more nontraditional, heterogeneous mix of students from differing socioeconomic statuses and ethnicities, began during the westward migration of the colonists in the early years of the states (Arendale, 2011; Vigdor, 2013); however, the largest increase in diversity of student enrollment stems from students in the 1970s entering college after World War II (WWII) through legislation outlined by the federal government.

In addition to the GI Bill, the federal and state governments through the Elementary and Secondary School Act (Elementary and Secondary School Act of 1965, 1965), A Nation At Risk report (U.S., 1983), No Child Left Behind (NCLB, 2002), and Race To The Top (RTTT) have publicized the increased importance of higher education and the access of postsecondary schooling to the general public (Levine & Levine, 2012). State-level legislation, along with increased pressure from the federal government, have mandated easy accessibility to college for all citizens (Seidman, 2012). As more students flooded into postsecondary institutions, college

retention rates have become a prestigious bragging right among schools and the basis for attracting better students (Berger et al., 2012). In addition to individual school prestige, the national economy is dependent upon college retention and degree acquisition by its citizens (Seidman, 2012). The global status of the U.S. as an educational forerunner hinges on the number of degree-holding citizens. In recent years, the U.S. has had to find skilled mathematicians and scientists from other countries indicating a failure on the part of the educational system to adequately supply the economy with enough skilled workers (Seidman, 2012).

Investigating trends in college student retention and student attrition patterns through the development of specific curriculum designed to meet the needs of academically underprepared students is vital to increasing college graduation rates and meeting the demands placed on postsecondary institutions through state and federal legislations. Furthermore, examining federal mandates like NCLB (2002) and Common Core Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) for kindergarten through twelfth grade provides a good foundation for investigating underprepared college students. In addition, this phenomenon should be viewed through the lens and scope of Bandura's (1997) social cognitive theory and Vincent Tinto's (2012) retention theory.

Theoretical Framework

The theoretical framework of the study provided the foundation and support for the study. In qualitative research, the theoretical framework provide the underpinnings of the study helping researchers establish a clear direction and provide support for the development of research questions and data collection methods. Bandura's (1997) social cognitive theory focused the study on examining students' experiences in light of perceived self-efficacy in math courses.

Bandura's (1997) notion of self-efficacy shaped this study's research questions, data collection methods, analysis, and discussion. Tinto's (2012a) retention theory provided the needed literature support for developing the research questions and data collection pieces.

Bandura's Social Cognitive Theory – Self-Efficacy

Bandura's (1997) social cognitive theory examines the process by which a person is able to perform or learn. More specifically, Bandura's (1997) social cognitive theory discusses the idea of self-efficacy and its effects on the learning process. Bandura's (1997) work describes three factors that influence one another within the learning process. The learning process is described as the processes of thought that lead to action on the part of the learner (Bandura, 1986). Bandura (1977) labels these factors as causations to learning and are (a) behavior, (b) personal factors, and (c) external factors. The behavior of a student, or how a student acts or responds, influences the ability of the student to learn and retain information. In addition, personal factors, such as the cognitive ability of a student or biological events within a student's life, affects learning. Lastly, external factors or the academic and social environment of the learner affects the learning outcome of the student. Within this theory, cognitive ability is only one of the causes of learning. Utilizing this theory, developmental math students with high levels of self-efficacy, albeit lower cognitive abilities, should be able to learn new concepts. Interestingly, Bandura's theory explains this phenomenon using the opposite thought process when Bandura (1997) claims, "misbeliefs in one's inefficacy may retard development of the very sub-skills upon which more complex performances depend" (p. 395). Looking within developmental math, students with low self-efficacy in math underperform students with higher self-efficacy (Grassl, 2010; Howard & Whitaker, 2011). In addition, students with higher levels of self-efficacy complete challenging tasks, persist in the midst of challenges, and give more

effort (Grassl, 2010). Bandura (1997) noted that this idea of self-efficacy or self-belief does not guarantee success, but self-doubt leads to failure.

Self-efficacy within students is based on four factors (a) prior performance, (b) perceptions of other students' learning, (c) positive feedback, and (d) emotional response of the learner (Bandura, 1997). Self-efficacy has a powerful effect on students' decisions and actions (Bandura, 2002). Within developmental mathematics, students' levels of self-efficacy are significantly lower due to prior mathematics performance (Grassl, 2010). Bandura's (1997) theory of self-efficacy places high significance on the prior performance of students. Unfortunately, students enrolled in developmental math courses most often have negative perceptions of themselves in prior mathematics courses (Grassl, 2010; Howard & Whitaker, 2011). This negative perception and low self-efficacy beliefs significantly retard the academic achievement of developmental math students. Vuong, Brown-Welty, and Tracz (2010) explained the difference among students with high levels of self-efficacy compared to students with lower self-efficacy. College students with lower self-efficacy incur higher levels of stress, depression, and lower levels of effort exerted on tasks (Vuong, Brown-Welty, & Tracz, 2010). In addition, students with lower self-efficacy have been shown to have lower persevering rates on tasks (Vuong et al., 2010). This coupled with lower levels of effort impedes the level of academic achievement among students with lower levels of self-efficacy (Vuong et al., 2010). The results from this quantitative study showed grade point average (GPA) measures and the likelihood of persistence among first generation sophomore students were directly and significantly related to self-efficacy among the students (Vuong et al., 2010).

Howard and Whitaker (2011) showed the emerging themes of a negative and positive turning point for successful developmental mathematics students through a phenomenological

study. Participants identified a key time in elementary or middle school where a negative perception of mathematical ability started. The students carried this negative perception of their mathematics ability with them to each subsequent math course. Students were more likely to have low self-efficacy in the initial weeks of the developmental math course based on prior math performance. Within the developmental math course, the successful math students indicated a positive turning point when the students realized that math was easier than previously perceived. After students' self-efficacy in math increased, students saw an increase in academic achievement (Howard & Whitaker, 2011). The increased academic achievement further increased students' feelings of self-efficacy. The cyclic illustration of Figure 2 and Figure 3 summarizes Bandura's (1997) theory of self-efficacy on the social cognitive processes of perception and experiences using Howard and Whitaker's (2011) research.

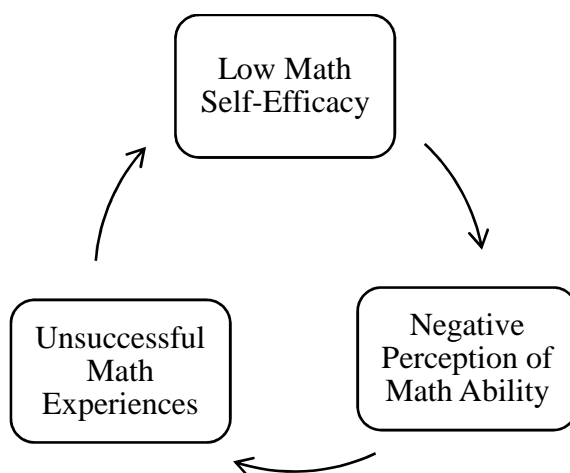


Figure 2. Low self-efficacy and student perception.

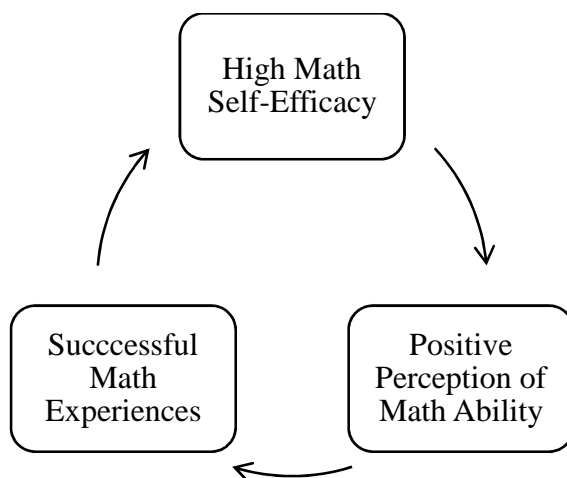


Figure 3. High self-efficacy and student perceptions

While these two cycles seem to perpetuate each other, Howard and Whitaker (2011) discovered that students with unsuccessful performance in prior math courses can have a positive turning point in math which effects how they perceive their current math course. Figure 4 shows how students can either continue in the cycle of unsuccessful math experience, negative perceptions and low self-efficacy, or break the cycle. Once the cycle breaks through a positive turning point, students enter the cycle of positive math experience, positive perception and high self-efficacy in developmental math courses (Howard & Whitaker, 2011). There is no research to suggest students stay in the cycle of high efficacy or return to the cycle of low efficacy.

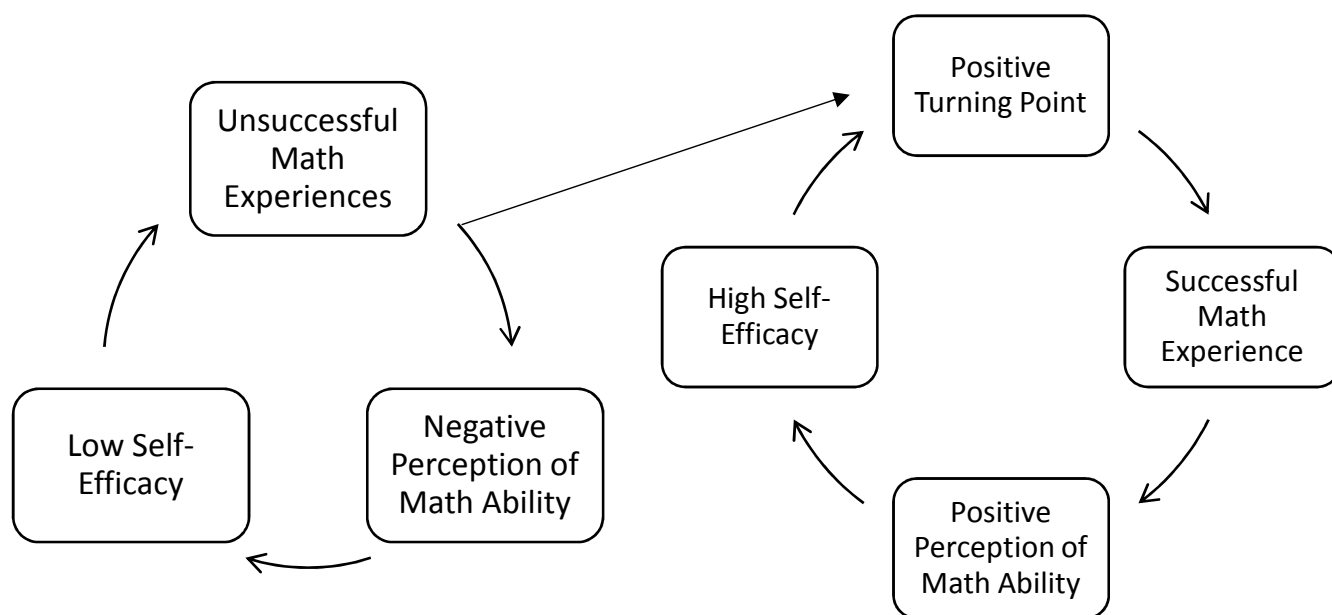


Figure 4. Break in negative math performance.

Another phenomenological research study explores the relationship among developmental student experiences and achievement through the power of self-efficacy. Koch, Slate, and Moore (2012) stressed the importance of understanding how the students perceive placement within the developmental course sequence and experiences within the courses. The weak results in the Koch, Slate, and Moore (2012) study were due to the very small size ($n = 3$); however, the findings indicated that student perceptions of developmental math placement and the experience provides invaluable insight for kindergarten through 12th grade educators, 2-year and 4-year colleges. The information gleaned from this study can help meet the needs of this expanding population (Koch et al., 2012).

Tinto's Retention Theory

Tinto's (2012a) retention theory provides a model for institutional action to retain and progress students towards a college degree. Tinto (2012) argued that in order to fully address student attrition, researchers must look at actions universities take to retain students. A solid model of student retention married with institutional action gives guidelines for policies,

programs, and procedures to increase student retention with a focus on historically underserved college students (Tinto, 2012). Tinto's model for student retention focuses on four conditions that must be met by the university to encourage and assist student success. The four conditions are (a) expectations, (b) support, (c) assessment and feedback, and (d) involvement (Tinto, 2012).

Expectations are a clear determinate of student success. Tinto (2012) maintained the desperate need of students to know what is required for academic success through consistent and clear expectations from the university. Furthermore, high expectations for student ability from the university ensure a higher chance of student success (Tinto, 2012). Within a university setting, different students might experience a different set of expectations. Tinto (2012) warned that labeling students as remedial implies a subtle expectation of a lower standard. Koch et al. (2012) reported initial reactions of negativity surrounding developmental math student placement. Students self-identified themes of lower cognitive abilities and expressed negative thoughts about the stigma of being enrolled in a remedial math course (Koch et al., 2012). The second research question in the study seeks to examine this perception among developmental math students to uncover any perceived meanings of being a developmental or remedial math student.

Financial, social, and academic support are necessary for student success in Tinto's (2012) retention theory. Institutions implementing Tinto's retention theory have increased the academic support students enrolled in developmental courses receive through tutors, peer study groups, and summer bridge programs. Hooker (2012) utilized the Peer-Led Team Learning model to encourage peer support within the developmental math course. Utilizing this model, Hooker (2012) indicated an increase perseverance rate of 47% and higher proficiency on

assessments in comparison to the control group. Mireles, Offer, Ward, and Dochen (2011) reported significant gains for students enrolled in developmental math paired with a 5.5 week study skills program. The categories that showed significant improvement for the students were (a) anxiety, (b) attitude, (c) concentration, (d) information processing, (e) motivation, (f) selecting main ideas, (g) self-testing, (h) study aids, (i) test strategies, and (j) time management (Mireles et al., 2011). Overall, this type of academic support resulted in statistically significant results for all categories and researchers concluded the programs were a success (Mireles et al., 2011).

Another condition of Tinto's (2012) retention theory that must be met in order to promote student success is assessment and feedback. Continuous assessment and immediate feedback are necessary to students. The assessments are necessary to inform the instructor of concepts that need to be reviewed, and feedback is necessary for students to master new concepts. Koch et al. (2012) reported the participants indicated the feedback the instructors provided via email resulted in perceived benefits by the participants. Within developmental math courses, many universities are utilizing technology to increase immediate feedback. The emporium model utilizes the latest technology to increase student participation, continuous assessment, and immediate feedback (Twigg, 2011).

The last condition of Tinto's (2012) retention model is student involvement. In this sense, involvement is most clearly associated with student engagement. Social and academic engagement are indicators of student retention. The more socially and academically engaged students are, the more likely they are to persist at a university (Tinto, 2012).

Bandura's (1997) and Tinto's (2012) theories provided the framework for this study. Both theories seem very independent of one another; however, Bandura's (1997) work on self-

efficacy does relate to postsecondary institutions abilities to retain students. Student retention directly correlates to Tinto's (2012a) work on the conditions that can increase student retention rates. Focusing on students' self-efficacy within a crucial developmental course can help identify areas of institutional strengths and weaknesses. This study will focus on examining students' perceptions and experiences through Bandura (1997) and Tinto (2012a) in order to view this phenomenon through the lens of self-efficacy and student retention.

Literature Review

Postsecondary institutions are seeing an increased number of students arriving to campus with academic deficiencies in math, reading, and writing (Ashby, Sadera, & McNary, 2011; Bahr, 2013; Bahr, 2008; Bailey, Jeong, & Cho, 2010; Diploma to Nowhere, 2008; Remediation: Higher, 2012; U.S. Census Bureau, 2009). Over 20% of all entering university freshman and close to 60% of community college freshmen are required to take one developmental course (Howard & Whitaker, 2011; Lewis & Farris, 1996). Enrollment in developmental education continues to rise (Bahr, 2010; Calcagno & Long, 2008; Howard & Whitaker, 2011; Howell, 2011; Koch, Slate, & Moore, 2012; Mireles, Offer, Ward, & Dochen, 2011). While remedial education has been in existence in the United States for decades, there is a distinct difference between the remedial courses offered 100 years ago and today's developmental curriculum (Boylan, 2002).

Necessitated by the increasing number of academically deficient students enrolling in college courses, developmental education is a debatable and very controversial topic. According to Arendale (2011), the constant controversy surrounding developmental education is an American tradition. The developmental label attached to curriculums and courses at postsecondary institutions infuriates some scholars. These critics insist that developmental

courses diminish academic standards, cheapen institutional credentials, and discourage academic faculty (Bahr, 2010). Proponents of developmental curriculums and courses argue that offering these developmental courses is a way to equalize academic inequalities present in secondary, middle, and elementary schools and socially disadvantaged students (Bahr, 2010). In addition, developmental education courses are viewed as a way to assist all students in increasing a higher lifelong earning potential (Bahr, 2010).

History of Remedial Education

While some researchers use the terms *remedial* and *developmental* interchangeably, other researchers refuse to see the similarities among these two terms. Hunter Boylan (2002), a well-known author and professor, argued that developmental education is the thoughtful integration of theoretical approaches rooted in psychology within the curriculum. Remediation does not imply the same standard of sophisticated care that is applied to developmental curriculum (Boylan, 2002). Historically, developmental education started when competent students lacked either math or writing skills. These students were academically competent in major-related courses but needed a refresher course to complete either a math or English requirement. Today's developmental curriculum addresses academically deficient students in a number of content areas (Boylan, 2002). In addition, present developmental students lack social and academic competencies in other areas that past students did not lack (Boylan, 2002). A huge shift in U.S. developmental education developed when postsecondary education changed from the idea that college was only for the elite few to the idea that postsecondary education was attainable for all citizens (Bankston III, 2011; Levine & Levine, 2012).

College for Some

In 1849, a college preparatory department was established for the University of Wisconsin for students who were deficient in basic skills (Boylan, 2002). Very prestigious universities like West Point and the Naval Academy have preparatory academies designed to assist students in meeting strenuous admission standards. The United States Military Academy Preparatory School (USMAPS), also known as West Point Prep, started admitting preparatory students in 1946 and the Naval Academy Preparatory School (NAPS) boasts an official start date of 1914 (Burley, n.d.; USMAPS, n.d.). Students attend USMAPS or NAPS for a year and engage in a very demanding remedial curriculum designed to increase test scores. At the end of the year, preparatory students hope to gain admission into the school that previously denied them admission the year prior.

Although college preparatory academies and remedial courses were available early in American history, college was considered a luxury reserved for the children of privileged upper class families (Arendale, 2011; Bankston III, 2011; Levine & Levine, 2012). Before mass immigration laws in the 1920s, the U.S. population of school-aged children was over 20 million compared to over 9.5 million in 1870 (Levine & Levine, 2012). In 1870, less than half of school-aged children attended school, and school years were 80 days long; however, only 2% of this population graduated high school (Levine & Levine, 2012). By 1920, 80% of children attended school, and school years were increased to include over 110 days; however, graduation rates were around 15% (Levine and Levine, 2012). Depending on the location in the U.S., compulsory school attendance laws were passed between 1852 and 1918 (Levine & Levine, 2012). One reason for this shift in school attendance was the increase in school-aged population through immigration. Immigrant families were financially poor and settled in the inner cities.

Children worked or wandered the streets, often joining gangs and committing crimes (Levine and Levine, 2012). A way to get children out of harsh working environments and off the streets was to open schools for all children. Because high school graduation was not the goal of the mass education system during this time, once a child was old enough and a job was available, students dropped out of school to pursue the job opportunity.

Entrance into WWII ended the depression era in the U.S. The U.S. economy boomed in the postwar era, and white collar jobs expanded the economic potential of citizens (Bankston III, 2011). Professional and technical jobs were in demand and required workers to have postsecondary schooling. The increased earning potential created a broader economic base among social classes, and while postsecondary education in the U.S. was still reserved for the elite in 1960, the elite was expanding (Bankston III, 2011). Governmental policies on education in the 1950s led to the public expectation that postsecondary education was the normal progression for all Americans (Bankston III, 2011). After the launch of Sputnik in 1957, President Dwight Eisenhower proposed the National Defense Education Act (NDEA). NDEA provided grants to teach mathematics and science in early education and gave college loans to identified high ability students (Bankston III, 2011). However, NDEA's lasting legacy was the emphasis on college prep and the idea that high school was not the end goal of education. Although NDEA did not produce a sharp rise in college attendance, Americans started to realize that postsecondary education was attainable for the average person.

In 1964, President Lyndon Johnson declared war on poverty in the U.S. and decided the chief weapon to combat poverty was schools (Groen, 2012). The War on Poverty increased the public idea of college for all (Bankston, 2011). The War on Poverty included the Elementary and Secondary Education Act (ESEA), which introduced the federal government into public schools

(Groen, 2012) and the Higher Education Act (HEA) which created scholarships based on need, not merit, loans with no interest, and part-time employment for postsecondary students (Bankston, 2011). While some of the kindergarten through twelfth grade (K-12) education policy changes are addressed in later sections, a major shift in postsecondary education occurred as a result to President Johnson's War on Poverty. Because education was the weapon to combat poverty, society started to see *college for some* as *college for all*.

College for All

Governmental subsidies continued to rise after the HEA. Although HEA was not the forerunner of governmental subsidies, this piece of legislation encouraged the pursuit of higher education among middle and lower class families by linking ESEA and HEA (Bankston III, 2011). The very first governmental subsidy for the pursuit of higher education for the average American was the introduction of the Government Issue Bill (GI Bill), or Serviceman's Readjustment Act of 1944, for war veterans after WWII. This single piece of legislation was paramount in expanding governmental subsidies for postsecondary attendance and solidifying the idea that college was a realistic expectation for the average American (Bankston III, 2011). In 1966, the GI Bill included Korean War veterans and military members who served, but not in a war.

The Basic Educational Opportunity Grants of 1972 subsidized postsecondary education for low income students. This legislation, also known as Pell Grants, provides free money from the federal government for students to attend college based solely on income (Aud, et al., 2013; Bankston III, 2011). One year after the introduction of the Pell Grants, 176,000 students received money to attend college (Toby, 2009). During the 2007-2008 academic year, 5,428,000 students received Pell Grant money (Toby, 2009). This is a 2984.1% increase in the number of

students receiving Pell Grant money in less than 34 years! From 2000 to 2010, the Pell Grant Program through the federal government has increased the amount of monies issued to students from \$10 billion to \$38 billion (Aud et al., 2013). Furthermore, in 2011 the federal government spent \$146 billion in financial aid to college students in the form of grants and loans (Aud et al., 2013).

The development from *college for some* to *college for all* can be seen through federal legislation that pushed the idea that college was a realistic option for war veterans, middle-income and low-income families through subsidies. Further K-12 legislation created college prep courses for students to extend schooling beyond high school. The business of higher education started to turn out larger percentages of workers with degrees than jobs that required degrees (Bankston III, 2011). Many jobs in the 1940s did not require college degrees; however, since the introduction of college for all and the push by the federal government to continue schooling after high school, the U.S. workforce demands college credentials for employment. Managerial positions in the 1940s did not require a college degree. Now, managers hold postsecondary degrees. While the 1940s required experience, the 1980s required a college degree (Bankston III, 2011).

With the rise of college for all without any ties to academic preparedness or merit, some people advised revisions on subsidies to include only a select few academically prepared or high ability students (Bankston III, 2011). The former president of Harvard University, Dr. Bryant Conant, worried about the rapidly expanding opportunities for higher education to underprepared students in the 1930s (Bankston III, 2011; College rolls, 1938). Dr. Conant believed increasing the number of collegiate students with a selective enrollment process would be counterproductive (College rolls, 1938). From 1929 to 1951, the University of Chicago

president, Robert Hutchins, thought the federal government made college attendance so attractive, that some students might go to college even though they should not (Altscheler & Blumin, 2009). To discourage underprepared students from attending college, some postsecondary institutions instituted admission standards based on academic preparedness (Bankston III, 2011). This did not slow the demand for postsecondary education and in 2011, there were 18.1 million college students (Aud et al., 2013). Potential students found other postsecondary institutions to attend. Postsecondary institutions offered remedial courses to underprepared students (Bankston III, 2011). Over 90% of public postsecondary institutions and close to 67% of private postsecondary institutions offered remedial courses during the 1990s and mid-2000s (Snyder, Dillow, & Hoffman, 2009).

No Child Left Behind

Although developmental math in postsecondary education is concerned with post-adolescent learners, examining the policies included in NCLB (2002) help facilitate a well-rounded picture of education in the United States and provide further evidence to the idea of college for all. Furthermore, the lack of quality and rigor in the K-12 curriculum has been blamed for the increased need for remediation in colleges (Bettinger & Long, 2008).

Achievement gaps in students start small in elementary school and widen as students progress in grade levels (Fletcher & Tienda, 2010; Lee, 2012). Without addressing achievement gaps in K-12 education, postsecondary institutional actions to address these achievement gaps will be limited (Fletcher & Tienda, 2010; Lee, 2012). Lee (2012) argued that addressing the achievement gaps in education need to occur during elementary and middle school initiatives because initiatives aimed at high school and college students might not be effective in addressing the college readiness gaps.

In 2001, President George W. Bush signed the NCLB Act of 2001 (2002) with intentions of providing high quality K-12 education and improving K-12 education by closing the achievement gap between high performing and low performing students (Fletcher & Tienda, 2010; Jahng, 2011). NCLB (2002) reauthorized and renamed President Johnson's ESEA but with broader implications through the transformative nature of NCLB (Groen, 2012). More specifically, NCLB (2002) aimed to reduce the difference between minority and nonminority students through test-based accountability for all students (Jahng, 2011; Lee, 2010). This secured bipartisan support due to the focus on more effectively serving minority students (Groen, 2012). NCLB (2002) created single performance goals for all children, minority and nonminority, and mandated that schools meet adequate yearly progress (AYP) on state mathematics and reading tests. School funding is contingent upon schools reporting state test results on the mathematics and reading tests divided into student subgroups to the federal government (Groen, 2012; Jahng, 2011). The federal government requires schools to divide students into subgroups based on disabilities, low English proficiency, cultural backgrounds, and low socioeconomic backgrounds (Jahng, 2011). The cutting scores of proficiency tests are determined by each state. Some states choose lower proficiency percentages, which effectively increases AYP due to a lower standard. Other states have set higher proficiency standards for students, which decreases the likelihood of meeting AYP goals. Research indicates that most proficiency scores on the end-of-grade (EOG) testing are within the failing range according to the National Assessment of Educational Progress (NAEP) scale (Levine & Levine, 2012).

AYP demonstrates which schools effectively served minority students and allowed stakeholders to determine the efficiency of the schools (Groen, 2012). Schools that do not meet AYP are labeled as under-performing or failing schools. The federal government can remove

funding from failing schools. Furthermore, students attending failing schools are given additional resources and support or the option to transfer to a non-failure school (Jahng, 2011). Staff at underperforming schools can be restructured under NCLB (2002), moving half of the staff and the principal to other schools (Levine & Levine, 2012). This effectively controls the state-run schools. The removal of federal funds and the opportunity to lose money through student transfers force public schools to comply with the mandates set forth in NCLB (Jahng, 2011). In one federal educational policy, NCLB (2002) created federal accountability and control over state-run schools. NCLB (2002) has been labeled as the most intrusive policy in the history of American education (Jahng, 2011; Wells, 2009).

NCLB (2002) effectively created mathematics standards for subject mastery in students grades three through 12; however, the implications of NCLB (2002) have demanded higher skills from younger students (Jahng, 2011). School districts are mandating skills once taught in first and second grades to be taught in kindergarten and kindergarten skills are pushed down to preschool-aged children (Jahng, 2011). Children's learning outcomes are determined by test scores, where the higher the score equates to higher levels of mastery and knowledge (Jahng, 2011). Content-knowledge assessments, like the state-testing for NCLB (2002), do not take into account students' background or culture. All students are asked the same content knowledge questions and comparison subgroups are pre-determined. The idea that all knowledge can be assessed and compared through a standardized tests lead some people to believe that NCLB (2002) focuses on the normalized assimilation of minority students into the American education system (Jahng, 2011). The typical American school is comprised of middle-class, white students and interestingly, any student who does not fit into this category is labeled as a minority. NCLB (2002) claims any minority student is at a distinct disadvantage in schools. NCLB (2002)

effectively implies minority students need help, are lagging behind nonminority students, and lack competencies only the education system can rectify (Jahng, 2011). NCLB (2002) gives credence to the savior-complex of the educational system. Minority students need the American education system to right the unjust of not being white or middle-class. NCLB (2002) masks humanitarian support of the minority family through increased accountability and surveillance under the umbrella of academic achievement (Jahng, 2011).

Examining NCLB (2002), Bandura's (1997) idea of self-efficacy, and Tinto's (2012) retention theory together show how the basic foundation of NCLB affects postsecondary education. The main focus of NCLB is labeling students as minority or non-minority, with a focus on minority students (Jahng, 2011). NCLB (2002) legislation promised to remove the low expectations of minority and low-income students, while increasing academic achievement among these students; however, there is little evidence to substantiate this claim (Fletcher & Tienda, 2010). Tinto (2012) discussed the need to carefully construct high expectations for all students, which means to be careful in labeling students. Minority students in public education are the foundation for funding in schools through AYP. Politicians, school administrators, public educators, parents, community members, and students are all aware of the labels associated with NCLB. These stakeholders know that meeting AYP through different subgroups affects funding and organization at the school. This breeds an environment of anxiety, lower morale, and anger (Levine & Levine, 2012). Furthermore, teachers' effectiveness in the classroom is tied to student performance. A focus on underperforming students could affect the self-belief of students in the classroom, due to increased attention on minority students. Teachers influence students' self-efficacy due to being a significant figure in students' lives (Bandura, 1977). While self-belief

does not necessarily ensure successful outcomes, students who doubt their academic abilities will not perform to the best of their abilities (Bandura, 1977).

In addition, NCLB (2002) inundates students with yearly testing, which can lead to disenfranchised youth (Groen, 2012). A growth trajectory study indicated that current U.S. high school students are an entire year behind U.S. high school students from thirty years ago (Lee, 2010). High school students are reporting a significant and substantial slowdown of academic growth when compared to thirty years prior (Lee, 2010). A report by the Center on Education Policy (CEP) confirmed that high school students show less progress than elementary and middle school students (2012). There is no doubt that NCLB (2002) has changed the focus of education in the U.S. (Groen, 2012; Jahng, 2011; Lee, 2010). The testing regime of NCLB (2002) is a huge change in educational policy in the U.S. (Groen, 2012). Schools focus more time on tested subjects, like reading and mathematics, and less time on non-tested subjects, like art and music (Groen, 2012; Levine & Levine, 2012). Pedagogy, or the teaching method, has shifted to include teaching students how to take reading and mathematics tests (Groen, 2012; Levine & Levine, 2012). Research indicates this practice of teaching to the test occurs more frequently in low-income schools than affluent schools (Levine & Levine, 2012).

In addition, because schools feel the pressure to do well on state-tests, districts have started to give benchmark tests throughout the year to assess students (Groen, 2012). Consequently, students are being prepared for tests, being tested, or reviewing test results. This pervasive testing environment equates academic achievement to a test score (Groen, 2012). Unfortunately, research suggests that high standardized testing scores is not a result of sole content knowledge, but a result of parental income, quality educators, and educational level of the mother (Groen, 2012; Paul, 2004). Furthermore, in the past twenty years under NCLB

(2002) accountability and high-stakes testing, achievement test scores have not risen (Lee, 2010). High school students are spending more time taking advanced courses and school districts have high-stakes testing has shifted to included tougher promotion and graduation standards (Lee, 2010). Schools are spending more and more time on reading and mathematics and less time on art, music, social studies, sciences, recess and/or lunch breaks without seeing any benefits (Groen, 2012; Lee, 2010). Interestingly, math and reading achievement trajectories in the past thirty years indicates current U.S. students are ahead of the growth curve in elementary school, level out during the middle school years, and lose ground in high school compared to U.S. students thirty years ago (Lee, 2010).

CEP (2012) noted an increasing gap of decline among high school students compared to elementary and middle school students; furthermore, CEP (2012) indicated large achievement gaps between minorities, low-income students, and gender in advanced math courses. As testing pedagogy and curriculums saturated with test prep and heavy reliance of math and reading increases for each grade level, student achievement scores reflect the opposite and decrease each subsequent year in school (Lee, 2010). More students are taking higher math courses earlier. Nationally, the number of eighth grade students taking Algebra I is roughly one-third (Vigdor, 2013). Compared to the mid-1980s, this is double the number of students taking Algebra I in the eighth grade. Although students are taking advanced coursework earlier, they perform no better on assessments, either national or international (Vigdor, 2013).

NCLB (2002) mandates proficiency standards through high-stakes testing and sanctions on schools that do not meet AYP; however, NCLB (2002) does not ensure resources for the top performing students remain with these students (Vigdor, 2013). Often, schools shift these resources from top performers to the lower performing students to meet the demands of NCLB

(Vigdor, 2013). Some researchers would argue that the education equality movement in the U.S., aimed at closing the gap for lower performing students, has effectively harmed all students, especially top performing students (Vigdor, 2013). Pluckner, Burroughs, and Song (2010) assert that academic scores for high achievers has either been stagnant or only slightly increased since 2003 under NCLB (2002). Studies revealed that while low performing students have big gains, more advanced students have gained very little (Loveless, 2008). While the achievement gap between students is closing, it is at the expense of the top performers showing very little, if any, growth (Loveless, 2008; Vigdor, 2013). Although a focus on developmental math surrounds lower performing students, do we see a pattern of higher performing students from middle and high school in developmental math courses? Does the heavy content focus on mathematics and reading through federal mandated, state-testing and less time on other subjects affect the educational perceptions and experiences of U.S. students? Do postsecondary students report experiences of rigorous mathematics testing in elementary, middle, and secondary schools?

Howard and Whitaker (2011) indicated that successful developmental math students identify a specific point in their prior educational experience where there was a negative experience in elementary, middle, or high school that changed their perception of their math ability. This negative turning point impacted their ability to learn new math concepts (Howard & Whitaker, 2011). Howard and Whitaker (2011) found that these negative turning points were followed by a positive turning point, or learning experience, within the developmental math course that changed their perception of learning math concepts. Figure 6 shows the cycle of unsuccessful math experiences, negative perceptions, and low self-efficacy being broken by a positive turning point. After the positive turning point, participants in the study reported positive

math experiences, positive perceptions of their math ability and high self-efficacy (Howard & Whitaker, 2011).

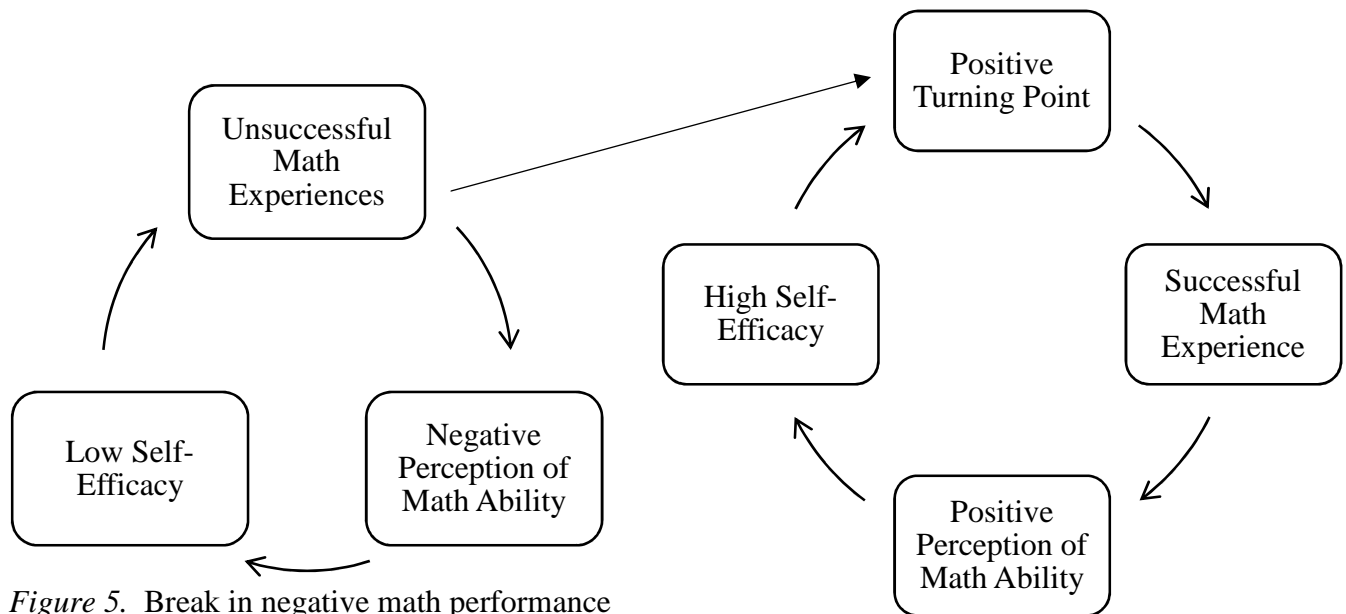


Figure 5. Break in negative math performance

From this positive turning point, participants were able to learn the math concepts they previously could not or did not learn. There is no research to indicate that once students experience a positive turning point, they remain in the cycle of successful math experience, positive perception of math ability, and high self-efficacy. Figure 6 illustrates this positive cycle based on Bandura's (1997) idea of self-efficacy.

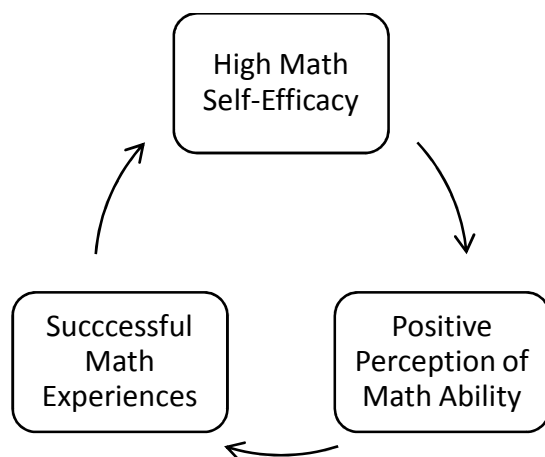


Figure 6. High self-efficacy and student perceptions

Figure 7 shows the opposite cycle of unsuccessful math experiences, negative perceptions of math ability, and low self-efficacy. There is no research to indicate that students who are unsuccessful in math continue in the cycle of unsuccessful math experiences, negative perceptions of math ability, and low self-efficacy; however, Howard and Whitaker (2011) concluded that a positive experience in math was a significant theme among all newly successful developmental math students. Do students who are struggling within developmental math courses need to have a positive experience in math, in order to overcome past negative experiences? There is no research to indicate when and why this negative turning point happens. Do high stakes testing, additional time spent in mathematics, or a push for mathematics skills to a younger grade affect the ability for students to have successful mathematics experiences in K-12 classrooms?

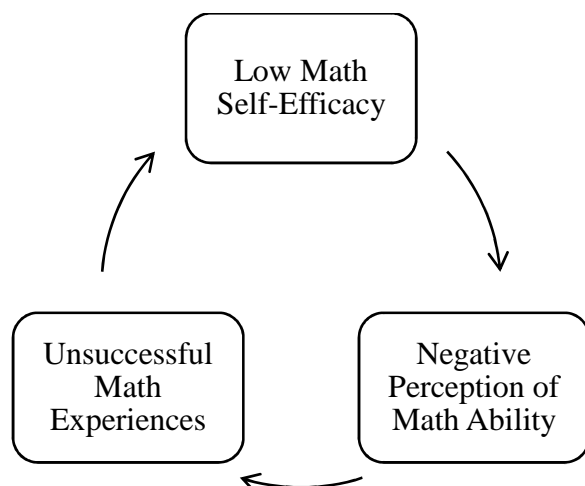


Figure 7. Low self-efficacy and student perception

Developmental Education Trends

Research indicates that a third of students placed into developmental courses do not register for these courses (Bailey, 2009; Bailey et al., 2010). Often students do not enroll or attend the referred developmental course (Bailey et al., 2010). Registering students and enrolling them in the correct developmental courses are not the only problems surrounding developmental education. Progression rates through developmental courses are terribly low. A vast majority of students enrolled in a developmental math course never graduate with a two-year or four-year degree (Complete College America, 2012). In fact, less than 10% of developmental students graduate from two-year community colleges in a three-year time span (Complete College America, 2012). Only 33% of developmental students will complete a four-year degree in a six-year time span (Complete College America, 2012). Community college students who enroll in developmental math courses have less than a 25% chance of completing a degree or earning a certificate within an eight year time span (Bailey, 2009). These low statistics are a decrease from the ACT data which reveal a 39.6% graduation rate of developmental students in five years (Trends and tracking charts: 1983-2010, 2010). In two years, there was a documented 6% drop

in graduation rates among college students (Complete College America, 2012; Trends and tracking charts: 1983-2010, 2010).

Student enrollment in developmental education is increasing each year, indicating the desperate need for developmental education (Bahr, 2010; Calcagno & Long, 2008; Howard & Whitaker, 2011; Howell, 2011; Koch et al., 2012; Mireles et al., 2011). Postsecondary institutions, mainly community colleges, admit academically deficient students in order to provide educational options to local citizens (Boylan, 2002; Parker, 2012). Characteristically, community colleges admit minority, low-income, and first-generation college students (Parker, 2012). For these community college students, developmental education courses determine the difference between degree completion and attrition. Parker (2012) argued that present options in postsecondary developmental education are not effective or efficient in providing the basic skills necessary for college success. Disadvantaged students are not adequately progressing through developmental courses and are lagging further behind advantageous students (Bahr, 2010). Disadvantaged students refer to groups of students who consistently through literature show increased presence in developmental education courses and lower successful remediation rates when compared to their peers (Bahr, 2010). Furthermore, disadvantaged students come from lower socioeconomic backgrounds (Vignoles & Powdthavee, 2009). Literature indicates that students from low socioeconomic background fare worse in college than students from higher socioeconomic backgrounds and consistently do not acquire college degrees at the same rate (Vignoles & Powdthavee, 2009).

Although age, ethnicity, and socioeconomic status vary in developmental courses, a disproportionate number of minorities and low-socioeconomic status students (Howell, 2011; Lee, 2012) populate these courses (Bahr, 2010). One reason for this is due to the overwhelming

number of minorities from low socioeconomic homes (Faitar, 2011). Park, Denson, and Bowman (2013) warned that while minorities and low socioeconomic status are related, these terms are not interchangeable. Looking at developmental math courses, African-American and Hispanic students' enrollment is double the enrollment of Caucasian and Asian students (Bahr, 2008). Furthermore, Caucasian students have a successful remediation rate that is three times higher than African-American and Hispanic students (Bahr, 2008). A more current report suggested only slightly higher odds for African-American students when compared to Caucasian students enrolled in a developmental math course (Bailey et al., 2010). Examining trends in K-12 education, typically Asian and Caucasian students remain on track for a four-year degree in elementary, middle, and high school (Lee, 2012). In elementary school, Hispanic students were on track to a four-year degree until third grade (Lee, 2012). After third grade, research revealed that Hispanic students remain on course for only a two-year degree completion (Lee, 2012). African-American students projected a two-year degree completion until primary school, when math achievement trajectories showed that African-American math achievement diminishes to two-year college entrance during middle and high school years (Lee, 2012). Other interesting trajectories indicate that if parents hold an associate's degree, bachelor's degree or higher, students were on track to complete a four-year degree (Lee, 2012). Students of parents who hold high school diplomas or General Equivalency Diploma (GED), tended to be on track to a two-year degree (Lee, 2012). Until second grade, students of parents who did not complete high school were on track for a two-year degree, but after second grade, students were on track for two-year college entrance only (Lee, 2012). Lee's (2012) assertions concerning parents' level of education can be linked back to aforementioned socioeconomic status of students. Projected economic income for families with less than a high school diploma is under the poverty level.

The degree a parent holds can be correlated to the amount of money in the home (U.S. Census Bureau, 2009). Further discussion concerning the link between educational status and income can be found in the next section.

In addition, younger students have a higher successfully remediate rate than older students (Bailey et al., 2010). Also, female students remediate more successfully than male students (Bailey et al., 2010). Historically, African-American and Hispanic males are considered a disadvantaged subgroup due to high enrollment in developmental education and lower successful remediation rates (Bahr, 2010; Bailey et al., 2010).

Implications

Due to the low successful completion and graduation rates among developmental students, postsecondary institutions must look for ways to increase student success. Developmental education is an expensive undertaking for postsecondary institutions especially when developmental students have high attrition rates and limited graduation rates. Curriculum development and implementation for developmental education is costly for community colleges, universities, states and the federal government. According to research, community colleges invest roughly \$2 billion annually and universities average \$500 million (Bailey et al., 2010). Strong Schools America (2008) published an article titled “Diploma to Nowhere” that estimated the cost of each remedial student enrolled in a two-year institution around \$2,000 and each remedial student enrolled in a four-year institution cost the institution roughly \$2,000 to \$2,500. Developmental education is an expensive undertaking for post-secondary institutions with limited graduation rates and high student attrition rates.

Financial contributions through tuitions, fees, and federal grant monies are imperative for postsecondary institutions to offset the cost of developmental education. Retaining

developmental students is a high-priority for postsecondary institution. Unfortunately, developmental student attrition rates indicate the loss of millions of dollars in tuition and fees (Seidman, 2005; Silverman & Seidman, 2011-2012). While the immediate loss of tuition and fees is a heavy burden on institutions, the longevity of monies lost through alumni contributions is a considerable factor for postsecondary institutions.

In addition to the loss of money by colleges and universities, the United States Census Bureau (2009) highlights the personal loss of monies over a lifetime by students that do not complete a degree. College graduates can expect to earn roughly \$48,000 compared to \$18,000 a year for high school dropouts (U.S. Census Bureau, 2009). This report also illustrates the upward mobility in yearly income with the addition of postsecondary school completion (U.S. Census Bureau, 2009). Personal loss for college dropouts include earning lower incomes, loan debt, and the loss of the investment monies used for college (Swail, 2006).

The effects of student attrition through the loss of taxable income is a concern for federal and state governments. Research indicated that low SAT math scores can predict lower lifelong earning potentials for pre-collegiate students (Vigdor, 2013). Lower annual salaries for workers equates to lower taxes collected per person by the government. In addition, student attrition rates are projected to lead to a 14-million skilled-worker deficit by 2020 (Carneval & Desroches, 2003). Updated figures indicate that this number is on the rise. Parker (2012) indicated a projected need of an addition 22-million skilled workers in the United States by 2018. Regardless of the statistic used, the desperate need of skilled workers and the increasing student attrition rates among developmental students have caught the attention of politicians, legislators, and philanthropists. President Obama directly addresses this issue by challenging community colleges through specific legislative mandates to increase student graduation rates by 5 million

before 2020 (Bailey & Cho, 2010; Parker, 2012). Often referred to as the gate-keeper of postsecondary education, developmental courses determine whether or not a student will graduate with a degree or dropout. Because of this negative perception of developmental education courses, philanthropists, Bill and Melinda Gates through the *Bill and Melinda Gates Foundation* have set up grant monies to facilitate redesigns of developmental math curriculum to increase completion rates among developmental students. Furthermore, the *Lumina Foundation for Education* has monies available through the *Developmental Education Initiative* to help schools fund new curriculums to address developmental learner needs in hopes to increase graduation rates.

Purpose of Redesigns

The increasing cost of developmental education on the federal and state governments, postsecondary institutions and students, the enormous need for skilled workers in the United States, and the high percentage of college dropouts illustrate an alarming need for schools to effectively address student needs, invest in researching new curriculums, and change the structure and curriculum of developmental courses.

Current developmental courses are problematic due to non-individualized placement tests, lengthy semesters, and inflated costs of the course for the students and colleges, and the disproportionate number of adjunct faculty assigned to developmental courses (Parker, 2012). Most postsecondary universities require incoming freshmen to take placement exams (Bailey, Jeong, & Cho, 2010; Martorell & McFarlin, 2011; Parker, 2012). Placement scores, along with academic transcripts and aptitude test scores, are used to place students in the appropriate tier of developmental math (Martorell & McFarlin, 2011; Parker, 2012). One method used to identify and place developmental students is *The ACCUPLACER® Test*; this test is a logarithm-based

assessment taken online (Medhanie, Dupuis, LeBeau, Harwell, & Post, 2011). Research shows that *The ACCUPLACER® Test* has a predictability power similar to ACT scores (Medhanie et al., 2011). *The ACCUPLACER® Test* is not utilized the same at every university; however, this study focused on the placement power associated with test. Unfortunately, these placement test scores may determine the level of math placement regardless of how many course objectives a student has already mastered. For example, if a student has mastered all but factoring equations, the student will place in the lowest level of developmental math even though this is the last objective covered in the course. The student will be required to pay for, attend, and complete work for objectives they have already mastered. This would mean that a student would have to invest an entire semester for one course objective before moving onto the next developmental math. This hypothetical student requiring very little remediation would be enrolled in the same course with students requiring intense remediation of all the objectives. Students requiring more than one developmental math course can expect to invest at least one entire academic year in non-credit bearing courses. This is a huge disadvantage for students using financial aid. These students are using a majority of the money on developmental course tuition, fees, and books, in addition to having to take more credit-bearing courses after the successful completion of the developmental coursework (Bahr, 2010; Parker, 2012).

Fortunately, research shows math skills in students after successful remediation are comparable to the math skills of students not requiring remediation (Bahr, 2008). Furthermore, these two groups of students are very similar in transferability from two-year colleges to four-year colleges and have almost identical credit attainment (Bahr, 2008). Bahr (2008) concluded that remediation can fully address the mathematics deficiencies of developmental math students. Bettinger and Long (2009) showed significant differences among remedial students and non-

remedial students. Although Bahr (2008) and Bettinger and Long (2009) indicated positive effects of remediation on developmental students, Calcagno and Long (2008) concluded that there is very little effect of remediation on students. Calcagno and Long (2008) examined outcomes for community college students who scored just above and just below the cutoff score for developmental math courses on the College Placement Test (CPT). Calcagno and Long (2008) found that students who scored just below the cutoff score on the CPT were more likely to persist in subsequent math courses compared to the students who did not have to enroll in the developmental math course. When examining the two groups, Calcagno and Long (2008) found no difference among students who took the developmental course and students who did take the developmental course on the completion rate of college-level math courses. In addition, there was no significant effect from remediation on two-year degree completion or on student transfers to four-year universities (Calcagno & Long, 2008). While Calcagno and Long (2008) reported the negative effect of remediation on developmental math students, the results only included students who scored very close to the cutoff score to place out of developmental math. The results are only reliable for similar students and thus, do not give much insight to students who have more deficient math skills (Bailey, 2009).

Traditional, Blended, and Online Environments

When discussing delivery methods for developmental education, the terms traditional, blended, and online learning appear. Traditional learning refers to a 40-hour course spread out over a 16-week course. Traditional settings, also known as face-to-face, do not require the use of the internet for instruction, supplemental material, or assignments (Ashby et al., 2011). Typically, instructors lecture during the class time (Trenholm, 2009). Students complete the homework assignments outside of class using pencil and pen. Quizzes and tests are given in

class. A blended learning environment refers to the same 40-hour, 16-week structure, but with technology integration into the course. Technology integration can be in the form of digital media, online homework, quizzes, tests, and electronic books (E-books). A blended learning environment keeps the location of the course within the classroom and uses technology to enhance the learning experience. The online learning environment does not have a physical location on campus; students and instructors meet online in a virtual classroom. All course material is presented online, typically using a software server that organized the objectives, activities, quizzes, and tests for each course (Ashby et al., 2011). Figure 8 illustrates the different controls and focuses of the three methods. Note under the blended learning diagram, there is no control or focus. The amount of traditional or online learning will affect the levels of control and focus in the blended learning course. If the blended course has a stronger traditional lecture approach, one can expect a greater degree of instructor control, as well as focus on the instructor. Likewise, the greater focus on the online component in the blended learning environment, the higher student control and technology focus.

Investigating current literature surrounding traditional, blended, and online learning environments yields conflicting reports (Ashby, Sadera, & McNary, 2011; Means, Toyama, Murphy, Bakia, & Jones, 2010). A large meta-analysis looked at 50 studies and concluded that a blended classroom environment showed significant differences in student outcomes when compared to traditional and online environments; however, later research shows a substantial and significant decline in assessment means in the blended environment compared to traditional and online environments (Ashby et al., 2011). Twigg (2011) points to the fact that the technology software in blended environments, like the math emporium model, is not the reason for student success. The way the software is utilized in course redesigns is the key to student success.

Similarly, software integration in developmental math courses can encourage student success or hinder student success. Using math software as a supplement or add-on to the same delivery format of instruction, does not yield increases in developmental student achievement rates (Twigg, 2011).

Current Math Redesign Models

Developmental math is the course most underprepared students are required to take in college (Bahr, 2008). For example, in California, 90% of incoming community college freshmen are not prepared to take a college level math course indicated through a placement exam (Boroch et al., 2010). Only 70% of the same population of students were not prepared to take a college level reading or writing course indicated on a placement exam (Boroch et al., 2010).

Mathematics course redesigns occur in multiple forms. Course redesigns refer to process of designing new curriculum for whole courses of developmental math, not just one section or course, to increase learning outcomes through low-cost technology integration (Twigg, 2011). Course redesigns examines way to effectively deliver mathematics instruction through technology integration. Some institutions focus solely on placement exams and preparing students to take these tests. Other institutions attempt to blend high academics and the millennial students' technological fortitude through blended class design utilizing a more traditional face-to-face instruction time and online component. Still other universities have undergone a complete curriculum redesign using math emporium models.

Regardless of the course redesigns, the prevalent theme among universities is the integration of technology into developmental math courses. Many math publishers offer accompanying software for instructors and students. One publisher, Pearson, hosts MyMathLab™ (MML™) to use with a textbook. This software is a digital resource and online

classroom. Instructors can manipulate MML™ to fit each individual course, create homework, quizzes, tests, and additional assignments using online question banks, download media, PowerPoint lectures, instructional videos, the e-textbook, and much more. Pearson's MML™ capabilities are limited only by the creativity of the instructor and how much technology an instructor wants to use in the classroom. MML™ gives students the opportunity to actively engage in practicing math concepts with models and visuals. Advocates for this technology integration concluded that this type of engagement can increase student achievement (Yoder & Hochevar, 2005).

Montana State University Billings utilized MML™ to redesign developmental math courses into modules. Students tested into the modules and progressed at individualized paces. Chairsty Steward, the Assistant Director of Academic Support Center, reported one-third of students enrolled in the redesigned courses completed the developmental sequence faster than peers in the traditional developmental math courses (Speckler, 2012). Furthermore, one-fifth of redesign students outscored traditional developmental students on the final exam and over a quarter of redesign students had a higher pass rate (Speckler, 2012).

Volunteer State Community College redesigned the elementary algebra curriculum and introduced the math emporium to developmental students. The courses increased the number of students per class ($N = 40$) and required all students to take the course strictly online in a computer lab (Speckler, 2012). This school boasted an increase passing rate (14%) and higher final exam score (10%) when compared to students enrolled in the traditional math developmental courses (Speckler, 2012).

Jackson State Community College asserts increased student retention, increased student completion rates, and lowered institutional costs after redesigning existing developmental math

courses into modules (Speckler, 2012). Cleveland State Community College also saw an increase in completion rates for students enrolled in redesigned courses and indicated that students that successfully completed the redesigned courses outperformed non-remedial peers in college level algebra courses (Speckler, 2012). Furthermore, Cleveland State Community College saw a 20% decrease in institutional costs after the curriculum redesign (Speckler, 2012). Lastly, Wilbur Wright College, City of Colleges of Chicago, also reported an increase in developmental student retention and a 20% increase in course completion among students enrolled in the redesigned modules compared to traditional developmental math students (Speckler, 2012).

Math Emporium Model

The math emporium model is a specific course redesigned for high-enrollment math courses that removes lecture while utilizing interactive computer software to personalize the math course and provide immediate assistance (Twigg, 2011). The pedagogical underpinnings of the model are the student-centered use of technology, with individualized assistance when needed, and a consistent, high-quality learning experience regardless of the course instructor (Twigg, 2012). The emporium model's four core principles identify the reasons why the emporium model is successful within higher education. These four reasons are a) increased time on math problems, b) increased time on difficult problems and less on mastered concepts, c) immediate assistance, and d) students must do math (Twigg, 2011). These reasons are backed by 11 years of experimental, quantitative research studies (Twigg, 2011). Bonham and Boylan (2012) attributed the math emporium's success to increased student engagement and the focus on students working on math problems. The National Center for Academic Transformation (NCAT) started redesign models 11 years ago using a four-tiered approach: a) experimentation,

b) modification, c) replication, and d) expansion (Twigg, 2011). NCAT studies have shown that the math emporium model results in increased student success and decrease in postsecondary instructional cost (Twigg, 2011). Table 2 summarizes the NCAT results at various postsecondary institutions between 1999 and 2009 (Twigg, 2011). After 2009, NCAT insisted postsecondary institutions exclusively use the math emporium model to redesign developmental math courses due to the overwhelming increase in student achievement and reduction in institutional costs (Twigg, 2011). Furthermore, each of the results in Table 2 reflect only the initial student success increase and cost reduction. As institutions continued to use the math emporium model, student success rates increased (Twigg, 2011).

Table 2

Postsecondary Institutions using NCAT Math Emporium Model Redesigns

Postsecondary Institution	Year	Number of Students	Student Success Percentage Increase	Cost Reduction
Virginia Tech	1999	1500	8.4%	77%
University of Idaho-Moscow	2000	2428	16%	31%
University of Alabama	2000-2003	1500 per year	38.2%	30%
University of Missouri –St. Louis	No date	No data	30%	30%
Louisiana State University	2004-2006	4900 per year	11%	36%
Cleveland State Community College	2009	1200 per year	17%	20%
Jackson State Community College	2010	No data	44%	20%
Alcorn State University	2008	600	34%	34%
Mississippi Valley State University	2008	500 per year	13%	No data
University of Central Florida	2009	4100	11%	30%
Santa Fe College	2009	2760	19%	30%

The math emporium model not only increased student achievement, but the University of Alabama indicated that African-American students had higher success rates in the math emporium model than Caucasian students, despite the fact that African-American students had higher math deficiencies going into the course than the Caucasian students (Twigg, 2012). At the University of Idaho-Moscow, researchers found that Hispanic students had a 10% increase in percentage after the course redesigns (Twigg, 2012). Before the redesigns, the University of Idaho-Moscow indicated the Hispanic population in developmental math had been unsuccessful (Twigg, 2012). Both universities concluded that the math emporium model's individualized format, increased time on math tasks, immediate feedback, and assistance (Twigg, 2012).

Gaps

With a huge shift in education through NCLB (2002) and President Obama's RTTT, postsecondary institutions need to examine current practices in developmental education to determine how to best meet the diverse needs of incoming and current students. Student enrollment and attrition rates are increasing, while graduation rates are decreasing. In addition, a large worker deficit in the U.S. needs to be addressed. Although the math emporium model has high success rates among developmental math students, there are no studies examining students who are not passing after course redesigns. A review of the literature reveal the following gaps:

1. Even with extensive school reform in the last 30 years, math achievement growth rates deteriorate faster in U.S. middle and high school students when compared to industrialized countries (Lee, 2010) and a widening gap among minorities and low-income students in advanced math in high school (Center on Education Policy, 2012). A study is necessary to investigate why this is occurring. Lee (2010) calls for a longitudinal study using cross-cohort comparison exploring the effects of social and educational policies on math achievement rates among U.S. middle and high school students. Studies in student motivation, instructional practices and organization are warranted (Center on Education Policy, 2012).
2. Some states are extending the conventional K-12 block to include preschool and postsecondary education. Labeled P-16, states are examining initiatives and policies that will extend from preschool through a four-year degree. A better picture of the U.S. educational system would include national assessment studies for P-16 education (Lee, 2010). This type of study could help facilitate a more seamless transition from

- high school to college and increase efforts to maintain academic growth from preschool through a four-year degree (Lee, 2010).
3. Due to the widening math achievement gap among minorities and low socioeconomic students, more research is necessary to understand college readiness trajectories and how to address this widening gap (Lee, 2012). Lee (2012) argued that state standards for math will prepare students in completing a two-year degree and national standards are a better indicator of college readiness. Future research is needed to examine national standards and benchmarks for college readiness using math achievement to address equity and effectiveness of curriculum through shifting environmental influences that shape student growth achievement and trajectory from preschool to college (Lee, 2012).
 4. The math emporium model has shown tremendous improvement in the quality of developmental math courses and increase in student achievement (Speckler, 2012; Twigg, 2011). While increasing student success rates in developmental math courses is important, there are no studies examining students who do not pass these courses after the redesign. Howard and Whitaker (2011) looked at successful developmental math students' perceptions and experiences, and recommended future research to repeat their study and expand to include students who are not experiencing success in developmental math courses.
 5. Student perceptions and experiences in developmental math have been studied by two researchers in the past five years (Howard, 2008; Koch et al., 2012). Both studies call for increased qualitative studies surrounding developmental math students. Specifically, Howard (2008) calls for a repeatable study with more varied

participants. Koch et al. (2012) also called for research with more participants and one that examines the experiences of students who do not persist in developmental math courses.

Need of the Study

There is a need to understand the developmental math students' perspectives and experiences. Howard (2008) and Koch et al. (2012) bring attention to this need by calling on future research to include more qualitative studies with increased number of participants. Howard's (2008) phenomenological study had 13 participants and Koch et al.'s (2012) phenomenological case study had three participants. Both studies mentioned the need for larger sample sizes to provide a deeper description of the experiences (Howard, 2008; Koch et al., 2012). Koch et al. (2012) noted the absence of any literature or research surrounding developmental math students who do not persist. This study examines the lived experiences of students who are struggling to complete a developmental math course with a high number of participants. This addresses the literature gap and can add the description of struggling in a developmental math course to the body of literature.

Conclusion

Increasing enrollment in developmental math courses, high demand for redesigned developmental math courses, and the lack of qualitative studies examining developmental math student experiences and perceptions are all factors that demand more research, study, and attention from the math community. Developmental math students have not had a voice in the extensive quantitative studies and these students are the very best resource to examine. The next chapter highlights the methodology of the study.

CHAPTER THREE: METHODOLOGY

High attrition rates among developmental math students are a major concern for postsecondary institutions in the U.S. An increasing majority of community college students and university students require at least one remedial course (Bautsch, 2013; Kilian, 2009). Typically, students who require remediation are less successful in college, progress at a slower rate than college-ready peers, and have lower graduation rates (Bahr, 2008; Bahr, 2013; Bailey et al., 2010; Bettinger & Long, 2009). Prior research reported high enrollment rates in developmental math and low completion, retention, and graduation rates of developmental math students (Bahr, 2008; Bahr, 2013; Bailey et al., 2010; Bettinger & Long, 2009; Boylan, 2002; Calcagno & Long, 2008; Diploma to Nowhere, 2008; Howard & Whitaker, 2011; Martorell & McFarlin, 2011; Parker, 2012; Remediation: Higher, 2012; Silverman & Seidman, 2011-2012). This study examined students who had unsuccessfully completed a developmental math course. The participants provided personal perceptions and experiences of struggling to complete a developmental math course within a math emporium model. There are no qualitative or quantitative studies examining the lived experience of unsuccessful developmental math students (Howard & Whitaker, 2011).

The purpose of this transcendental phenomenological study was to examine the experiences of students who did not meet the university's standard of passing a developmental math course. The following sections detail the study's design, procedures, data analysis, my background and methods for increasing the trustworthiness of the findings.

Design

This study investigated struggling students' perceptions of developmental math courses through a transcendental phenomenological approach to qualitative research. This research

design was most appropriate for this study because of the focus on the lived experiences of students who did not meet the university's standard of passing a developmental math course. A phenomenological design allowed me to examine the interactions between measureable outcomes, like passing or failing a math course, with immeasurable qualities, like perceptions and experiences (Moustakas, 1994).

Transcendental Phenomenology

A transcendental phenomenological approach to qualitative research was the focus of my study. A transcendental phenomenology focuses the study around rich, textural descriptions, structural descriptions and an essence of the study (Creswell, 2013; Moustakas, 1994). Transcendental phenomenology is useful for describing the phenomenon using the participants' experiences, perceptions, and voices. According to Creswell (2013), the textural descriptions examine the participants' experiences, the structural descriptions develop through how the participants experienced the phenomenon. Furthermore, Moustakas' (1994) data analysis method of transcendental-phenomenological reduction was the best suited methodologically for my study and was used to achieve a textural-structural synthesis and essence of the experience. The focus of the study was the participants' lived experiences and not my interpretation of the experiences. To focus on the students' experiences and utilize a true transcendental approach within a phenomenological design, I bracketed out presuppositions and acknowledge them in my personal biography section. By doing this, I opened myself up to new ideas and consciousness (Moustakas, 1994). This was the only research methodology that aligns with my research questions and was supported by current research (Howard, 2008; Howard & Whitaker, 2011). Although published under two studies, one was a dissertation (Howard, 2008) and the other, a published article based on the dissertation (Howard & Whitaker, 2011). Howard (2008) and

Howard and Whitaker (2011) used a phenomenological approach to their qualitative research study. The research question focused on the lived experience of unsuccessful and then, successful developmental math students. The data collection and analysis were aligned with a phenomenological approach to qualitative research. This approach most closely mirrored my study and the clear, logical approach to successful developmental math students was consistent throughout the research design. Furthermore, prior research (Canfield, 2012; Howard & Whitaker, 2012) indicated the use of phenomenology to examine developmental math students' experiences, perceptions, and persistence.

Alternative Methodologies

The narrative inquiry approach to qualitative research was investigated and deemed an inappropriate research method for this study due to the narrative inquiry approach focus on people's stories through history and utilization of a narrative explanations to understand the behavior of people (Clandinin & Connelly, 2000). More specifically, the purpose of descriptive narratives is to describe through sequential events an individual account in hopes of giving meaning to the narrative (Polkinghorne, 1988). Narrative researchers are concerned with a continuum experience of the participant (Clandinin & Connelly, 2000). The fluidity of movement between the past and present within the narrative approach, and the focus on an individual or small group of people are reason enough to reject this approach to studying the occurrence of students who are struggling to complete a developmental math course. Furthermore, there is no current research that would support the decision to complete a narrative inquiry in developmental math education.

The ethnography approach to qualitative research was investigated and determined to be an inappropriate research method for this study due to the ethnography focus on a culture

(Fetterman, 1998). Furthermore, the ethnographer, examines patterns of predictable behavior and thought (Fetterman, 1998). An ethnographer focuses writings around daily life (Fetterman, 1998). This approach to qualitative research methods within developmental math education is not supported by current research. In addition, I purposefully approached my research examining this phenomenon from all angles and inclusive of all cultures and ethnicities in an attempt to fully understand the lived experience of students who are struggling within a developmental math course regardless of ethnicity. Because my research did not examine a specific culture or group, an ethnographic approach to qualitative research was not utilized in this study.

The grounded theory approach to qualitative research was investigated and rejected as a potential approach for this study due to the grounded theory focus on using data to build a theory (Corbin & Strauss, 2008). This research study does not use a theory from current research or seek to build a theory from the data collected in this study. In addition, no current research would support the decision to approach my research study with the grounded theory approach. The case study approach to qualitative research was investigated and determined to be an inappropriate qualitative research approach for my study. A case study is reserved for unique or contemporary events through examining the how and why in circumstances (Yin, 2014). In addition, case study research seeks to extensively and through in-depth data collections describe a social phenomenon within everyday environments (Yin, 2014). The focus on the depth of studying a contemporary social situation coupled with collecting data from participants in their everyday environments are reason enough to disregard the case study approach to qualitative research for my study, another focus of case study research is more reason to reject this form of inquiry. Yin (2014) attempts to balance the need for quality participants through eliminating

potential participants via multiple screening processes and the need for multiple participants. Thus, he recommends the total number of participants to range between one and 12 (Yin, 2014).

The overarching principle in case study research is the depth of the data collection and analysis. While this research is very important and applicable to developmental education, when examining the lived experience of multiple participants utilizing the data collection procedures outlined in this study, a case study approach is not appropriate. Yin (2014) explained that there was no standard for case study research. The lack of standards was apparent in the review of literature for developmental math. My study sought to include as many participants as possible from various backgrounds to completely saturate the data with participant participation that reflected the developmental population as a whole and gain an understanding of the experience of struggling within a developmental math course.

Methodologies in literature. The inconsistencies in the literature offer very little to help in deciphering between a case study and phenomenological approach to my research study. The case study approach and phenomenological approach to qualitative research were the only two approaches that were supported by current research. Kilian (2009) used an explanatory case design in a phenomenological study, focusing on how and why questions. Furthermore, Kilian's (2009) research mentioned the uniquely bounded and contemporary experience of developmental math. I rejected this notion that students who are struggling within a developmental math course was unique or contemporary. The longstanding history of developmental education in the U.S. was discussed in detail at the beginning of Chapter Two. Furthermore, students who are struggling within a developmental math course was not a unique or bounded situation. Thousands of students are struggling within developmental math courses (Bahr, 2013).

Kilian (2009) used developmental math students and faculty as participants. I rejected this approach to my study due to the focus on the phenomenon of only students who are struggling within a developmental class. I was neither interested in examining the perceptions of faculty nor giving faculty a voice in the study. Furthermore, Kilian (2009) used two different approaches to arrive at their research design. This blending of research designs lent more to confusion than a clear, focused research design. Englander (2012) argued that the combination of two qualitative research methods cannot be done. Each research method approach utilizes different methods for participant selection, data collection, and analysis (Englander, 2012). Combining methods is like “mixing oranges and apples!” (Englander, 2012, p. 14).

Another study (Koch et al., 2012) used a phenomenological case study approach to qualitative research, using Moustakas (1994), Creswell (2007), and Yin (2003) to justify the blending of two qualitative approaches and used only three participants. Again, the blending of two qualitative research approaches was fundamentally incorrect and assumed all qualitative research methods were one method and interchangeable (Englander, 2012). Researchers mixing qualitative approaches to research knowingly or unknowingly make the fallacious claim that the philosophical assumptions of the various qualitative research method approaches are compatible and substitutable (Englander, 2012). This blending of approaches decreased the rigor needed to collect and analyze the data. Englander (2012) noted that qualitative research, as a scientific approach, must be consistent in methodology in order to be repeatable. In addition, quantitative research must stem from one logical branch of theory and must use one specific research approach to organize and plan out steps to conduct a rigorous, scientific study (Englander, 2012). Consequently, the lack of one approach or combination of two approaches leads to confusion and

a less rigorous study. Table 2 provides a summary of the qualitative research methods considered and rejected in favor of a transcendental phenomenology research method.

Table 3

Qualitative Research Methods Considered

Qualitative Approach	Data Source	Key Consideration	Reasons for Rejection	Supported by research?
Case Study	Yin (2014)	This methodology focuses on in-depth data collection among participants in their natural settings. In addition, a case study approach requires a unique event or contemporary issue to study.	This research study does not focus on unique events. The lack of standard research design in the discipline of developmental math literature lends caution to attempting a case study approach.	Yes
Ethnography	Fetterman (1998)	This methodology examines patterns of predictable behavior and thought from the viewpoint of a specific culture group.	This research study does not focus on a culture.	No
Grounded Theory	Corbin & Strauss (2008)	This methodology uses an existing theory or builds a theory from research data to examine research questions.	This research study does not focus on using data to build a theory. In addition, this research does not use a pre-developed theory to answer the research questions.	No
Narrative	Clandinin & Connelly (2000) Polkinghorne (1988)	This methodology describes through sequential events an individual account in hopes of giving meaning to the narrative. The focus of this research is the continuum of a participant's story.	This research study does not focus on peoples' stories through personal events or history.	No

Research Questions

There were four research questions to help describe the lived experiences of students who did not meet the university's standard of passing a developmental math course. The first research question was firmly rooted in Moustakas' (1994) approach to phenomenology and provided the foundation for the study. The second and third questions were similar to prior phenomenological research by Howard and Whitaker (2011) on unsuccessful and then, successful developmental math students and Canfield's (2013) phenomenological study on unsuccessful developmental math students' persistence and perception of math abilities. Both of these questions used Bandura's (1997) theory of self-efficacy to focus the research. The final question was based on Tinto's (2012) retention theory and Bandura's (1974) self-efficacy theory. The research questions were:

1. What was the experience of students who did not pass a developmental math course?
2. What experiences and attitudes impact students' mastery of basic math skills?
3. What are students' perceptions of developmental math course placement?
4. How do students perceive the university's mathematics emporium model?

Participants

The study utilized 13 developmental math students who did not meet the university's standard of passing a developmental math course. The number of participants aligns with Polkinghorne's (1989) and Creswell's (2013) recommendations of 5-25 participants. Moustakas (1994) suggested that researchers consider using varied participants: "age, race, religion, ethnic and cultural factors, gender, and political and economic factors" (p. 107). The essential criteria for selecting research participants was ensuring each participant has experienced the phenomenon of not meeting the university's standard of passing a developmental math course

(Moustakas, 1994). All developmental math students were contacted via email with a short description of the study and a link to sign informed consent (see Appendix D and Appendix E). In order to take part in the study, participants had to be able to report specific experiences within the phenomenon. Participants were interested in the study and were willing to participate in lengthy-interviews (Moustakas, 1994).

The participants were overwhelmingly female ($n = 10$) compared to males ($n = 3$). Most of the participants were sophomores ($n = 6$). There were three juniors, four seniors, and no freshmen in the study. All participants were full time, traditional college students between the ages of 18-25. The ages of the participants were 18-21 years ($n = 10$) or 22-25 years ($n = 3$). Eleven participants were Caucasian, 1 Hispanic, and 1 listed other for ethnicities. Roughly half of the participants had a job ($n = 7$), while the remaining participants did not have a job ($n = 6$). Table 4 lists a full description of the participants.

Table 4

Description of Participants

Name	Gender	Age	Ethnicity	Classification	Major	Work
Eve	Female	18-21	Caucasian	Junior	Elementary Education	No
Caleb	Male	18-21	Caucasian	Sophomore	Special Education	Yes; 18 hours per week
Sarah	Female	18-21	Other	Sophomore	International Relations: Strategic Intelligence	No
Christina	Female	18-21	Caucasian	Sophomore	Family and Child Development	Yes; 40 hours per week
Jeanette	Female	22-25	Caucasian	Senior	Public Relations and Psychology	No
Anna	Female	18-21	Hispanic	Senior	Global Studies	Yes; 20 hours per week
Leigh	Female	22-25	Caucasian	Senior	Fashion Merchandising	Yes; 20 hours per week
Rosie	Female	18-21	Caucasian	Junior	Politics and Policy	Yes; 20 hours per week
Adam	Male	18-21	Caucasian	Sophomore	Biomedical Sciences	No
Becca	Female	18-21	Caucasian	Sophomore	Communications	Yes; 18-20 hours per week
Steven	Male	18-21	Caucasian	Sophomore	Cinematic Arts	No
Violet	Female	22-25	Caucasian	Senior	Psychology	No
Abigail	Female	18-21	Caucasian	Junior	Psychology	Yes; 18-30 hours per week

Sampling procedures

A total of 13 participants from a central Virginian university were selected to participate in this study. Participants were sampled until thematic saturation was achieved by no new themes emerging from the data. All participants were students who did not meet the university's standard of passing a developmental math course. Students who did not meet the university's standard of passing a developmental math course earned an overall grade of less than 70% or failed to complete all necessary homework, quizzes, and tests. For my study, all participants were enrolled in a developmental math course during the Spring 2014 semester. All courses were completed before the start of the study. All participants were on summer break during the data collection phase.

In order to maintain a high level of integrity and minimize potential risks to the participants in my study, no instructor or university employee was asked to identify any students who did not meet the university's standard of passing. In order to find potential participants, all developmental math students were emailed a description of the study with a link to sign a digital informed consent (see Appendix D and Appendix E). Students determined whether or not they fit the criteria of the study and were willing to participate. After receiving informed consent from potential participants via Google Doc submission, I emailed potential participants to schedule an interview and confirm students experienced the phenomenon of interest (see Appendix F).

Sample Size

The final sample size of the study was 13 participants due to thematic saturation. This sample size fell within the recommended guidelines for phenomenological studies (Creswell, 2013; Polkinghorne, 1989) and aligned with other phenomenological studies on math efficacy in

postsecondary students (Canfield, 2013; Howard, 2008; Howard & Whitaker, 2011). This number was based upon the number of developmental courses offered at the university. There are roughly 50 developmental courses offered each semester with 20-25 students in each course. The total number of students who do not pass a developmental math course at the university is approximately 250 students per semester. Willing students who signed informed consent and indicated a desire to participate in the study were invited to participate (see Appendix E). This convenience sample ensured that participants were willing and able to share their experiences within the phenomenon. All participants were given a pseudonym for confidentiality.

Setting

This study utilized a private, Christian, non-profit, four-year university in Virginia. This university offers over 160 certificates, undergraduate, masters, and doctoral degrees to over 12,600 residential students. Recently, the university redesigned all developmental math courses to a math emporium model. Students are placed into math courses based on math SAT and ACT scores. Students who desire a higher math placement may take a placement exam. There are two developmental math courses at the university. All developmental math courses are taught by seven full-time faculty members. The two developmental math courses, Math 100 and Math 110, require an overall grade of 70% or higher and completion of all modules and exams to progress to the next math course. Students who do not meet the 70% requirement or do not complete all modules or exams fail the course and not be allowed to progress to the next level until they satisfactorily complete the course.

Math Emporium Requirements

The university requires developmental math students to meet one time a week in a classroom with the instructor. This time is spent covering new material for the week, reviewing

difficult material from the previous week, checking student progress, and offering tips to increase successful completion of the course within the emporium environment. In addition to class time, developmental math students are required to log at least three hours a week in the math computer lab. The minimum total time each week developmental math students spend on math is four hours. The math computer lab has 250 computer work stations for students to access seven days a week during 80 operating hours. The math computer lab is fully staffed with faculty and specially trained tutors to assist developmental math students.

Course curriculum is aggregated into alphabetized modules online. Students access the week's materials and complete all necessary homework, quizzes, and tests online. For example, during the first week of the semester, developmental math students in Math 100 work on Module A material. During week two of the semester, students work on Module B. Students are not allowed to move from one module to the next without successfully completing all homework and quizzes with 80% accuracy. At the end of four units, students must pass a test with 70% accuracy to move on to the next unit. Overall, a student must complete the course with at least 70% to move on to the next math course.

While the university provides a detailed weekly schedule, students who complete the week's lessons and all assignments with an 80% and tests with a 70% proficiency may move on to the next lesson at any time; therefore, the emporium model is self-paced. Students who are behind the suggested schedule risk taking longer than one semester to complete the course and having to re-enroll into the same developmental math course the following semester.

The math emporium model redesign is the most effective redesign model (Twigg, 2011). Investigating the phenomenon of students who are struggling within a math emporium model

allowed me the opportunity to examine the phenomenon of struggling students in the most effective redesign model (Twigg, 2011).

Procedures

I secured Institutional Review Board (IRB) approval from the university (see Appendix J). Afterwards, a short description of the study and informed consent for participants was emailed to all developmental math students from the prior semester by their instructor (see Appendix A and Appendix B). Participants were sampled during the summer break and were not be enrolled in any math course. Informed consent from the participants was received, and I sent a welcome email with attached Self Description Questionnaire III (SDQ III) link and interview date and time inquires to each participant (see Appendix C and Appendix D). After I received interview date and time requests and the SDQ III were complete, I emailed participants with the interview date and time and a link to the formal response questions (see Appendix E and Appendix F). Participants were asked to complete the formal response questions with embedded demographic questions prior to the interview.

All interviews were completed using Skype due to the geographical distance of the participants during the summer break. All interviews were audio recorded (see Appendix G for a list of interview questions). Two undergraduate tutors and I transcribed all interviews verbatim. Undergraduate tutors were taught how to transcribe and I verified the authenticity of all transcriptions. After all the interviews were transcribed, a copy of the transcribed interview, along with a thank you letter, was emailed to each participant (see Appendix H). Participants were encouraged to clarify any points or add to their interviews at the bottom. Participants emailed any changes or clarifications to me within two weeks.

Any digital copies of interviews, SDQ III, and formal response questions were stored in a password protected folder on my personal computer and will be deleted seven years after the publication of my dissertation. Figure 8 shows the study procedures.

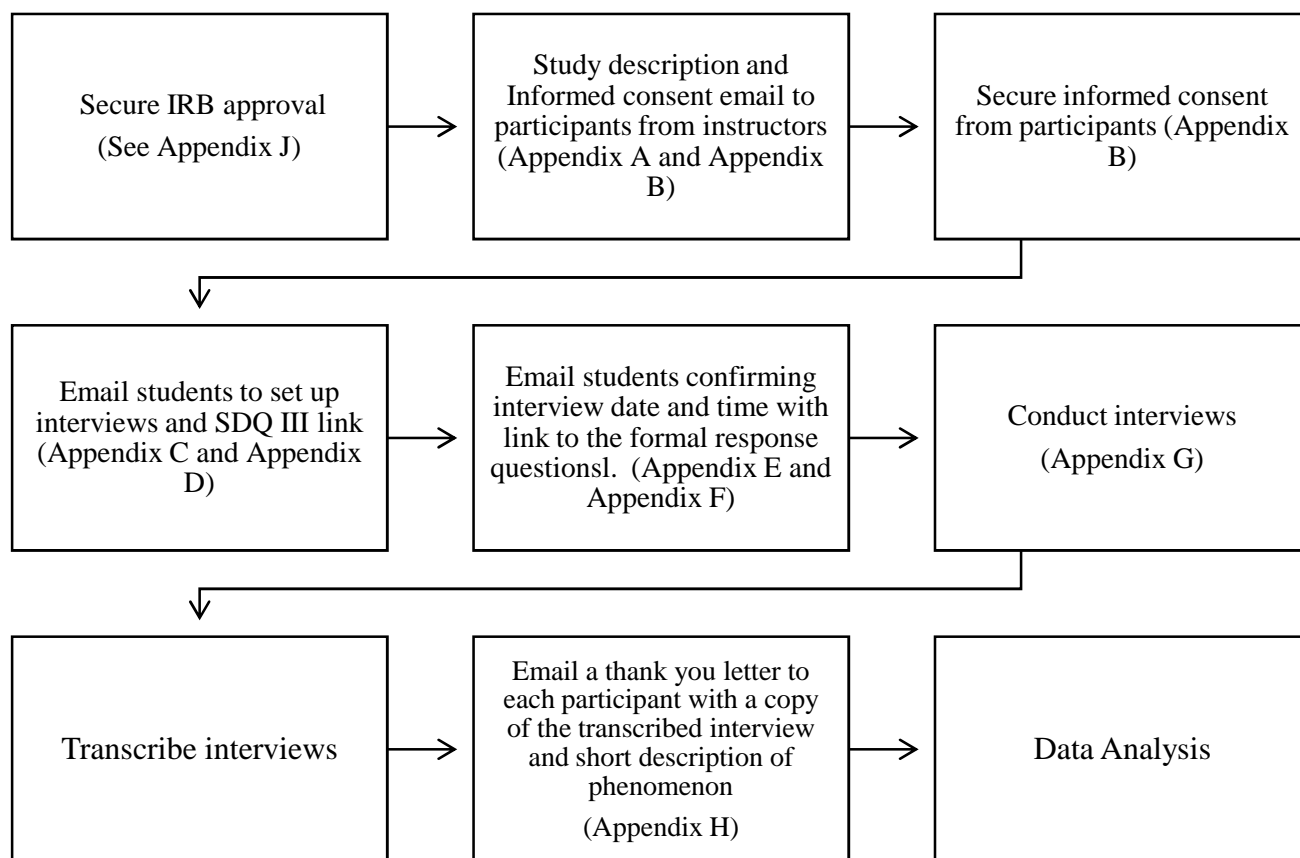


Figure 8. Study procedures

Personal Biography

I was an adjunct professor teaching developmental math courses in Hawaii. I have taught math in North Carolina at the middle school and post-secondary setting. Currently, I am completing my Educational Doctorate in Curriculum and Instruction at Liberty University. I obtained my Master's in Elementary Education and Bachelor of Science in Elementary

Education from Campbell University in Buies Creek, North Carolina. In addition, I hold valid North Carolina and Virginia teaching licenses certified at the Master's degree level in elementary education (K-6), math (6-9), science (6-9) and gifted education (K-12).

Because I am the human instrument during this phenomenological study, all writing was in my voice with the exception of Chapter 4, which was written using the participants' voices to add to the trustworthiness of the study. My voice was influenced by my past experiences and personal thinking processes. I have never struggled in math as a student. In elementary and middle school, I was in the Gifted Program for math. While I struggled with graduate level statistics online in my doctoral program, I attributed this to the instructional method of the course, the instructor, and my life situations at the time. While I attributed a lower grade to outside circumstances, I suspect most of my participants to attribute lower math grades to a lower cognitive ability.

During my teaching experience, there have been very few students who could not handle the concepts covered in developmental math courses. Students have the cognitive ability to complete the course, but consistently tell me that they are not good in math. My past students assume that understanding and successfully performing in English or writing courses is synonymous with poor math ability. My students are quick to counter any poor math skills with better and easier English or writing abilities. In addition, students can pinpoint when math became difficult and they no longer liked being in class. Another observation from teaching developmental math courses comes from students who are overworked and attending school full time. I have had a number of students get less than two hours of sleep and attempt to attend my math course. They fall asleep in class. While this situation is not cognitive, students will fail to recognize and admit that not getting enough sleep could affect their math grades. More often

than not, my students will attribute a low grade to their cognitive ability without recognizing nonacademic factors that could have influenced their math performance. In addition, students will often attribute a high grade to a situation and not their cognitive ability. By completing this study, I hoped to gain a better understanding of my developmental math students and give meaning to their experiences.

Data Collection

This study used a transcendental phenomenological approach to qualitative research. As such, I collected data from the participants using questionnaires, formal responses, and interviews. I was the human research instrument (Lincoln & Guba, 1985) and I sought to describe the lived experience of students who have not passed a developmental math course. The phenomenon of interest was students who did not meet the university's standard of passing a developmental math course.

Credibility and trustworthiness within the study was increased through multiple data collection sources. Questionnaires (see Appendix D), formal responses (see Appendix F) and interviews (see Appendix G) were used to describe the phenomenon of interest. All three methods of data collection were used together to describe the participants' experience in developmental math and increased the overall voice of the participant. The three methods gave credence to the overall and collective story of the participants.

Formal Responses

Phenomenological research suggests using a myriad of data collection techniques in order to fully describe the experience of the participants (van Manen, 1990). Canfield (2013), Howard (2008), and Howard and Whitaker (2011) used observations and site documents to collect data. Due to the nature of my study, observational data was not an effective way to collect data for two

reasons. First, in my study, the developmental math course was completed. Participants were no longer be enrolled in a developmental math course; therefore, I was unable to collect data through observations. Secondly, my study's setting is in a computer lab and the course material was self-paced. Instructors do not lecture in the math emporium setting and therefore, observing instructional methods, student interactions, and behaviors was not appropriate for this setting. Due to these reasons, formal responses concerning student interactions with instructors, tutors, and peers, and behaviors the participants recall in the math emporium setting gave similar descriptions of the observational data collected from prior studies. Canfield's (2013) and Howard's (2008) observational protocols and site documents were used to develop the formal response questions. Table 5 shows the demographic data that was embedded in the formal responses. Table 6 lists the formal response questions, where the questions were generated in prior research, the research question the formal response question addresses, the theoretical framework and provisional codes for the formal response questions.

Table 5

Demographic Questions in Formal Responses

Question	Rationale for Question	Prior Research	Research Questions	Theoretical Framework
What is your gender? <i>Female</i> <i>Male</i>	Purposeful Sampling Data Triangulation	Canfield (2013) Howard (2008) Howard & Whitaker (2011) Moustakas (1994)	RQ 1	Bandura (1997)
What is your age? <i>18-21</i> <i>22-25</i> <i>26-29</i> <i>30-33</i> <i>34-37</i> <i>Over 37</i>	Purposeful Sampling Data Triangulation	Canfield (2013) Howard (2008) Howard & Whitaker (2011) Moustakas (1994)	RQ 1	Bandura (1997)
What is your ethnicity? <i>African-American</i> <i>Asian</i> <i>Caucasian</i>	Purposeful Sampling Data Triangulation	Moustakas (1994)	RQ 1	Bandura (1997)

<i>Hispanic</i>				
<i>Pacific-Islander</i>				
<i>Other</i>				
<i>What is your classification in college?</i>	Purposeful Sampling Data Triangulation	Canfield (2013) Moustakas (1994)	RQ 1	Bandura (1997)
<i>Freshman</i>				
<i>Sophomore</i>				
<i>Junior</i>				
<i>Senior</i>				
<i>What is your major?</i>	Purposeful Sampling Data Triangulation	Canfield (2013) Moustakas (1994)	RQ 1	Bandura (1997)
<i>Are you a full time or part time student?</i>	Purposeful Sampling Data Triangulation	Canfield (2013) Moustakas (1994)	RQ 1	Bandura (1997)
<i>Are you employed?</i>	Purposeful Sampling Data Collection	Canfield (2013)	RQ1	Bandura (1997)
<i>Yes</i>				
<i>No</i>				
<i>If yes, how many hours per week do you work?</i>	Purposeful Sampling Data Collection	Canfield (2013)	RQ 1	Bandura (1997)
<i>What is the highest level of math you have successfully completed prior to college?</i>	Purposeful Sampling Data Collection	Canfield (2013) Howard (2008) Howard & Whitaker (2011)	RQ 1 RQ 2 RQ 3	Bandura (1997) Tinto (2011)
<i>Algebra 1</i>				
<i>Algebra 2</i>				
<i>Calculus</i>				
<i>Geometry</i>				
<i>Pre-Calculus</i>				
<i>Trigonometry</i>				
<i>Other:</i>				
<i>When did you take your highest level of math prior to college?</i>	Purposeful Sampling Data Collection	Canfield (2013) Howard (2008) Howard & Whitaker (2011)	RQ 1 RQ 2 RQ 3	Bandura (1997) Tinto (2011)
<i>Middle School</i>				
<i>9th Grade</i>				
<i>10th Grade</i>				
<i>11th Grade</i>				
<i>12th Grade</i>				

Table 6

Formal Response Questions

Research Question (RQ)	Formal Response Question	Prior Research	Theoretical Framework	Provisional Codes	Data Source
RQ 1	Describe your typical week in the Math Emporium? Include what you did in the class, where you sat, what you brought to class, who you talked to, if/how you asked for help, how you learned the material, etc.	Observation Protocol: Canfield (2013) Observation Protocol: Howard (2008)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1	How many hours did you log in the Math Emporium each week?	Site Documents: Canfield (2013)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1	When you encountered trouble, did you go to your professor for help? Why or why not? What happened?	Observation Protocol: Canfield (2013) Observation Protocol: Howard (2008)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1	Did you use the tutors in the Math Emporium? If yes: Did you find the tutors helpful? In what ways did you find the tutors helpful? If no: What is the reason you did not use the tutors in the Math Emporium?	Observation Protocol: Canfield (2013) Observation Protocol: Howard (2008)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1 RQ 4	Did the Math Emporium help you feel more or less confident in your math ability? Why?	Interview Question #3: Canfield (2013)	Bandura (1997) Tinto (2011)	Self-Efficacy Math Emporium Model	Formal Response Questions
RQ 1	If you could redo your last math course, what would you do differently?	Canfield (2013)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1	What would have helped you successfully complete your last math course?	Canfield (2013)	Bandura (1997)	Self-Efficacy	Formal Response Questions
RQ 1 RQ 4	What advice would you give a student who is about to start their first developmental math course in the Math Emporium?	Interview Question #1: Canfield (2013)	Bandura (1997) Tinto (2011)	Self-Efficacy Math Emporium Model	Formal Response Questions

Self Description Questionnaire III

Participants completed an online questionnaire before the start of the interview. Students were asked to complete the SDQ III, a psychological instrument designed to measure self-concepts in late adolescents (see Appendix E). The SDQ III is designed for late adolescents and early adults and the Centre for Positive Psychology and Education (CPPE) has made this instrument available online. The measurement instrument is based on Shavelson's model and research that explains perceptions of self are formulated through experience, environment, and evaluations by others (Marsh, 1992; Marsh, Barnes, & Hocevar, 1985; Shavelson, Hubner, & Stanton, 1976). Significant others have the ability to influence feelings of self-perception through the words and reinforcements they give people. Significant people are people who are respected and admired, or have a close relationship to the person. Significant people can be parents, siblings, aunts, uncles, cousins, teachers, or people in authority. Ultimately, significant people play a large part of a person's self-perception.

The Shavelson's (1976) model of self-concept features seven major points (a) organized and structured, (b) multifaceted, (c) hierarchical, (d) stable/unstable, (e) age specific, (f) evaluative and descriptive, and (g) differentiable from other constructs (Marsh et al., 1985; Shavelson et al., 1976). In this model, the seven major points were further divided into academic and nonacademic areas (Marsh et al., 1985; Shavelson et al., 1976). Academic self-concept examined English, history, math, and science. Nonacademic self-concept examined areas of social, emotional, and physical. These nonacademic concepts were rooted in peers' and significant others' perceptions, participants' emotional state of being, and personal ability and appearance.

Beginning research on self-concept focused on preadolescent self-concept called the Self Description Questionnaire (SDQ) (Marsh et al., 1985). SDQ coupled with the Shavelson's model of self-concept provided the foundation for the development of the SDQ III (Marsh, 1985). The SDQIII focuses on 13 factors using 136 items on the questionnaire (Byrne, 1996; Hattie, 1992; Marsh & O'Niell, 1984; Marsh et al., 1985). The 13 factors are math, physical appearance, general esteem, honesty/trustworthiness, physical abilities, verbal, emotional stability, parent relationships, academic, same-sex relationships, opposite-sex relationships, spiritual values, and problem-solving (Byrne, 1996; Hattie, 1992; Marsh & O'Niell, 1984; Marsh et al., 1985). The questionnaire used an eight point rating scale. Table 7 shows a sample SDQ III item.

Table 7

Sample Self Description Questionnaire III Item

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Definitely False	False	Mostly False	More False Than True	More True Than False	Mostly True	True	Definitely True

_____ I find many mathematical problems interesting and challenging.

The SDQ III was shown to be a reliable and valid instrument for post adolescents through multiple sources using Cronbach's alpha. Good values of internal consistency reports values of Cronbach's alpha higher than .8 ($\alpha \geq .8$). The SDQ III was found highly reliable (13 factors; $\alpha = .89$) with low correlations between the factors ($r = .09$) (Marsh & O'Neill, 1984). These results indicate that each of the factors are distinct factors, differentiable from one another

(Marsh & O'Neill, 1984). Later research resulted in similar findings (13 factors; $\alpha = .878$) and showed individual reliability alphas for mathematics self-concept ($\alpha = .95$), problem solving self-concept ($\alpha = .79$) and academic self-concept ($\alpha = .86$) (Marsh et al., 1985). Faria (1996) compared Portuguese student responses on the SDQ III to Marsh's Australian student (1989) results and found the reliability of the instrument greater than .8 in all factors with the exception of problem solving. Faria's (1996) reported mathematics self-concept ($\alpha = .92$) compared to Marsh's (1989) mathematics self-concept ($\alpha = .94$); academic self-concept ($\alpha = .8$) compared to ($\alpha = .92$); and problem solving self-concept ($\alpha = .75$) to ($\alpha = .84$), respectively.

Faria (1996) recommended two solutions to increase heterogeneity of the scales: (1) present similar items or (2) add items more closely resembling real life. Even with the slight difference in reliability for the problem solving self-concept, Faria (1996) concluded the study indicated that the SDQ III allowed for the comparison in two different cultural settings with similar results. This indicated the SDQ III is an adequate multidimensional scale for different contexts (Faria, 1996).

Byrne (1996) published normative data on multiple self-concept instruments, including the SDQ III. Using reported data from numerous responses ($N = 2,436$), reliability coefficients ranged from .76 to .95, with a mean $\alpha = .9$. A test-retest reliability was studied by Marsh, Richards, and Barnes (1986a; 1986b) and indicated over the course of 18 months, stability coefficients between $r = .87$ and $r = .74$; taking into account the numerous life changes that occurred in the participants during the 18 month study, Byrne (1996) concluded the SDQ III provided strong indications of test-retest reliability. Furthermore, examining only the SDQ III academic factors (verbal, mathematics, and academic), convergent validities ranged from .54 (verbal) to .86 (mathematics) and with a mean $r = .69$ (Byrne, 1996). This showed a strong

convergent validity. According to Bryne (1996) the SDQ III has endured extensive and rigorous testing over numerous years and concluded that the SDQ III is the best self-concept measurement tool for adults with the most validation.

In my study, the questionnaire was used to determine three factors of self-efficacy (a) mathematics, (b) problem solving and (c) academics (see Table 10). These three factors added to the description of the phenomenon through helping explain the participant's self-belief in mathematics, problem solving, and general academics. Bandura's (1997) theory of self-efficacy indicates students who have low self-efficacy scores underperform. The SDQ III helped determine if participants who have underperformed also describe their abilities as low. Table 8 explains each of the factors under investigation on the SDQ III.

Table 8

SDQ III Factor and Descriptions

Factor	Description
Math	Measures the skills and math ability ratings of participants
Problem Solving	Measures the ability of participants to employ problem solving skills
Academic	Measures the general academic skills and ability ratings of participants

The SDQ III allows researchers to use the instrument without prior authorization on the condition that researchers acknowledge the origins of the instrument and report any findings to the SELF Research Centre (Marsh, 2014). Furthermore, permission was given to use single or multiple scales without consultation of the authors (Marsh, 2014). (See Appendix K for permission from the author to reproduce the SDQ III items within my dissertation.)

Interviews

All interviews were one-on-one, semi-structured and open-ended. Interviews were scheduled via email after participants signed informed consent. Interviews were conducted through Skype and were audio recorded. Each interview lasted approximately 45 minutes. Interview questions (see Appendix G) were developed based on Moustakas' (1994) transcendental phenomenology recommendations and current literature in the field (Howard, 2008; Howard & Whitaker, 2011). An interview protocol was developed and implemented for each interview (see Appendix G for interview protocol and questions). Table 9 shows the relationship between the research questions, interview questions, and theoretical framework with the provisional coding for data analysis.

Table 9

Interview Questions

Research Question (RQ)	Interview Question	Theoretical and Empirical Framework	Provisional Codes	Data Source
RQ2	Try to remember one of the last times you felt successful in math class and tell me about the situation. Probe: How did you feel? Probe: How did you act? Probe: What did you do?	Bandura (1997) Tinto (2011)	MH SE	Interview
RQ2	Please describe your teachers' perceptions of you in math class in elementary, middle, and high school. Probe: Were their views similar or different from yours? Probe: How did you know?	Bandura (1997) Tinto (2011)	MH SE	Interview
RQ2	Knowing what you know now, what would you change about your K-12 math experience that would help you be more successful in math?	Bandura (1997) Tinto (2011)	MH SE	Interview
RQ2	Tell me when you started to identify yourself as unsuccessful at math? Probe: How did you know you were unsuccessful at math? Probe: How did you feel? Probe: How did you act? Probe: Was there any experience that occurred that confirmed this feeling of	Bandura (1997) Tinto (2011)	MH SE	Interview

	being unsuccessful in math?			
RQ3	Tell me how you felt when you found out you would have to take a developmental math course in college? Probe: Was this placement expected or a surprise? Probe: Do you feel this was a good placement? Probe: Why or why not?	Bandura (1997) Tinto (2011)	MH PoCP SE	Interview
RQ1 RQ3	What feelings were generated when you first started your developmental math course?	Bandura (1997) Tinto (2011)	MEM MH PoCP SE	Interview
RQ1 RQ3	Can you tell me about any successful math experiences you have encountered in your developmental math course?	Bandura (1997) Tinto (2011)	MEM PoCP SE	Interview
RQ1 RQ3	How do you feel unsuccessful in your developmental math course?	Bandura (1997) Tinto (2011)	MEM PoCP SE	Interview
RQ1 RQ4	What are some changes the university could make to the math emporium to help you be successful?	Bandura (1997) Tinto (2011)	MEM SE	Interview
RQ1 RQ3 RQ4	Are there any other thoughts or significant experiences concerning your developmental math course that you would like to share?	Bandura (1997) Tinto (2011)	MEM PoCP SE	Interview

Data Analysis

Moustakas' (1994) data analysis technique of phenomenological reduction was primarily utilized in this study. After analyzing the SDQ III results using the mean from the participants, Moustakas' (1994) phenomenological model using phenomenological reduction was followed. This following steps outline Moustakas' (1994) phenomenological model using phenomenological reduction (a) Bracketing the Topic, (b) Horizontalization, (c) Clustering into Themes, (d) Textural Description of the Experience, (e) Structural Descriptions of the Experience and (f) Textural-Structural Synthesis (see Figure 9). The SDQ III results were integrated into the horizontalization and clustering into themes portion of the analysis.

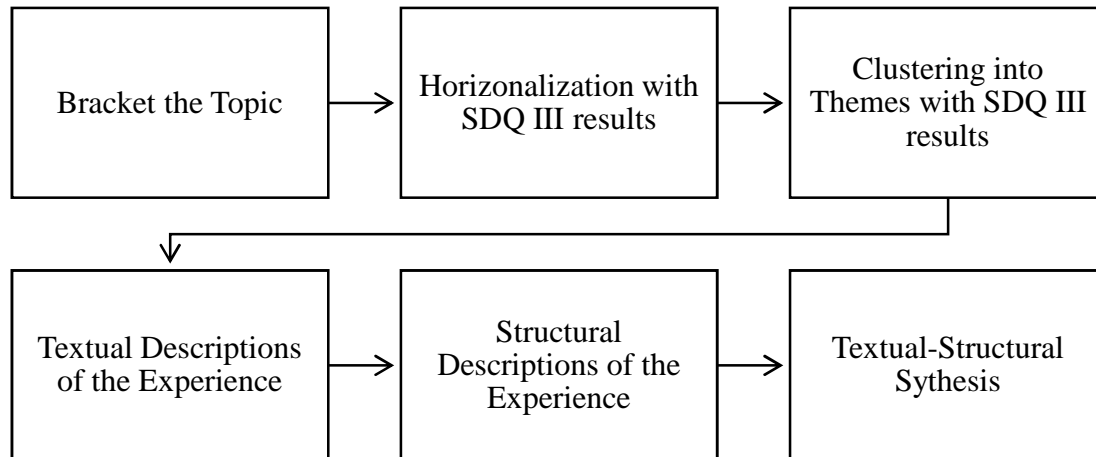


Figure 9. Data analysis flowchart

Bracketing the Topic

In an effort to see the phenomenon afresh, I set aside any predispositions and I allowed new ideas, experiences, perceptions and people into my consciousness (Moustakas, 1994). In order to engage in the data collection and analysis in a new way, I described all of my personal experiences with teaching developmental students who have struggled within my developmental math course in an attached document (see Appendix I). In bracketing out past experiences, I focused on listening, observing, and interacting with the data before reflectiveness (Moustakas, 1994). Bracketing, along with the epoche process, focused the research away from me and ensured the research process was firmly rooted on the experiences of the participants and research questions (Moustakas, 1994). The purpose of the process of epoche through reflection was to prepare for new information and knowledge (Moustakas, 1994). The amount of work, conscious and unconscious, required to satisfactory remove all preconceived notions, judgments, thoughts and biases is rarely achieved; however, the practice of continually reflecting and practicing the epoche process increased my competency in examining the phenomenon with a

fresh perspective and aided in my openness to receive new insight and information (Moustakas, 1994).

While speaking about the qualitative research approach of ethnography, Fetterman (1998) stated to begin with personal biases surrounding people's behavior. Thinking about these biases allowed them to be controlled and assisted in focusing the research and decreasing the researcher effect (Fetterman, 1998). This focus on controlling preconceived notions added to the quality of this study, and along with the triangulation of the data, the trustworthiness of the study. I strived to approach this phenomenon open to new ideas, but aware that my reflections, thought process, and imagination were important to fully embrace and used while analyzing new data (Fetterman, 1998). After the epoche process, I reread the research questions and focused myself on thinking about those questions while conducting the data analysis.

Horizontalization

All interviews were transcribed verbatim by two undergraduate trained tutors and myself. I verified the authenticity of the transcriptions after receiving them from the tutors. Furthermore, I examined the participants' interviews and I looked for significant statements from the participants. Initially, all statements had equal value (Moustakas, 1994). The process of horizontalization was reading and rereading the transcribed interviews. Through multiple readings, I coded the interviews by focusing on significant statements (Moustakas, 1994). A few significant statements of (a) feeling isolated, (b) relationships with teachers, (c) negative attitudes, and (d) placement emerged from the data. Overlapping statements were eliminated. These statements included negative attitudes and self-doubt. These significant statements consistently presented together; therefore, the statements were combined to give a better description of the phenomenon.

Cluster into Themes

The significant statements by the participants were used to identify themes (Creswell, 2013; Moustakas, 1994). The theme refers to a frequently used word or phrase (van Manen, 1990). In order to fully describe the phenomenon, a discovery of similar themes among different participants added to the rich, descriptive analysis of the phenomenon. Also referred to as cross-coding, similar themes emerged from various participants and helped fully describe the phenomenon. Provisional coding helped me initiate the data analysis through identifying significantly similar themes among participants (Saldaña, 2013).

The four provisional codes developed through the theoretical framework of Bandura (1997) and Tinto (2011) addressed the four research questions. These codes were (a) self-efficacy, (b) math history, (c) perceptions of course placement, and (d) math emporium model. Due to the emergent nature of qualitative research, I did not limit myself to these four provisional codes, but I was open to where the data led. The focus of the themes and cross-coding was used to reduce the significant statements into smaller clusters of themes and to note the similarities among the participants. This allowed me to write a full, rich description of the phenomenon. See Table 10 for a list of provisional codes.

Table 10

Provisional Codes for Data Analysis

Research Question	Theoretical Framework	Provisional Code	Shorthand Code
RQ1 RQ2 RQ3	Bandura (1997)	Self-Efficacy	SE
RQ2	Bandura (1997)	Math History	MH
RQ3	Bandura (1997) Tinto (2011)	Perception of Course Placement	PoCP
RQ3 RQ4	Tinto (2011)	Math Emporium Model	MEM

Additional codes of negative experiences with teachers, positive experiences with teachers, feelings in math courses, and math confidence levels emerged from the data.

Textural Descriptions of the Experience

The textural descriptions of the data focused on vividly describing the individual experience of struggling in a developmental math course. A rich description of this phenomenon was written from the verbatim transcripts and although brief, encapsulated the feelings surrounding the participants within a developmental math course. The textural descriptions used specific quotes from the participants to more fully describe the phenomenon. The textural descriptions described *the what* of the phenomenon that helps the readers understand a full, well-rounded definition of the phenomenon. Individual textural descriptions were examined and a composite textural description included a collection of all individual descriptions into one group description (Moustakas, 1994).

Structural Descriptions of the Experience

While the textural descriptions of the experience focused on *the what* of the phenomenon, the structural descriptions focused on the background and *how* of the phenomenon. The structural description of the experience focused on the underlying subtleties of the experience of struggling within a developmental math course (Moustakas, 1994). This included details about participants' past math courses and how the participants arrived in developmental math courses. The structural description of the participants as a group helped readers understand how the participants collectively experienced the phenomenon and arrived in a developmental course (Moustakas, 1994).

Textural-Structural Synthesis

The final step in data analysis was textural-structural synthesis. This provided the foundation for explaining the *how* and *what* of the experience (Moustakas, 1994). The textural-structural synthesis utilized the data from the formal response, interviews, SDQ III, my intuition and my reflection. According to Moustakas (1994), reflection throughout the research study helped create the structures for the essence of the experience. These descriptions through the textural-structural synthesis clarified the experience of struggling within a developmental math class through my intuitive and reflective integration of the composite textural and structural descriptions (Moustakas, 1994). The textural-structural synthesis culminated in a full, composite description of the essence of the phenomenon.

Trustworthiness

A specific and detailed approach was utilized in the study to maximize the trustworthiness of the study. Using Creswell's (2013) validation strategies, the study used triangulation, rich, thick descriptions, member checking, and peer review.

Triangulation

Lincoln and Guba (1986) and Creswell (2013) recommended multiple sources of data collection, also known as triangulation. Three different sources of data collection ensured the proper employment of triangulation (Creswell, 2013). Using this strategy, I used multiple sources to corroborate my research methods, data collections, data collection, and theoretical framework (Creswell, 2013). The formal responses, interviews, and SDQ III provided the needed three components to ensure triangulation of data. The three components of triangulation confirmed that the emergent themes came from the data collection and analysis. The provisional codes of self-efficacy, math history, perception of course placement, and math emporium model were derived from the work of Bandura's (1997) social cognitive theory and Tinto's (2011) retention theory. The provisional codes were used to examine all three sources of data to determine if the emerging themes explain the phenomenon. Furthermore, past qualitative and quantitative studies surrounding self-efficacy and developmental math were utilized to solidify emerging codes and themes.

Rich, Thick Descriptions

Rich, thick descriptions of the experience were used to increase the transferability of the study (Lincoln & Guba, 1986) and allow the reader to more fully and clearly understand the phenomenon (Moustakas, 1994). I used detailed descriptions of the participants and settings. According to Creswell (2013), detailed descriptions allowed me to transfer the meanings and essences of my study to other locations to determine the applicability of the findings to other students who are struggling within a developmental math course. Noting the shared characteristics among the descriptions allowed the findings to be more transferable (Creswell,

2013; Lincoln & Guba, 1986). In addition, describing the details required the use of multiple participant quotes and an active participant voice (Creswell, 2013).

Member Checking

Thoughtful and purposeful member checking was used to ensure the transcriptions were accurate and consistent with the experience of struggling within a developmental math course (Moustakas, 1994). This was a very important part of my study. This was done by bringing the data back to the participants. This allowed participants to check for accuracy and added to the credibility of the experience (Creswell, 2013). The first way this was employed in the study was by inviting the participants to be co-researchers (Moustakas, 1994). This step occurred after I completed the transcriptions and data analysis. Participants received a copy of the transcribed interview and emerging themes (see Appendix H). Participants were asked to provide feedback. I received feedback from six participants on the accuracy of the transcriptions. Two participants specifically addressed the emerging themes and agreed with the themes. Rosie responded, “I do think that these descriptions from other students about the math emporium are accurate.” Adam emailed and stated, “I feel as though your analysis was spot on. I agree with the majority of the other participants, in the way they feel about the math emporium and why we failed.”

Peer Review

Lastly, a peer review provided an additional check of the research by examination of the research methods, data collection, analysis, and meanings (Creswell, 2013). In addition, a peer review allowed me to gain insight from a trusted peer from a sympathetic source. The peer was a doctoral candidate using a phenomenological approach to her dissertation and provided a high quality edit due to prior editing work on my study in past doctoral courses. The peer edited the dissertation for style, form, and content. Most of the changes she suggested were cosmetic. She

commented that the findings were thoroughly backed with participants' quotes and the recommendations were rooted in the emerging themes and implications.

Ethical Considerations

A benefit of this study was giving developmental math students a voice to describe the experience of struggling within their first developmental math course. This voice has not been heard in literature and was the main motivation for this transcendental phenomenology study. Participants, through being co-researchers, were given the opportunity to express their perceptions and experiences in developmental math courses. This benefit outweighed any risks for participation in the study. Creswell (2013) noted the importance of the benefits of the study outweighing the risks. Although there are no known risks of this study, ethical safeguards were employed for the study due to any unanticipated risk brought on by reflecting on past struggles in math. These ethical considerations were addressed through consent, confidentiality and anonymity, data security, counseling and tutoring services, and compensation.

Consent

All developmental math students enrolled in Math 100 or Math 110 were emailed a short description of the study and a link to informed consent (see Appendix A and Appendix B). Students read the descriptions and determined if they fit the criteria needed for participation. If they were willing to participate, they digitally signed informed consent. This process ensured that no instructor identified a student who had not successfully passed a developmental course. This consideration was put into place to safeguard against potential participants feeling discouraged or sadden by instructors identifying them as failing a developmental course.

Confidentiality and Anonymity

In order to maintain anonymity for the university and participants, I used pseudonyms. Potential participants were assured confidentiality in the consent forms and all published findings will include a pseudonym. There was no distinguishing information linking participants to the pseudonym or study.

Data Security

All digital copies of the formal responses, interview transcripts, SDQ III, and signed informed consent papers were be stored in folder on a password protected computer. Any written data was scanned into my computer and stored in a password protected computer. Physical copies were be shredded. All digital files will be destroyed seven years after publication.

Counseling and Tutoring Services

There are many resources available to students at the university. During the description of the study and on informed consent, students were given to the student advocacy office email and phone number (see Appendix A and Appendix B). If participants mentioned any feelings of inadequacy or depression while in the study, I supplied the student advocacy office contact information again.

Compensation

Participants were greatly appreciated, and I showed my appreciation through an emailed thank you letter, along with the transcribed interview. Participants were given the choice between a \$10 iTunes or Starbucks gift card.

Conclusion

The need to understand the experiences and perceptions of developmental math students is crucial and necessary. This study added to the body of literature in a way that has not been

studied. There is no research examining the experiences and perceptions of students who have not successfully completed a developmental math course. The results of this study could impact how institutions relate to and encourage completion, retention, and graduation among developmental math students. Focused mainly on the unsuccessful developmental math students, this study shed light on attitudes and prior math experiences that hinder the ability of students to experience success in a developmental math course. The next chapter focuses on the data analysis and findings of the study. Chapter five examines the findings through my interpretations and literature. Furthermore, there will be implications of the study and recommendations for future research.

CHAPTER FOUR: FINDINGS

The purpose of this transcendental phenomenological study was to describe the experiences of participants who did not meet the university's standard of passing a developmental math course in a math emporium model. Phenomenology uses a researcher's personal interest to develop questions (Moustakas, 1994). My research began while attending a math faculty meeting where quantitative data was presented and analyzed by the math faculty members. During the meeting, I was overwhelmed at the number of developmental math students who failed a math course at the university. I started to wonder if all struggling developmental math students had similar experiences in their math courses.

Looking at the literature, there were no qualitative studies focusing on struggling developmental math students in the math emporium model. Thus, this study focused on the shared similarities and experiences among struggling developmental math students. The foundation of the study was found in the research question: what was the experience of students who did not pass a developmental math course? The rest of this chapter describes this phenomenon using the participant's voice and provides an overall understanding of the experience. Moustakas (1994) suggests examining the experience from many angles and perspectives in order to understand the entire phenomenon being investigated. Because of this recommendation, the Self Description Questionnaire III (SDQ III), formal responses, and interviews were used to compile a well-rounded description of the study.

Research Questions

There were four research questions used to describe the lived experiences of students who did not meet the university's standard of passing a developmental math course. All four questions used the theoretical frameworks provided by Moustakas (1994), Bandura (1997), and

Tinto (2012a). Previous qualitative research assisted in the development of the questions (Canfield, 2013; Howard & Whitaker, 2011). The four research questions were:

1. What was the experience of students who did not pass a developmental math course?
2. What experiences and attitudes impact students' mastery of basic math skills?
3. What are students' perceptions of developmental math course placement?
4. How do students perceive the university's mathematics emporium model?

Participants

There were 13 participants included in the study. Each participant (a) was an undergraduate student, (b) enrolled in a developmental math course at the university, (c) took the course in the Math Emporium, and (d) did not meet the university's standard of passing the course. All participants voluntarily indicated they had failed to meet the university's standard of passing.

The strict guidelines for participation were set in order to ensure the phenomenon under investigation would be studied. Because this study focused solely on students who did not pass a developmental math course, only students who did not pass could be included in the study. In addition, because the math emporium model is considered a redesigned way to teach developmental math, students must have taken the developmental math course in this model. Course redesigns have been shown to increase passing and progressing rates among developmental math students. Furthermore, the math emporium model added another dimension to the study and I needed to ensure only students enrolled in a developmental math course in the math emporium model were included.

In order to recruit for the study, I emailed all students enrolled in a developmental math course from January through May 2014. The email included a short description of the study and

a link for informed consent (Appendix A). Students who met the criteria listed in the description clicked the informed consent link and digitally signed informed consent (Appendix B). After receiving informed consent, participants were emailed a link for the SDQ III (Appendix C and Appendix D). After I received the digital responses for the SDQ III, students were emailed a link to answer the formal responses (Appendix E and Appendix F). After I received the digital responses for the formal response questions, I interviewed each participant (Appendix G). Each participant was assigned a pseudonym for the study.

Descriptions of Participants

There were 13 total participants in the study. The following section provides a short description of the participants.

Adam was a Caucasian male aged 18-21. He was a full time sophomore majoring in Biomedical Sciences. His last math course was in 10th grade and he recommends future developmental math students to complete more work outside of the Math Emporium.

Eve was a Caucasian female aged 18-21. She was a full time junior majoring in Elementary Education. Her last math course was in 10th grade and she recommends scheduling blocks of time to devote to developmental math courses.

Caleb was a Caucasian male aged 18-21. He was a full time sophomore majoring in Special Education. His last math course was in 11th grade and he recommends setting aside plenty of time to get math done in the Math Emporium.

Sarah listed other as her ethnicity and was aged 18-21. She was a full time sophomore majoring in International Relations-Strategic Intelligence. The last math course she took was in 11th grade. For future developmental math students, she recommends working ahead and not procrastinating. She cautioned students to stay focused on math while in the Math Emporium.

Christina was a Caucasian female aged 18-21. She was a full time sophomore majoring in Family and Child Development. She completed her last math course in 12th grade. She wants future developmental math students to avoid procrastinating!

Becca was a Caucasian female aged 22-25. She was a full time senior majoring in Public Relations and Psychology. She took her last math course in 11th grade. Like participants before her, Becca warns future developmental math students of procrastination and recommends using the tutors for extra help.

Anna was a Hispanic female aged 18-21. She was a full time senior majoring in Global Studies. Her last math course was completed during the summer between her 11th and 12th grades. Anna recommends not falling behind or taking time for granted in the Math Emporium.

Leigh was a Caucasian female aged 22-25. She was a full time senior majoring in Fashion Merchandising. She completed her last math course during her 12th grade year and recommends picking the right teacher for developmental math courses. Furthermore, she wants future students to view developmental math courses like a job because according to her, struggling math students can spend 20 or more hours in the Math Emporium.

Rosie was a Caucasian female aged 18-21. She was a full time junior majoring in Politics and Policy. She finished her last math course in 12th grade and suggests developmental math students follow the math schedule and complete all Math Emporium hours.

Steve was a Caucasian male aged 18-21. He was a full time sophomore majoring in Cinematic Arts. He completed his last math course his senior year in high school and wants to tell future developmental math students to take the math course seriously.

Jeannette was a Caucasian female aged 18-21. She was a full time sophomore majoring in Communications. She completed her last math course in 11th grade. She recommends taking good notes and building a good relationship with the instructor.

Violet was a Caucasian female aged 22-25. She was a full time senior majoring in Psychology. She did not remember when she completed her last math course, Algebra 1, but recommends getting to know the instructors, work hard, and finish the course early.

Abigail was a Caucasian female aged 18-21. She was a full time junior majoring in Psychology. The last math course she completed was in 11th grade. For future developmental math students, she recommends staying on schedule and finding study groups to help learn the material.

Self Description Questionnaire III

Participants were asked to complete the SDQ III which measured their self-efficacy in three major areas: mathematics, academics, and problem-solving. The SDQ III is an 8-point Likert scaled ranging from Definitely False to Definitely True. The results from the mathematics portion is represented in Table 11, Table 12 and Table 13.

Table 11

SDQ III Mathematics Results

	I find many mathematical problems interesting and challenging.	I have hesitated to take courses that involve mathematics.	I have generally done better in mathematics courses than other courses.	Mathematics makes me feel inadequate.
Adam	Mostly True	True	Mostly False	More True Than False
Eve	Mostly True	True	True	False
Caleb	True	Definitely True	Definitely False	Definitely True
Sarah	More False Than True	Mostly False	Mostly True	Mostly False
Steven	Mostly True	Definitely False	Definitely False	Definitely False
Leigh	More False Than True	Definitely True	Definitely False	Definitely True
Violet	Mostly False	More True Than False	Definitely False	Definitely True
Anna	Mostly False	True	Mostly False	More False Than True
Christina	False	False	Definitely False	False
Jeanette	True	Definitely True	Definitely False	Definitely True
Rosie	False	True	Definitely False	True
Becca	Definitely False	Definitely True	Definitely False	Definitely True
Abigail	Definitely False	Definitely True	Definitely False	Definitely False

Table 12

SDQ III Mathematics Results

	I am quite good at mathematics.	I have trouble understanding anything that is based upon mathematics.	I have always done well in mathematics classes.
Adam	Mostly False	False	More False Than True
Eve	More True Than False	Mostly False	More False Than True
Caleb	False	Mostly True	Definitely False
Sarah	Definitely True	False	Definitely True
Steven	Definitely False	More False Than True	Mostly False
Leigh	False	Mostly False	False
Violet	Definitely False	Definitely True	Definitely False
Anna	More False Than True	More False Than True	Mostly False
Christina	Definitely False	False	Definitely False
Jeanette	Definitely False	Definitely True	Definitely False
Rosie	Definitely False	Mostly True	False
Becca	Definitely False	Definitely True	Definitely False
Abigail	Definitely False	Mostly False	Definitely False

Table 13

SDQ III Mathematics Results

	At school, my friends always came to me for help in mathematics.	I have never been very excited about mathematics.
Adam	Mostly False	Definitely True
Eve	More True Than False	Mostly True
Caleb	Definitely False	Definitely True
Sarah	Mostly True	True
Steven	Definitely False	More False Than True
Leigh	Definitely False	Definitely True
Violet	Definitely False	Definitely True
Anna	Mostly False	More False Than True
Christina	Definitely False	Mostly False
Jeanette	Definitely False	Definitely True
Rosie	Definitely False	Definitely True
Becca	Definitely False	True
Abigail	Definitely False	Definitely True

In order to get a more comprehensive view of the participants, each of the eight ratings were given a numeric value. The values are listed in Table 14. The numeric scores were added together and averaged to give an overall description of the mathematics self-efficacy of the participants. Table 15 reports the results of the SDQ III with numeric ratings where the mean score fell between four and five. Mean scores that ranged between four and five revealed a neutral feeling on the statement. Figure 10 and Figure 11 illustrate the results of the SDQ III numeric ratings when the questions revealed a low mean score. Questions with a low mean indicated the tendency of the participants to agree with the statements. Figure 12, Figure 13, Figure 14, and Figure 15 report the results of the SDQ III numeric ratings on questions that revealed a high mean score. Questions with a high mean indicated the tendency of the participants to disagree with the statements.

Table 14

SDQ III Numeric Rating Scale

SDQ III Rating	Numeric Value
Definitely False	8
False	7
Mostly False	6
More False Than True	5
More True Than False	4
Mostly True	3
True	2
Definitely True	1

Table 15

SDQ III with Neutral Numeric Ratings

	I find many mathematical problems interesting and challenging.	Mathematics makes me feel inadequate.	I have trouble understanding anything that is based upon mathematics.
Adam	3	4	7
Eve	3	7	6
Caleb	2	1	3
Sarah	5	6	7
Steven	3	8	5
Leigh	5	1	6
Violet	6	1	1
Anna	6	5	5
Christina	7	7	7
Jeanette	2	1	1
Rosie	7	2	3
Becca	8	1	1
Abigail	8	8	6
Mean	5	4	4.5

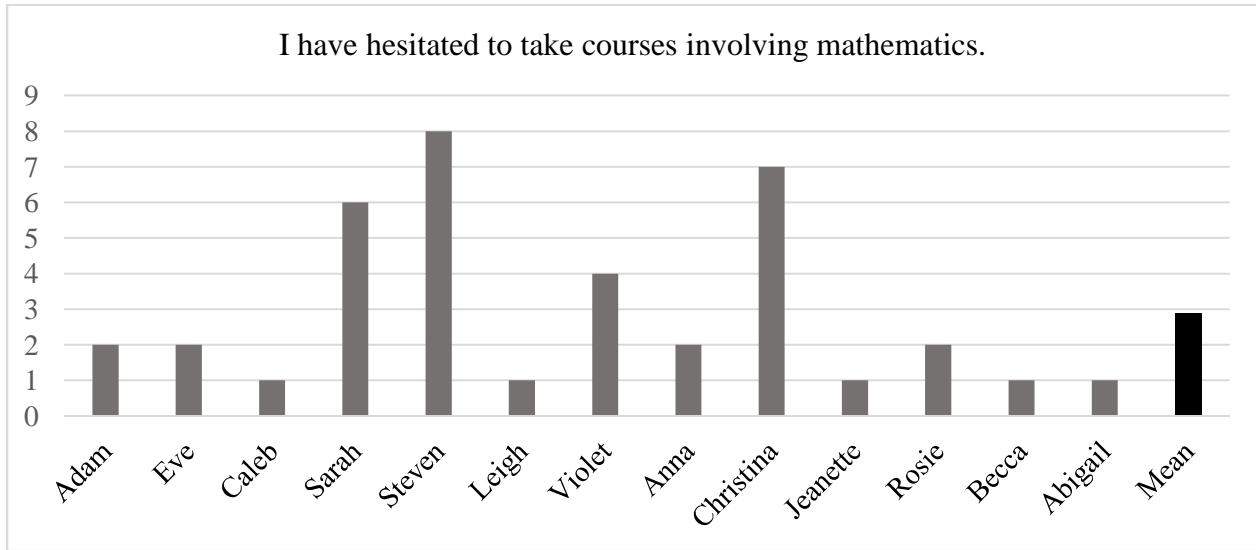


Figure 10. SDQ III Numeric Results. This figure shows individual ratings and the low mean score of this SDQ III question.

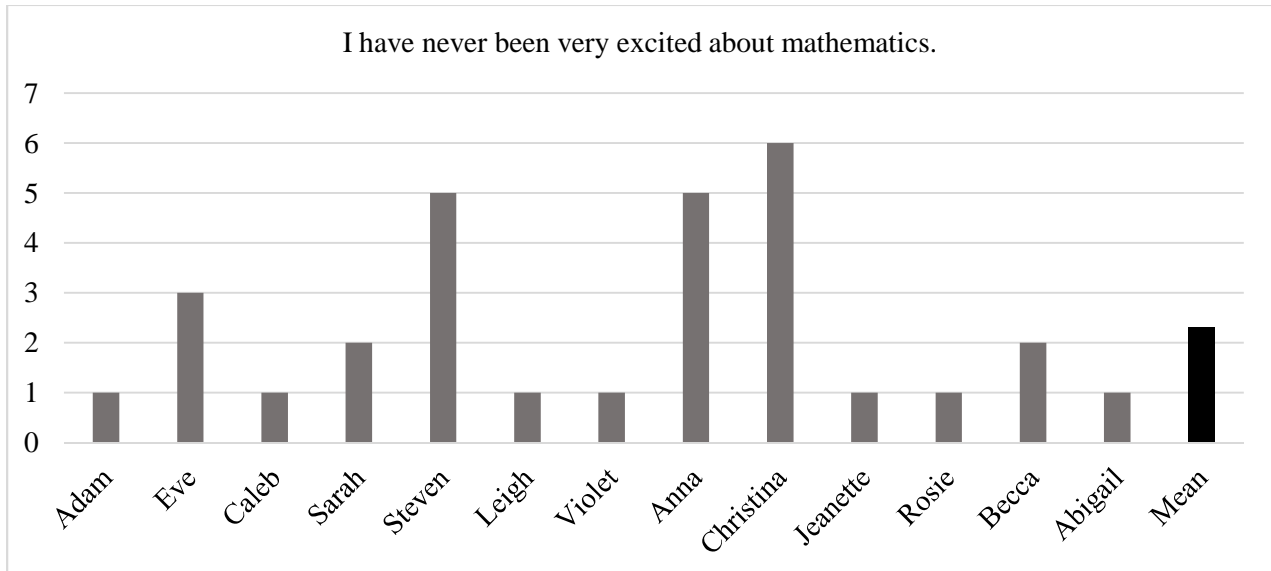


Figure 11. SDQ III Numeric Results. This figure shows individual ratings and the low mean score of this SDQ III question.

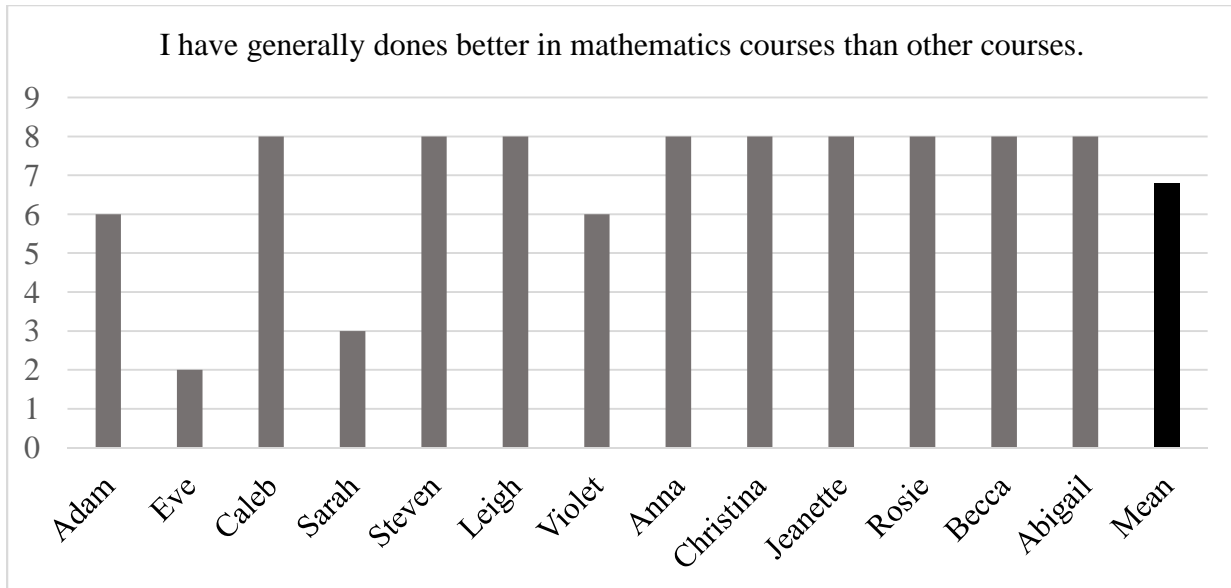


Figure 12. SDQ III Numeric Results. This figure shows individual ratings and the high mean score of this SDQ III question.

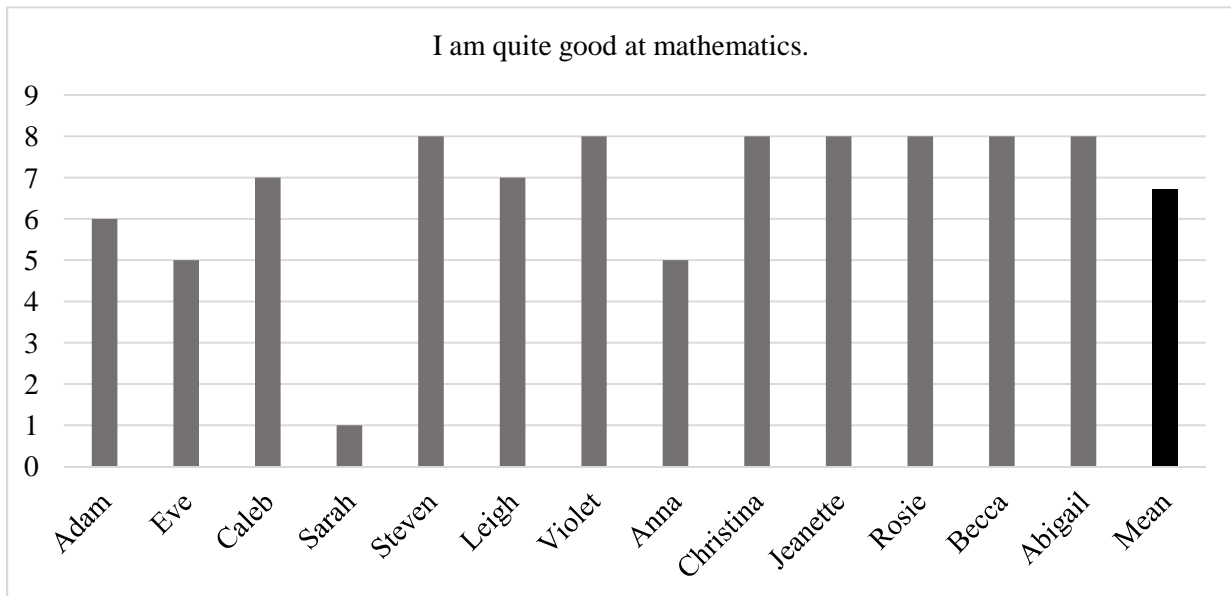


Figure 13. SDQ III Numeric Results. This figure shows individual ratings and the high mean score of this SDQ III question.

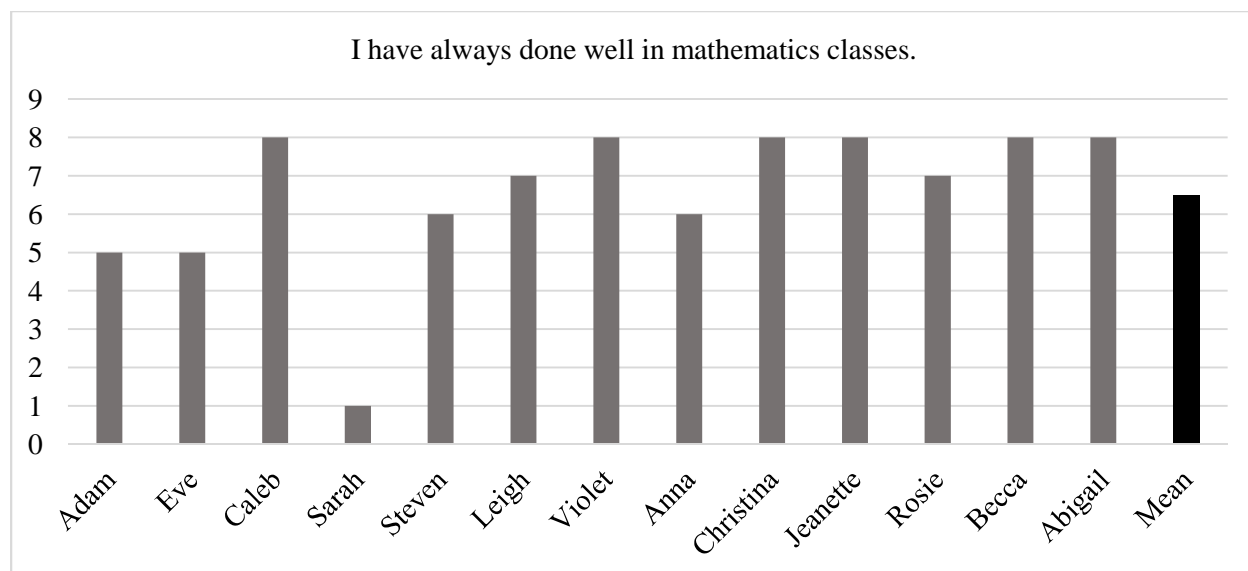


Figure 14. SDQ III Numeric Results. This figure shows individual ratings and the high mean score of this SDQ III question.

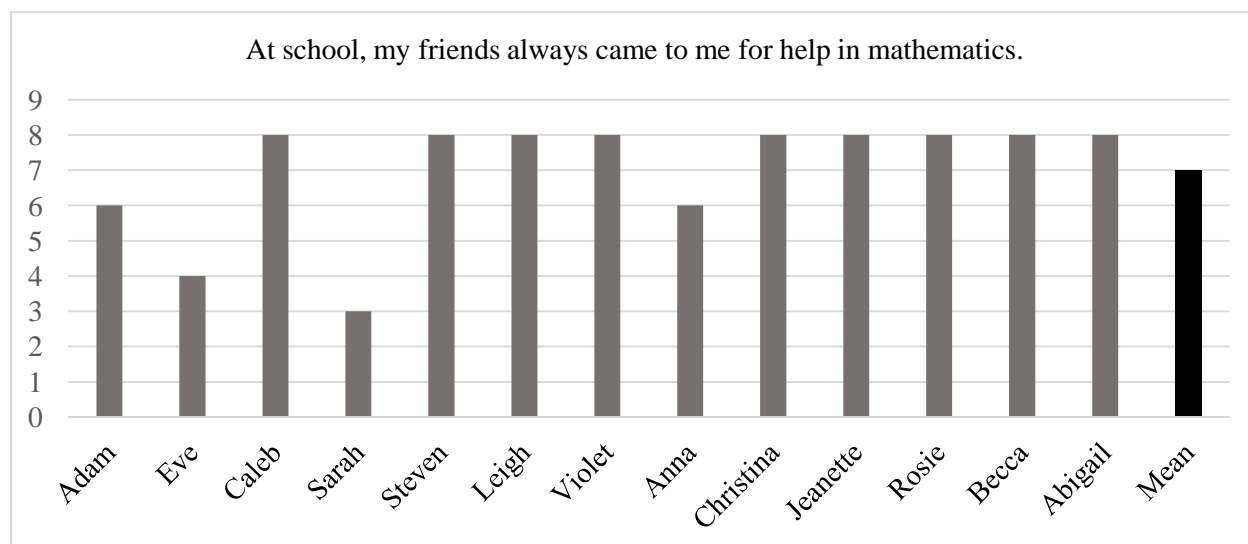


Figure 15. SDQ III Numeric Results. This figure shows individual ratings and the high mean score of this SDQ III question.

Using these numeric values, the mean scores from the data revealed the following: (a) participants overall hesitate to take math courses, (b) generally do worse in math compared to other courses, (c) do not believe they are good in math, (d) have never done well in math classes,

(e) have never been very excited about math and (f) their friends did not come to them for help in math courses.

Formal Responses and Interviews

Participants were asked to write their responses on the formal response electronic document before the interview. The formal response questions were designed from Canfield's (2013) and Howard and Whitaker's (2011) qualitative studies on developmental math students. Both studies used observations and/or site documents to gather data (Canfield, 2013; Howard & Whitaker, 2011). For my study, observations were not a valid data collection tool, because the developmental math courses had ended prior to the start of the study. In addition, my study used the math emporium model which utilizes a computer lab environment to individualize lessons and homework. This setting would not have allowed me to gather much observational data on the students; therefore, formal response questions were generated to gather the same information, but from the participants' perspective. All participants were given the same eight questions designed to help describe the phenomenon of not meeting the university's standard of passing a developmental math course in a math emporium model (see Appendix F). Demographic data was collected on the formal response questions.

In addition to formal responses, participants answered interview questions to help describe the phenomenon. Each participant was asked 11 interview questions (see Appendix G). Some participants were asked the probing questions, while other participants thoroughly answered the original question and did not need a probe. Interviews lasted between 11 and 26 minutes, depending on the participants' responses. All interviews were audio recorded and transcribed verbatim. All transcriptions were emailed to the participants to ensure the validity of the participants' answers. This type of member checking allowed the participants to make any

necessary changes, clarify any responses, or agree with the transcript. There were no changes made to the transcripts by the participants during the member checking process.

The data from the formal responses and interviews were analyzed using Moustakas' (1994) phenomenological reduction. Using Moustakas' (1994) phenomenological reduction allowed significant themes to emerge from the data which were used to describe the phenomenon. The textural and structural descriptions of the data help describe the individual and group struggles within the phenomenon. The textural-structural synthesis, with my reflection throughout the research study, helped created the foundation for the essence of the phenomenon (Moustakas, 1994). Together, the data analysis process and SDQ III results woven together helped clarify the experience of struggling within a developmental math class and culminated in a full, composite description of the essence of the phenomenon.

Themes

The following themes emerged from data concerning the research questions. Participant quotes are used to solidify the themes and provide an answer to the research questions.

Research Question One

The first research question examined the experience of not passing a developmental math course. Participants reported (a) isolation, (b) self-doubt and negative attitudes towards developmental math, (c) success clouded by inability to progress, and (d) fixed mindset.

Isolation. Participants in the study reported feeling alone in the Math Emporium. Some participants shared experiences of feeling alone in developmental math courses, feeling different from their peers, some physically isolated themselves in the Math Emporium, and many mentioned sitting down at the computer and plugging in music that would help them escape even further from the Math Emporium. The SDQ III results solidified this idea of being alone when

the participants identified friends did not come to them for help in any math courses. There were three subthemes of (a) unintentional isolation, (b) intentional isolation, and (c) musical escape.

Unintentional isolation. This subtheme emerged with participants mentioned being isolated and alone at the computer in the Math Emporium. Furthermore, participants reported feeling isolated from peers as their classmates were progressing and they were not. According to Abigail:

Basically you just sit there at your computer and you're basically on your own unless you specifically bring a tutor over to help you. If you are like me and you struggle with math, it's gonna be a very frustrating experience cause you feel like you're kind of alone. Sort of drifting in this sea of failure.

Becca explained, "If you are a straggler you kind of have to just fend for yourself because everyone else is ahead of you and if you don't catch up then you have that option of failing". In addition, Becca mentioned when you are behind, "you don't have time to catch up because everyone just keeps moving along without you."

Eve also discussed knowing that everyone else was ahead of her. She said:

It was awful. Like they knew, really the professor knew, everyone was all ahead. But, I knew I was behind. I didn't know how behind I was, but I really was. I thought I was behind a little bit, but at the end of the semester, I was behind a lot.

Jeannette also reported being different from her peers in the course. She was frustrated by "not being able to move forward to the next unit when everyone else was moving forward."

Leigh felt that she was not getting the help she needed in the Math Emporium, which made her feel like she was struggling alone. After asking for help, she met with a tutor and her instructor. After meeting with her instructor, she recalled:

[The instructor] put me back out in the math lab to keep doing my best... she would never like sit down with me again with what I was struggling with so it seemed like the math anxiety just kept getting worse and worse because I felt like I wasn't getting the help I needed. I just felt like I was getting passed on to somebody else.

Furthermore, Leigh said she felt like an outcast and that there is "no place for us [struggling developmental math students] in the math system. Nobody is willing to work with us or give us the time that we need."

Jeannette felt that she had to figure out math by herself, which was a struggle for her. She felt lost in the Math Emporium without a teacher and expressed feelings of uncertainty. She stated:

I'd come to the Math Emporium and I would be like, 'I have no idea what I'm doing' ... a lot of times I wouldn't like put my cup up, or like ask a question, cause I didn't wanna look like stupid for not knowing.

Sarah reported, "I would just sit there for a certain amount of time and just literally stare at the computer screen and do like two problems." She further explained that she had a hard time even knowing what to do. She said, "I couldn't find myself, like it wasn't a good atmosphere for me to work on homework."

Intentional isolation. Some participants wanted to be isolated; they chose seats in the back of the Math Emporium; they did not ask for help; they wanted to do things on their own.

Adam took a more purposeful approach to the Math Emporium. He mentioned wanting to figure things out on his own. He said, "for the most part, I can just figure it out, and like hash it out on my own, cause that's the way I like to do it". He mentioned being "bull-headed" and wanting "to power through and do my own thing and be like, 'yeah, I did it myself'."

Caleb attributed his isolation to trying to transition from high school to college and stated:

Just like trying to figure everything out. And I think like a lot of it might have been my ego. Like I'm not usually one to ask people for help. I wanna try and figure it out myself.

In addition, he said, "you're working on everything by yourself the entire time" in the Math Emporium.

Violet also reported trying to "work out the problems on my own a couple of times". Similarly, Sarah wanted to work through problems by herself. Jeannette, even though she experienced unintentional isolation and feels of being lost in the Math Emporium, said that she would sit in a secluded area in the back of the Math Emporium. Anna also chose to sit in a secluded area in the back of the Math Emporium to be left alone.

Musical escape. Some of the participants mentioned putting in earphones to listen to music while in the Math Emporium. Steven, Christina, Anna, and Abigail all mentioned a daily routine of sitting down in a chair and selecting music before starting any math work. In addition, Becca reported the same daily routine. Becca said, "I went to a seat and plugged in my musical scores on Pandora so that I could jam to Broadway as I did math." She explained:

If it's a good day, I'd just sit there. I'd twiddle around with my Broadway musicals and have a happy, happy day in the Math Emporium. If it's a bad day, then I sit there, I flounder with math. The musicals help, but not very much cause it's like it's no use listening to tap dancing music when your mind is floundering on a math problem cause it doesn't make you happy.

Self-Doubt and negative attitudes towards developmental math. Participants reported negative attitudes towards the Math Emporium and developmental math. Along with this,

participants expressed low self-efficacy about their math skills and ability to be successful in math courses that stemmed from years of unsuccessful math experiences. The SDQ III results indicated participants did not believe they were good in math. In addition, participants reported on the SDQ III they do worse in math compared to other courses.

When asked about his daily routine in the Math Emporium, Caleb reported not getting to work right away. He said that he knew he “wasn’t going to do good on it [test]. I guess a lot of it was like I had a low self-confidence because of prior experiences in math and testing.”

Abigail said math was a “mixture of boredom and irritation cause it’s not fun at all for me. And I get frustrated with myself for not doing well, and I get frustrated with the subject, I guess, for being something that I don’t need to know.” Abigail referred to developmental math courses “as stupid people math” and “when people would ask me what math I was taking, like ‘I’m taking dumb people math.’” She said it was “embarrassing to be like, ‘I’m an intelligent human being, a halfway grown adult, and I had to take developmental math in college’.”

Leigh spoke in her interview about how her feelings impacted her ability to be successful. She said, “with math, I kinda just felt shut off and I already started putting myself down and feeling like I wasn’t going to succeed.” Her story continued when she shared in the interview about being embarrassed in math classes and how math classes “made me feel like less of a person for not understanding something that everyone else seemed to understand in very simple terms.” Furthermore, she recalled her peers “snickering behind me” and “the teachers would kind of just get frustrated” leading her to feel “awkward and embarrassing” in math classes. In college, she recounts a story of when “a professor called me stupid and that I was as dumb as a rock. And that really cut me off from math right then and there. Like, it was worse than I thought.” When talking about the aspects of the Math Emporium in the interview, Leigh

revealed that “when you are struggling you feel like you are an utter failure, that nothing you are doing is correct.”

When asked how Rosie felt in math classes, she replied with a short, “stupid”. She also revealed that the Math Emporium was “sucky to be in there when you don’t wanna be and you still have to be. And it’s really quiet so it’s kind of awkward... I obviously don’t get math...”

When asked what she does not like about the Math Emporium, Rosie chuckled when she replied, “math”. She explained by adding, “Math is hard anyway.”

Jeannette took the same developmental math course four times, failing each class. She described a typical day in the Math Emporium as getting frustrated, wasting time because she “wouldn’t know the answers”. She felt the atmosphere in the Math Emporium was filled with anxiety and “intensity”. Also, Jeannette mentioned negative attitudes among older professors and teachers in the Math Emporium caused her to think “oh, I hope so and so doesn’t come over here when I put my cup up!” Also, she found the Math Emporium environment “full of high anxiety and stress” and “overall, it was really depressing sitting in the Math Emporium because of all the rules and strictness of it.” She admitted “a lot of weeks I wouldn’t make the required hours” because she “felt ‘I really don’t want to do this’.”

Anna spoke about feeling “like I kinda zoned out because I didn’t think I could understand” math and that she was “frustrated” in math courses. She also admitted to feeling that she wasn’t going to do well in any math course because “I’m not great at math”.

Sarah said, “I was very apathetic about the class because I felt I knew most of the material and didn’t have to try as hard which resulted in me falling behind and not finishing the course.” In addition, she said:

I saw myself falling behind and not really caring enough to pick it back up again... I got all A's all semester, I got one B, and that class I didn't finish, so I felt pretty bad that was one of the easier classes that I could of just got it over with and I didn't.

Sarah reported feeling like the content was too easy and that she did not "like spending so much time on a class that I got over with so many years ago and I just wasn't feeling it when I started it [the developmental math course]."

Violet mentioned "I really don't like math." In addition, she said:

Math is not my best subject. Basically I just, I felt like it came down to this is just not my thing at all. This is just not something I understand... a lot of times it would just make me feel stupid that I couldn't understand basic algebra, you know basic things...I had to work longer at it, and I don't know, I just didn't pick it up as easily as I did reading or stuff like that.

When asked about her placement in developmental math, Christina expressed no desire to do math. This negative attitude was expressed when she said, "I didn't want to do it. I don't like math. It's not my strong suit."

Becca viewed the Math Emporium and her time spent in there as torturous. She said doing math was "like torture for me to sit there and do math." Becca, Rosie, Jeannette, Sarah, Violet, and Christina mentioned that they did not like going to the Math Emporium during the interview.

Success clouded by inability to progress. Many of the participants were able to report successful experiences within the developmental math course; however, in almost every case, participants mentioned getting stuck on one unit or assignment. This stopped their ability to progress in the course and according to participants, ultimately led to their failure in the course.

Steven explained that he felt “successful when I did the work, not successful when I didn’t finish on time.” In the interview he explained that one unit with “problems with letters with absolutely no numbers. And that would just confuse the crap out of me.”

In the interview, Abigail said:

Math 100, of course, it tricks you at the beginning; it’s still the easy stuff. And then all of a sudden it was very difficult. And it was frustrating cause I got stuck in one place and just could never progress past it.

Furthermore, she explained that she could not move past the easy material. She expressed frustration and annoyance “because it’s math and it’s hard, but then to get to such a point and simply fail over and over and over again and not be able to move past it was just awful.”

Becca had a similar experience. She talked about her success in the Math Emporium and reported, “The first two units I was fine. And then it hit... I think it was Unit E. And I could not pass the quiz. And I had to take it like six times before I could pass it.” This set her behind by one week, which she reported, turned into two weeks. After this, she said she could not catch up to her peers. Becca explained how she realized she was going to fail the course and “there was no avoiding it.” She shared how stressed she was in the Math Emporium, often bringing herself to tears in the last week of the semester. On the last day of the semester, Becca shared, “I spent a total of nine straight hours in the Math Emporium trying to get one test done.” Even with a professor’s help:

I was unable to pass and leave the Math Emporium and take my final exam...because I had less than a 70. And like there’s nothing worse than pressing that submit button and having a couple points off of the thing, and going like, ‘...this is my last day. I have to do this’ cause it adds onto the stress. And then you take it again. Then, you get a lower

score. And you take it again, and you get an even lower score. And you think, what am I not doing right because I'm reviewing but it's not sticking? Or it's not doing something.

Rosie reported taking a quiz 10 times and still not being able to pass. She expressed feelings of disappointment and said, "I tried so freaking hard...I was just stuck on that one thing and I couldn't do it."

Likewise, Leigh shared a similar story of starting the semester successfully until "I got to that one part that I didn't understand." She said she needed extra time to work out that section and started to fall behind her classmates.

Jeannette mentioned very minimal and unexpected successful experiences in the Math Emporium:

Like when I would get a right concept, like if a tutor was showing me or I would get a certain unit hammered down and like understood. I like clicked the right answer, and it was then like, "Yes!" Green! But I would type it (the answer) in like not having any idea if this is right or not and then I'd be like, 'Oh! It's right!' So..."

Furthermore, Jeannette was frustrated that she could not get the 80% passing score on a quiz that she needed to move on in the class. She reported:

I remember the last week before finals, I was on one of the last units before I had to take a test and I kept getting like in the 70s, like 75, 72, 79 on this one unit. And I was so frustrated. I spent like 12 hours in here and I could not, I could not get it done.

Christina felt successful when she passed the units, but she got to a point where she was too far behind her peers to catch up and finish the course. She mentioned the units after the first test were more difficult and "more confusing."

Adam said he got stuck on a unit and could not get a passing score on a quiz, even though he took “one quiz like nine times before I got to the next section.” This delay caused him to fall “like three weeks behind.”

Eve also discussed getting stuck on units when explaining why she felt unsuccessful in developmental math class. She said the time requirements made her feel unsuccessful.

The time requirements you have to do every week. And you had to have the units done every week. But I didn’t have them done. A and B had to be done by a certain... [pause] A had to be done by a certain week. B and C. But I felt maybe B and E needed more time. So I was stuck on B as long as I could get it done. Maybe C took 3 weeks instead of 2. You know? But sometimes it would take me longer, maybe 3 or 4 weeks to do unit D. And then the tests. The tests just drive me nuts. But the tests maybe took me 5 weeks. It just deviated. You just never know.

Sarah said she found herself “falling behind and finding it difficult to set aside time to catch up.” She said:

When I was applying myself to the beginning, yea, it was really easy for me, but then, I just figured I didn’t have to put so much time into it, as much as I thought I had to because it was so easy...I started falling behind. It wasn’t a matter of not being able to do the work, but not having enough time to finish it with the amount of time they gave us.

Research Question Two

The second research question focused on investigating what experiences and attitudes impact the students’ mastery of basic math skills. The themes that emerged were (a) fixed mindset, and (b) experiences with teachers.

Fixed mindset. Most of the participants reported lifelong feelings of inadequacy in math that impacted how they perceived their math ability. The participants repeatedly stated that because math was a hard subject, they were not good in math. The themes from the SDQ III results indicated participants hesitate to take math courses, do worse in math courses, and have a history of poor performances in prior math courses. Thus, the SDQ III, interviews and formal responses all solidified the theme of fixed mindset.

Abigail explained, “math has never been my strongpoint at all... basically, I just, I felt like it came down to this is just not my thing at all. This is just not something I understand.” She explained that she had to “work longer at it, and I don’t know, it just, I didn’t, I didn’t pick it up as easily as I did like reading or stuff like that”. When explaining her thoughts on the Math Emporium, Abigail revealed, “I just don’t really like math... I don’t like going in there, but that’s largely because I really don’t like math”. Later in the interview, Abigail said, “I’m not a math person. I don’t like math. It’s not fun for me. It’s not easy.”

Becca agreed with Abigail and further explained:

Math, again, has never been my strong suit so like sitting there, looking at the problems and like, ‘Okay, I’m in college now. I should be better at this. This is basic math. This is algebra. There are people who are in statistics that I am friends with. I’ve got a friend who is a math major who is like a couple things ahead of me, so like when I look at the people around me, it’s like I feel utterly inadequate in the fact that I cannot do math.

Furthermore, Becca said:

I knew I wasn’t very good at it [math]. And whenever I looked at math, it looked more like a foreign language cause it was, it was so many numbers and stuff like that and I’m not good with numbers. I’m good with words, but I can’t do numbers. Um, and even if

they [teachers] tried to help me or whatever, it just... it didn't work cause I couldn't understand the concept and it made me feel inadequate because everyone else was getting it but me.

Rosie bluntly explained why she was unsuccessful in math by stating, "math is hard anyway".

Leigh relayed a very low point in her math class where she encountered a teacher recommending her to drop to a lower math course. She felt she "really wasn't worth the time or effort. I was already a lost cause... It's like I'm not passing math."

Christina not only reported disliking math, but she said, "I didn't want to do it [math]. I don't like math. It's not my strong suit."

Caleb was hoping that college would change his inability to do math. He said:

I was kinda hoping that maybe now that I'm in college and stuff, things would start clicking for me in math. It didn't start clicking because like I realized as far as math goes, I'm not..."

Caleb struggled with focusing in the Math Emporium because "a lot of times if I knew a test was coming up or stuff, I'd kinda like dillydally around just cause like I knew I wasn't gonna do good on it." Caleb's testing anxiety came from a lifelong struggle with math. He remembered:

In high school, I never really studied for any of my tests, but I remember studying for an extensive period for my math test and getting help from the teacher, and then, like, I bombed the test. So I remember that was a moment that really solidified things. Cause I went above and beyond what I usually do and then, I bombed it.

When asked when the last time Leigh was felt successful in math, she replied:

Umm, probably never. I struggled a lot with math and teachers just pushed me along and never really cared... With math, I kinda just felt shut off and I already started putting

myself down and feeling like I wasn't going to succeed...It just seemed like I had to spend triple the time in just math.

She revealed later that she "didn't feel confident in [her] math ability."

Steven mentioned feeling confused in math courses and said, "I was better at history... Everybody has a subject they're not strong in. Mine's math." Similarly, Violet said she didn't pick up math "as easily as I did reading or stuff like that."

Christina knew she was unsuccessful in math because of her struggling grades. Christina explained:

They were always bad. And it was always very hard for me to, you know, get a good grade in math unless, you know, even if I did take four or five hours to study throughout the week, I still would be lacking.

In "sixth grade was when I first started realizing, you know, not up to speed like some of the other kids in my class." She dreaded math class. She recalled:

I didn't want to go. I knew I was going to walk in and be like, 'what's going on?' I just didn't want to pay attention cause I knew it wasn't something I was good at. And having that attitude, you don't wanna, you know, work hard on something that you're so down about.

Anna listed reasons why she knew she was unsuccessful in math.

I just really didn't grasp math. Like, I just wasn't able to manipulate things. I just, it was just... I don't know. I felt like I could never really get deep and actually understand like 'oh I should use this formula because this, this, and that.' It just never really clicked.

Experiences with teachers. Participants reported teacher experiences were impactful in prior learning environments and in the Math Emporium. Participants reported both negative and positive experiences with teachers. Both of these subthemes are discussed below.

Negative experience with teachers. Participants recalled negative experiences in math courses that solidified their feelings of inadequacy in their math skills.

In high school, Rosie mentioned having bad experiences with her math teachers. She recalled:

First of all, my teachers in high school were really bad at teaching. They, some of them, had like anger problems and stuff. So just, they wouldn't even actually teach. And I just didn't understand the rules. And they'd give us homework, and I'd be like, 'I don't know what I'm doing. This is so confusing. I don't even know what this word means.

Anna also shared an experience from high school when she did not understand how her math teacher taught. She said, "I didn't like his teaching style."

Again another participant identified a negative experience with a teacher who did not teach math. Christina shared:

My senior year I had a teacher and she wouldn't teach us. She didn't, you know, she didn't care. She'd just play videos or whatever and you can see, you know, her vision of the class, and it comes out on us as, 'Oh, you don't care if we learn. So why are we gonna, you know, put forth effort and what not?'

For Leigh, her elementary, middle, and high school math experiences were almost completely negative. She said she never felt successful in a math course and "I struggled a lot with math and teachers just pushed me along and never really cared... the teachers would kind of just get frustrated. In high school, she mentioned feeling like her teachers "thought I was being

lazy.” Because her father was in the military, Leigh moved around a lot as a child and teachers would teach math differently, making math difficult to understand and learn.

Jeannette started to identify herself as unsuccessful in math during high school. She said: I remember specifically my teacher in the ninth grade. I didn’t do well in the class and I think it was actually whenever he called on me in class and I didn’t know the answer, and then, ever since then, I was afraid to like raise my hand and say, ‘Oh, like this is the answer’ cause I would be too afraid that it was like the wrong answer.

In addition, she thought her teachers perceived her math ability as poor because she thought she “wasn’t good enough” in math classes.

Becca recounted an experience from fifth grade:

The only time I remember really anybody listening to me about my math is elementary/middle school when I was in fifth grade and I tried doing that weird, 24-multiplication game that they have people do in elementary school. I tried doing that but my fifth grade teacher told me to not even try cause I suck at math so much that I shouldn’t even try to do it... So, that was great.

Violet was homeschooled after sixth grade, but remembered one time in fifth grade:

I went up to my teacher to try and get help for a math problem and she just look at me, and she’s just like, ‘I don’t know how else to help you.’ And then she went on, and you know, tried helping out other students, and I was kind of like, ‘what do I do now?’ and I just went back and sat at my seat and it’s like, well if the teacher can’t help me...

Later, Violet remembered going to her dad for help in math. Although her mother did the homeschooling for the family, her dad was the math problem solver. She recalled:

If we had math problems, we went to our dad. But sometimes that didn't help either cause he learned it a different way and so he would try to explain it his way and it would just make it more confusing because he's *really* good at math. So, I had no idea what the heck he was talking about! A lot of times it was like I don't wanna go to my dad because I'll be just as lost, just a different way!

Adam recalled an experience when he had to drop to a lower level math course in high school. He remembered how:

It was just really awkward for me cause the teacher was known for teaching the general level classes. She treated us like children, like giving out candy in class. Like, it wasn't like that big of a deal, but kind of added the humiliation of dropping down at the same time.

Within the developmental math courses, Adam remembered a negative experience with his first developmental math instructor. He said:

Like my first semester teacher, I don't remember her name, but she was relatively new there. She wasn't a very delightful teacher. She's very...she came off as kind of mean. And so she was kind of rude about it. She was like, 'oh why don't you understand this concept? It's very basic'.

After Eve's interview was over, she spoke with me about her developmental math professors and the impact they had on her success. This participant-led, spontaneous conversation was not recorded, but Eve gave me permission to use it on my study. Immediately after Eve left, I documented our conversation. During member-checking, Eve verified my synopsis of the conversation was correct. Within her developmental math courses, Eve, mentioned her Math 110 instructor was not flexible and constantly reminded Eve that she was behind and not going to

make it. Eve said that she felt a lot of pressure in Math 110 and the instructor did not help her, even thought she was trying to get the work done.

Positive experiences with teachers. When participants shared successful math experiences in elementary, middle, and high school courses, they always reported their success was due to the teacher and isolated to that one specific course.

Abigail mentioned two teachers who positively impacted her math ability:

I had two really good math teachers in high school. One freshman year, Ms. -----, and one either sophomore or junior year, it all kind of blurs together, Ms. ----- . In both cases, like I'm not a math person. I don't like math. It's not fun for me. It's not easy, but both of those teachers had a good personality I clicked with, I guess, but they also explained things in a way that made it easy to understand. And they clearly enjoyed what they were doing so much that it made the whole experience a lot less painful...I had a lot more one-on-one time with them because, like, they cared. And they both expressed their concern that they felt like I could do better if I worked a little bit harder.

Jeannette shared similar experiences in school with a teacher. Jeannette explained:

In seventh grade, I had a really, really good teacher. And I did well in that class because he, I just like clicked with him really well, and he like taught very, very well. That was the only class I can remember feeling like, 'Oh, I did a good job!'

Becca recalled "one algebra class that I did relatively well in. And that was the best feeling in the world. Up until that year, I had been utterly unsuccessful in math at all." She explained her thoughts on why she was successful in that math class and no other math class:

I know that the teacher in that class, um, I was very close to. And I still am very close to.

I still go and visit her at the school and stuff like that cause I like being attached to my

teachers and the people I work with, and everything like that. I like building relationships. I was that kind of child. I don't know if it was the teacher or the structure of learning.

Christina, also, mentioned a good experience with a teacher in high school:

I had a really great teacher. He took things really slow, and he really emphasized on a lot of things, and that was something that I really needed at the time... I didn't look forward to going to math class, but I didn't dread it... I mean, I knew I was gonna walk in and even if I didn't understand what I was doing the first half of class, I knew I would leave knowing what to do on the homework, and how to handle everything. So I think, I definitely felt a lot less stressed. Just having the teacher emphasizing everything and being so careful and slow was really what I needed. He would always, you know, let us come in with a clean slate every single day. He didn't judge us on our past grades that we had gotten. He always would view us as you know, we can accomplish this. We can do well.

Lastly, Eve attributed past math success to a teacher. "She was very – the instructor was very helpful in helping me succeed. She helped me a lot."

Research Question Three

Examining the students' perceptions of developmental math course placement, two themes emerged. The themes were (a) expected placement and (b) good placement.

Expected placement. Participants expected placement into developmental math courses. Out of the 13 participants, 11 mentioned the placement was expected. Only two participants were surprised by the placement into developmental math courses. The following quotes show the context surrounding the participants' explanation as to why the placement was expected and

develop a better understanding of mindset of the participants before they started a developmental math course.

Rosie was not surprised at her placement in developmental math courses, “but I was still really disappointed just because I’d already done all the work like in high school, and I just didn’t want to do it cause I don’t get it.”

Like Rosie, Leigh was not surprised by her placement in developmental math. She said, “it was expected. I am not a good test taker especially with people watching with other students so I always figured I would test lower than what I should with my knowledge.”

Abigail recalled the placement as “it was definitely not unexpected. For sure, I wasn’t... I didn’t assume that I would get the lowest, lowest possible score, but it wasn’t a big shock when I did.”

Anna felt the placement was “expected. Like I’m not terrible, but I’m not great at math.”

Violet had taken beginning algebra at a local community college seven times before transferring to the university. After quite a number of years taking developmental math, she said that she was “not really” surprised at her placement in developmental math because “apparently the grade wasn’t high enough to transfer in.” She explained:

[I] was disappointed, but I was like, ‘okay, so it just means I have to take it an eighth time.’ ... I knew that I passed the class at the community college but I knew that the grade probably wasn’t going to be high enough, so I kind of expected it.

Adam said:

It wasn’t too surprising because I didn’t take the, um, thingy seriously. Like I had forgotten that I needed to do this. I like ran through them really quickly and it didn’t help that I hadn’t had math in a couple of years, so I had no clue what I was doing.”

Steven said, “I’m not going to lie. I did expect it.”

Good placement.

Although two participants did not expect placement into developmental math courses, all 13 participants felt the placement was a good placement for them. Participants explained how placement into developmental math courses would help build math skill deficiencies and a better foundation for future math courses. Caleb was the only participant to think his placement into Math 110 was too high of a placement. He eventually dropped from Math 110 to Math 100; however, overall he felt that placement into a developmental math course was a good placement for him. Steven felt the placement was good, but could not explain why he felt that way.

Even though Eve was surprised by her placement in developmental math, she felt the placement was good for her. She felt developmental math was a good placement because she felt she fit in best where “basic algebra” was being taught.” Likewise, Sarah did not expect her placement into developmental math; however, she said, “I thought it was good because I feel like I needed to be exposed to that kind of math again since I haven’t taken it in so long.”

Rosie thought developmental math was a good placement for her “cause even though I didn’t want to redo all that kind of math and re-learn it, I really needed to because now I’m in steps, and it’s a good foundation.”

Leigh thought developmental math courses “would help build my confidence and help build my math skills stronger so when I get into the college algebra or whatever I need for my degree, it would come a little bit easier because I would have a refresher course.”

Abigail mentioned doing poorly on the placement test and because of that score, placement in developmental math “made sense, but it was frustrating to be in class and already know how to do almost all of it.”

Anna thought the placement into developmental math was a good placement because “I felt like I really liked the program they used cause I actually understood what I was doing.”

Before even knowing if he had to take a developmental math course, Adam wanted to take one. He said, “I had wanted to take it cause I hadn’t taken math in three years.” He explained further about Math 100 placement

It was perfect. Especially because of the position I was in because of my [high] school. I think it was perfect. I actually really, really wanted to take it because I knew if I somehow, by a miracle, did end up in a higher math class, I would have no clue what I was doing. I lost all my foundation, so I really wanted to take it.

Research Question Four

Students’ perceptions of the university’s mathematics emporium model revealed themes of (a) a desire for change (b) overall positive experience with staff and (c) a change in math confidence. The SDQ III results indicated participants are not excited to take math courses, and developmental math courses in the math emporium model solidified this feeling.

Desire for change. There were two subthemes that emerged from the desire for change. The first subtheme was a change in instructional method. The second subtheme was a change in the time required in the Math Emporium. Many of the participants did not like the Math Emporium and wanted things changed.

When asked about his thoughts on the Math Emporium, Adam said:

I absolutely cannot stand it. I can’t stand... I hate going in there. Like I would love to go to a lecture, then do my homework online, all of it, and then like take the quizzes and that kind of things...I’m not a big fan of the math lab... the technological aspect and the distance from where everything else is kind of irritates me.

Desire for change in instructional methods. Most students mentioned a desire to have a traditional classroom or discussed frustrations with the class meeting day. Adam, Anna, Sarah, Abigail felt the class meeting day was useless. The following quotes illustrate these students' opinions on the class day. All of them share similar frustrations with the lecture class, but their reasons are uniquely different. Adam bluntly stated "the lecture was kind of useless" because the instructors "always like give you the option to leave halfway through to do your work and then, like the announcements aren't really anything important." Adam thought developmental math courses should just be "almost completely online."

Anna agreed with Adam and found "no point" to the lecture. She said students said:

I hate going to class... That part, I feel like not that it's a waste, but kind of... Just because, I mean with my professor especially, you have the option to just do homework and not listen to lecture and sometimes no one would come to the lecture. You know lectures, it's like, 'what's the point?' I mean, I didn't listen to the professor. They didn't make us, so it was just kind of like, 'eh, you know'. If the professors aren't gonna actually make you listen to the lecture, I don't see the point really, cause you're doing the same thing you'd be doing out here.

Jeannette believed that:

In the classroom, learning was a lot better cause it's hard just watching a video and trying to figure it out on yourself when you only have the teacher for like 20 minutes that week explaining a unit to you.

Adam mentioned the "the lecture was kind of useless. Like they never really, they always give you the option to leave halfway through to do your work and then, like the announcements aren't really anything important."

Sarah agreed and stated:

[The teacher] gives you the option to listen to her speak or work on homework...

Sometimes I would listen to her, but I usually already knew it so I would just try to work on the homework. I would always go to the lecture class, but I usually never paid attention to the teacher. I would just work on my homework because they give you that option.

Abigail failed to find the purpose in the class meeting. On the formal responses, she recorded this: “attend the once-weekly “class” meeting (This was almost always useless since the professor’s reviewing only helped if I was on the unit they were describing...which I was almost always not.)” She said:

Basically the computer screen is your professor and the chair is your classroom. Like that’s all there is...this interaction between you and the computer. And you can bring in a tutor if you need it, but like there’s not a whole lot of humanity going on. And I’m the type I need face-to-face kind of stuff. Like for me, if I am going to learn, I need someone to explain it to me and show me, and that kind of stuff. I think the Math Emporium, as a class sort of thing, should just be done away with entirely. You can’t base an entire course off of sitting in front of a computer, not a residential course. If it’s an online class, then obviously, you have to do it in front of the computer. But what’s the point of a residential course where you end up doing it online anyway?

Rosie expressed her desire to have a more traditional math course. She explained, “I wish it was all like in a classroom and you did the homework like on a piece of paper and handed it in.” She believes that doing homework on paper “and not on a computer, in a classroom with a teacher, like constantly there. It’s just a lot easier for me.”

Jeannette wished “the teachers, like, have a lot more sessions and time to go through and like teach the students, you know.”

Violet nicknamed the Math Emporium, “the Hell Hole” and proclaimed, “It’s an awful... I don’t, well like I said, I don’t really respond well to learning over a computer. That’s why I chose to come here as a resident student rather than online.” She believed:

If the course has been taught by an instructor instead of a computer that would have helped greatly. Actual class periods are only held once a week so that’s not conducive to receiving timely help and getting the work done.

She mentioned that the Math Emporium “for students that don’t really learn well that way, it’s more of a struggle than it maybe should be... I think maybe it would help if there was a more classroom type of option.”

Caleb also felt that the math emporium model was not a good fit for struggling students. He thought:

If I didn’t have a problem with math, I know I would love it there cause you can just go in, get your work done, and leave. And put in your hours there. But I think for people who struggle like myself, I think there should be offered more classes where you’re with your teacher the entire time like a traditional classroom.

Later on in the interview, Caleb offered his suggestion for changing the math emporium model to better suit struggling developmental math students. He thought, “I think I needed more of like one-on-one with a tutor or like a classroom setting. I think if they just offered a different, I think, like I said the traditional classroom”.

Jeanette found the math emporium model took time away from the teacher helping struggling students through difficult concepts and mentioned the math emporium model added to

her struggles with math. She suggested teachers should have more time to go over sections and teach the students.

Leigh mentioned changing the developmental course and stated:

...[by breaking] it down into month long segments, so for a month you're working on one section and you just go straight at it and get it done. You don't have to go so much week by week, so if you get behind you don't have teachers telling you you're going to fail the course... if you do it in a month long segment all you have to do is pass that one test at the end, just focus on that. You can fall behind, but it's much harder to because if you fall behind you only have those three weeks right there. Whereas if you fall behind at ---- just a little bit, it's your entire semester that's hurting you because you have to make up that extra work which means you have less time to work on the problems before the big test.

Christina had a similar idea. She said, "I don't know if it's possible, but probably doing the two semester math class, I think would benefit quite a few students."

Desire for change in time required in the Math Emporium. Many of the participants did not like having to log an additional hour outside of their scheduled class days to fulfill attendance obligations.

Adam said, "I hated the hours." He said, "I think they should cut the extra hours to have to go for. I had that class like two times a week and I had to go for four hours... I'd stay considerably longer and it's just a huge inconvenience, and the extra hours should be cut."

Eve tried to explain her dislike of the Emporium in her interview. "When the doors close, you are sucked in. You are sucked into the Emporium." She thinks the best change the university could make would be "if you didn't have to go to the Emporium!" Eve also said,

“make the hours shorter” in response to how the university could do that would help her be more successful in developmental math courses.

Abigail jokingly said, “I think if it weren’t a required prison sentence, basically, it would improve that a little bit,” when discussing ways to improve the Math Emporium.

Anna said she disliked the required class time for the Math Emporium and the penalization of attendance points for nonattendance. She suggested “maybe giving the students the option of just doing hours and not having to go to the classes.”

Jeannette gave a few suggestions to improve the Math Emporium. One of the suggestions was to reduce the amount of required hours. “The four hours was a lot of hours for getting, sometimes I would get stuff done and it’d be like, ‘well, I still have time left’.”

Sarah said, “I just didn’t like the idea of you have to fulfill four hours and do it whenever you want, but just get it done.” She had a few thoughts about the time requirements in the Math Emporium:

Like you’re done with the homework for that week and you just have to sit there for another hour and you’re not really supposed to be doing other homework. I don’t understand that.

Overall positive experience with staff. Participants mentioned how they liked the staff at the Math Emporium.

When asked what he liked about the Math Emporium, Adam replied, “just the staff mostly” and shared this experience about one of his developmental math teachers in the Math Emporium:

She would always do laps around the Math Emporium and she knew the students who were struggling with it and she could just like read your face and know if you’re having a

hard time. So, she came and helped. She was a big help... Dr. --- is very warm and I very much enjoyed her class.

Caleb echoed Adam's thoughts and said, "For the majority, I liked the staff that worked there. I felt very comfortable if I had to ask them a question or needed help. They were always very helpful and would go out of their way." Caleb also mentioned his Math 110 professor who:

Was very, very encouraging to me. She actually emailed me... saying how she hadn't seen me in class and was wondering if things were alright. And it was really encouraging to me and I explained to her how I'm really struggling in math right now and how it's just like, I know I'm behind on things and stuff.

Eve mentioned "the tutors are really fun" and helpful. Within her developmental math courses, Eve, also had a great Math 100 professor who helped her pass the course and had a positive influence on her. After failing Math 110 with another instructor, Eve re-enrolled in Math 110 under the same instructor from Math 100 due to having a positive experience with her Math 100 instructor and a negative experience with her Math 110 instructor.

Leigh also mentioned the tutors in her interview. She said:

I like all of the tutors. That as soon as you put a cup up, they will come by and help you. Pretty much everyone that I encountered there was very willing to help, very nice, and if I told them that I did not understand the way they were teaching me, they would go about it in another way that was easier for me to understand. And they were always happy to be in there which is really nice because I was already frustrated and upset. And to have someone come over with a smile and say, 'hey, can I help you?' and then for them to see that I am doing a lot of it correct. They would actually say that I was doing a good job and they would encourage me. And that was great to hear. Cause when you are

struggling you feel like you are an utter failure, that nothing you are doing is correct.

And for them to come and say that at least half of what I was doing was correct, that was really encouraging. It made me feel like I can do this. I'm half-way there. So, I would say definitely the tutors.

Abigail mentioned the tutors and professors. She said, "most of the professors I had were lovely. They tried to help me as best they could, and tried to be supportive. Most of the tutors are pretty nice."

Becca said that her instructor, Ms. --- was:

Definitely a great help. I loved having her as a teacher. She was always a great encourager especially towards the end of the time that I was in the Math Emporium. I started getting more stressed and I would start crying... so I would start crying in the Math Emporium and she was very comforting. So I loved having her in there.

Change in math confidence. The Math Emporium model had differing effects on the math confidence levels of participants. Participants responded an increase, decrease, or neutrality in math confidence levels due to the Math Emporium. More participants reported feelings of a decrease in math confidence due to the Emporium; however, there were participants that stated feeling an increase in math confidence due to the Emporium. The following statements were taken from the formal responses of participants when asked if the Math Emporium made them feel more or less confident in their math ability. All answers were submitted in the participant's own writing and were recorded below.

The following participants recorded increases in math confidence on the formal responses.

Eve: "The math emporium helped me a lot and made me feel confident about my math ability!!"

Rosie: “more confident. The tutors really helped me confident (sic) because they would explain how and why the problem worked they didn’t just give me the answer.”

Anna: “The math emporium has helped me like math more. I feel that MyLabsPlus is an amazing program that helps the student understand math better. I am learning more then [sic] I did in high school.”

Becca: “I feel a bit more confident but it is overwhelming at times. The concept of completing every assignment before the semesters end or the class is an automatic fail adds more stress and fear to math for me. I may not be capable of getting a certain score on a test simply because the material does not stick with me but unless I force my brain to spit out numbers I hardly understand I will fail or it’s a win or die situation.”

Christina: “More confident, my high school math teacher never taught us so it was a big change.”

The following participants responded with a neutral feeling on whether the Math Emporium made them feel more or less confident in their math ability.

Steven: “That aspect did not really change.”

Violet: “The Emporium itself has no real affect when it comes to confidence in my “math ability.”

The following participants recorded feeling less confident in their math abilities due to the Math Emporium.

Jeannette: “The math emporium honestly made me feel less confident. It was very difficult not having someone sit down with you for more than 2 minutes, explaining the concepts. I always felt like a bother to the tutors and professors.”

Sarah: “It definitely made me feel less confident because I was given the option to work whenever so I would find myself falling behind and finding it difficult to set aside time to catch up.”

Adam: “Less, because I didn’t finish the class twice.”

Leigh: “The math emporium made me feel less confident in my math ability.”

Caleb: “Less confident because I got scared come time for tests. I know I can learn things individually, but come time for the test, everything gets mixed up for me.”

Abigail: “LESS, OH MY GOODNESS, LESS. I cannot learn by sitting in front of a computer doing problem after problem. The videos provided with each lesson are absolutely awful. John Squires sounds like he needs to blow his nose all the time, and I never found a single video helpful. I stopped watching them after all. The sterile colors, silence, and oft-unfriendly people made the atmosphere absolutely stifling and nearly impossible to work in.”

Composite Textural Description

The composite textural description focused on a group description of the phenomenon of struggling to complete a developmental math course. Using the above themes, the data revealed the group descriptions of what it was like to struggle in a developmental math course.

Regarding placement within the developmental math course, all but two participants expected the placement and all of the participants thought the placement was good. In addition, participants felt placement in a developmental math course would help build math confidence and lay a foundation of solid math skills for future math courses.

Regarding the participants’ experiences struggling in a developmental math course, most participants expressed feelings of isolation. Participants were more likely to know they were behind their peers in the course and peers did not come to them for assistance in math, which

added to their feelings of isolation. Participants reported feeling as if no one had the time necessary to help them. In addition to feeling isolated due to struggling with the content and being behind their peers, some participants wanted to isolate themselves in order to do the work on their own. Furthermore, participants mentioned physically isolating themselves in the Math Emporium by selecting a seat in a secluded area and plugging earphones in to listen to music.

All the participants expressed negative attitudes towards developmental math or their math abilities. Participants used words like “low self-confidence,” “boredom,” “irritation,” “frustrated,” “dumb people math,” “embarrassing,” “awkward,” “utter failure,” “anxious,” “negative attitude,” and “apathetic” to describe their feelings in their developmental math courses. Furthermore, participants stated they did not like math and hated to be in the Math Emporium. Participants explained repeatedly that math was not their strong subject and readily provided examples of successful subjects. In addition, participants reported a hesitation to take math courses, frequently did worse in math courses compared to other subjects, and believed they were not good in math.

Participants failed to highlight much success in the course and overwhelmingly reported the inability to progress in the course, which led to failure. Many participants experienced easy material at the beginning of the course. This was where they experienced most of their success. After participants got beyond the easy material, they all reported an experience of repeated failures. This added to the frustration of the participants when they would fail quizzes and practice tests multiple times.

Finally, participants desired a change in the math emporium model. Participants stated the lecture was useless for struggling students because the instructors covered material that was beyond where they were at in the course. Participants requested a more traditional math course

and felt they would be more successful if they had a teacher presenting the material each class meeting day. Furthermore, participants reported never being excited about math courses.

Composite Structural Descriptions

Examining the phenomenon of struggling within a developmental math course was not isolated to the collegiate experience. Many participants arrived in developmental math through a long history of struggling within prior math courses. The structural descriptions focused on the background of how participants ended up in a developmental math course.

Almost all the participants reported a long history of disliking math or struggling within math courses. Most participants felt that because they were stronger in another subject, they did not have to be good at math. Participants compared their math ability with other subjects. Participants always reported success in other subjects compared to math and the inability to be successful in a math course. The participants perfectly illustrated a fixed mindset, or the idea that unsuccessful past experiences automatically ensures unsuccessful future experiences.

Participants indicated that teachers had a huge impact on their ability to succeed or fail in a math course. Participants revealed negative teacher experiences that affected their math self-efficacy. During these negative experiences, the participants started to identify themselves as struggling math students; however, some participants were able to have successful math experiences when they had a positive experience with a math teacher. Participants recalled teachers who took additional time to meet with them and go over difficult concepts. All the participants who had positive experiences with teachers said they felt successful in math during the course. Unfortunately, this success was limited to a specific teacher and course.

Textural-Structural Synthesis

Participants had a long history of struggling in math and had multiple stories to explain why they were never good in math. Prior grades, inability to understand mathematical concepts, and extended time spent on homework, quizzes, and tests solidified feelings of inadequacy in participants in math courses. Furthermore, participants recalled specific negative experiences with teachers in elementary, middle, and high school that decreased their math self-efficacy. Participants hesitated to take math courses, reported doing worse in math courses compared to other courses, genuinely believed they were no good in math, and lacked any excitement for the subject. Prior math experiences were not all negative for participants. Some participants mentioned great teachers who helped them succeed within a single math course in middle or high school; however, this success was limited to that specific teacher.

Although participants expected placement in developmental math courses and expressed agreement in the placement, negative attitudes and self-doubt about math abilities were prevalent among participants. Initial success in the developmental math courses among the participants was quickly clouded by an inability to progress in the course. Once participants started to fall behind peers in the course, they expressed feelings of isolation. Participants struggled to catch up once the course increased in difficulty. In order to explain why they struggled in a developmental math course, participants quickly pointed out that math was not their subject. Thus, the participants reported a fixed mindset surrounding mathematical abilities. Participants shared successful subjects and dismissed math as something they would never understand even if they dedicated time and effort into learning. Overall participants did not like the math emporium model and desired a traditional classroom setting or a change in the required hours of the Math Emporium. A slightly majority of the participants felt a decreased in math confidence due to the

math emporium model. Most of the participants reported positive experiences with the staff in the Math Emporium.

Anomalies

Within the research there were two different instances of anomalies that occurred. The first anomaly was revealed in the stories of Adam and Sarah. Both these students were higher performing math students in high school. Sarah was accelerated two years beyond her peers in middle school and high school. She took a college-level statistics course her junior year in high school. Similarly, Adam was in the honors program for much of his K-12 math courses, but his sophomore year in high school, he had to drop to a regular math course. He was not forthright in explaining why he had to drop to a lower-level math course. Sarah and Adam were two of the participants that reported intentional isolation in the Math Emporium and a desire to do things on their own.

Caleb, Jeannette, Adam, and Sarah reported multiple attempts at the same developmental math course in the math emporium model. Jeannette repeated the same developmental math course four times and was still unsuccessful on her fourth attempt. Caleb was placed in Math 110 and failed the course. He decided to drop to Math 100. He failed Math 100 twice before he dropped out of college. Adam failed Math 100 twice and has yet to pass the course. Sarah failed Math 110 twice and at the time of the interview, was concurrently enrolled in Math 110 for the summer through a different university and a statistics course. This second anomaly revealed multiple attempts at the same developmental math course with no successful experiences reported.

Conclusion

Through the SDQ III, formal responses, and interviews, 13 participants shared their experience of struggling to successfully complete a developmental math course in a math emporium model. The themes that emerged from the data were (a) isolation, (b) self-doubt and negative attitudes towards developmental math, (c) success clouded by inability to progress, (d) fixed mindset, (e) experiences with teachers, (f) expected placement, (g) good placement, (h) desire for change, (i) overall positive experience with staff, and (j) change in math confidence.

The themes of isolation, self-doubt and negative attitudes towards developmental math, and success clouded by inability to progress emerged from experiences within the developmental math course. Participants shared stories of unintentional isolation where struggling math students are behind peers in the course and the course continues on without the struggling math students. In addition, participants felt intentional isolation when they chose seats in the back of the Math Emporium and put earphones in to listen to music while in the Math Emporium. All participants expressed feeling of self-doubt towards math abilities and negative attitudes towards the developmental math course. Some participants nicknamed the Math Emporium the “Hell Hole” and developmental math classes, “stupid people math” and “dumb people math”. All participants shared experiences of success within the developmental math course at the beginning of the course, but the success came to a halt when they experienced difficulty in the course. Participants reported unsuccessfully taking quizzes and tests multiple times which ultimately led to their failure of the course.

Two themes emerged from the second research question examining struggling developmental students’ prior math history. The theme of fixed mindset developed from participants’ reports of always being bad at math and prior inability to perform successfully in

math means future failure in math courses. The second theme of experiences with teachers found struggling developmental math students have had successful math experiences in elementary, middle, and high school. All successful experiences reported by participants resulted from a positive experience with a teacher. Likewise, negative experiences with teachers resulted in a decrease in math efficacy and further confirmed feelings of math inadequacy.

Regarding students' perceptions of placement in developmental math courses, all participants with the exception of one expected the placement and thought the placement was good. Participants anticipated learning foundational skills in developmental math courses that would be applicable to collegiate level courses in the future.

Lastly, perceptions of the math emporium model revealed themes of (a) a desire for change, (b) positive experiences with staff, and (c) change in math confidence. Participants were not content with the math emporium model and requested a change back to a traditional classroom or decrease in hours in the Math Emporium. Overall participants reported positive experiences with staff members in the Math Emporium. A small majority of participants revealed a decrease in math confidence due to the math emporium model.

In the next chapter, I will present my personal analysis of the findings from the study. The aforementioned themes, anomalies, theoretical framework of Bandura (1997) and Tinto (2011) and my thoughts will be discussed. The implications, recommendations, and areas of future research will also be covered.

CHAPTER FIVE: DISCUSSION

Developmental math students are arriving on college campuses due to a lack of sufficient and adequate math education in kindergarten through twelfth grade (Jackson, 2014). High school curriculum and the need for remediation are closely related; however, even college-tracked high school students are requiring remediation in college (Bettinger et al., 2013). These students lack math skills necessary to successfully complete college level math courses. The U.S. recognizes the need for quality kindergarten through twelfth grade mathematics instruction and has policies in place to address these inadequacies in education. The predicted 22-million skilled worker deficit in the U.S. by 2018 is catalytic to encouraging swift and drastic changes in curriculum in not only kindergarten through twelfth grade, but also, postsecondary institutions (Parker, 2012). Although attention to kindergarten through twelfth grade educational programs has been ongoing for decades in policies to track educational achievement, the U.S. still faces an epidemic of underperforming students who are enrolling into postsecondary institutions (Cahoy, 2002; Jackson, 2014). Because of the lack of adequate preparation, postsecondary institutions have to remediate math deficiencies among undergraduates in hopes of preparing these students for college level math courses.

Recent research found through tracking Achieving the Dream (ATD) networked institutions that underprepared college students are arriving on postsecondary campuses with large academic deficiencies (Bailey et al., 2012). Enrollment in developmental math courses at postsecondary institutions is high, while progression and retention rates among developmental math students are low (Bahr, 2010; Bailey, 2009; Bailey et al., 2010; Calcagno & Long, 2008; Howard & Whitaker, 2011; Howell, 2011; Koch et al., 2012; Mireles et al., 2011; Remediation: Higher, 2012).

The voice of underprepared math students is rarely heard in literature (Howard & Whitaker, 2011; Jackson, 2014; Koch et al., 2012). Howard and Whitaker (2011) gave voice to successful developmental math students and discovered students' perceptions and experiences from past math courses affect developmental math course success. The history of repeated failures and insecurities about math abilities are brought into the college classroom (Howard & Whitaker, 2011). Koch et al. (2012) found placement into developmental math often leads to negativity towards math on the part of developmental math students. In addition, developmental math students view themselves as having a lower cognitive ability than peers (Koch et al., 2012).

The purpose of this transcendental phenomenological study was to examine the experiences and perceptions of developmental math students who did not meet the university's standard of passing developmental math course. The study focused on undergraduate students enrolled in a developmental math course who struggled and failed to successfully complete the course.

There were four research questions:

1. What was the experience of students who did not pass a developmental math course?
2. What experiences and attitudes impact students' mastery of basic math skills?
3. What are students' perceptions of developmental math course placement?
4. How do students perceive the university's mathematics emporium model?

In order to answer the research questions, 13 participants were given the SDQ III to measure their self-efficacy in mathematics, academics, and problem-solving. In addition, participants were asked to answer formal response questions and interviewed to gather observational protocol and interview questions gleaned from prior qualitative studies (Canfield,

2013; Howard & Whitaker, 2011) and grounded in the theoretical framework of Bandura (1997) and Tinto (2011).

In this chapter, there is a brief summary of the findings with discussions related to each theme. Current literature is interspersed throughout the chapter and provides a clearer understanding of the themes within the discussion. The theoretical framework is revisited with discussions related to the theories and findings. Lastly, the implications of the study, recommendations, delimitations and limitations and areas of future research, are discussed.

Summary of Findings

Chapter Four revealed the data from the SDQ III, formal responses, and interviews using Moustakas' (1994) phenomenological reduction. This process revealed themes of (a) isolation, (b) self-doubt and negative attitudes towards developmental math, (c) success clouded by inability to progress, (d) fixed mindset, (e) experiences with teachers, (f) expected placement, (g) good placement, (h) desire for change, (i) overall positive experience with staff, and (j) change in math confidence.

The themes of (a) isolation, (b) self-doubt and negative attitudes towards developmental math, and (c) success clouded by inability to progress described how participants experienced struggling to complete a developmental math course in a math emporium model. Two themes emerged to illustrate how prior experiences and attitudes impacted students' mastery of basic math skills: (a) fixed mindset and (b) experience with teachers. Concerning placement into developmental education, the themes of expected placement and good placement described the perceptions of developmental math students. Finally, the themes of desire for change, overall positive experience with staff, and change in math confidence were used to describe student perception of the math emporium model.

Theoretical Framework Revisited

Bandura's Social Cognitive Theory – Self-Efficacy

Self-efficacy describes one's own beliefs on whether or not learning is achievable. There are three causations to learning. The causations are (a) behavior, (b) personal factors, and (c) external factors (Bandura, 1997). How a student acts or responds influences the student's ability to learn information. This falls under the causation of behavior. Cognitive or biological events fall under personal factors responsible for learning outcomes. In addition, academic and social environments, or external factors, affect learning.

Self-efficacy in students is based on four factors (a) prior performance, (b) perceptions of other students' learning, (c) positive feedback, and (d) emotional response of the learner (Bandura, 1997). Bandura (2002) asserted that self-efficacy affects student's decisions and actions. Prior research reveals developmental math students have significantly lower self-efficacy due to prior math experiences (Grassl, 2010). Looking at the themes in this study, students' self-efficacy is based on a long history of negative experiences in math and with math teachers. Students did not report any experiences beyond the typical, traditional instructional methods in K-12 math courses. Low grades, long hours spent on math, and peers readily providing answers in math classes while they did not know the answers, were indicators of unsuccessful prior math experiences. This aligns directly with Bandura's (1997) factors that affect positive self-efficacy.

In addition, self-efficacy affects whether or not students will seek help and are motivated by the material (Schunk & Pajares, 2009; Usher & Pajares, 2008). The relationship among self-efficacy and performance in a course was evident in the study when participants expressed intended isolation. The participants who did not want to interact with anyone in the Math

Emporium were part of the outliers of the study. The participants who most clearly stated they wanted to do things on their own were Adam and Sarah. These two participants were high achieving math students in K-12 courses. They repeatedly stated they did not ask for help and wanted to do things on their own in the Math Emporium. Although researchers report this type of behavior is evident in students with low self-efficacy, Adam and Sarah did not report the same lower math self-efficacy of other participants (Schunk & Pajares, 2009; Usher & Pajares, 2008). More than likely, Adam and Sarah placed into developmental math courses due to the extended time lapse between their last high school math course and entering college.

Boylan (2011) equates math skills to a foreign language. Without adequate use and practice, students lose the ability to perform math tasks. Dr. Nolting, a well-known researcher of developmental math, explains the difference between time lapses in math, reading and English courses (Boylan, 2011). Because students are constantly using English and reading skills every day, students who have lapses in English or writing courses between high school and college do not have as significant a deficiency as math students (Boylan, 2011). Algebra skills are not used by students every day and if not used, these skills are lost (Boylan, 2011). Students can finish high school math requirements in their sophomore year. This leaves a two year gap between the last math course taken and a math placement exam for college.

Both Sarah and Adam reported high levels of procrastination, which according to research, is a defense mechanism (Boylan, 2011). Procrastination as a defense mechanism allows students who are unsuccessful to blame failure on external factors. This was a way to manipulate the locus of control from internal to external. Because both of these students reported higher levels of efficacy, logically, Adam and Sarah blamed poor performance on the

external factors of time versus their own inabilities to learn the material and be successful in the math emporium model of developmental math (Bandura, 1997).

According to Bandura (1997) prior experiences are incredibly significant to self-efficacy. Grassl (2010) and Howard and Whitaker (2011) reported negative perceptions of past math experiences among developmental math students. Negative perceptions and low self-efficacy among developmental math students impede academic achievements in math courses. All participants mentioned how they could not progress past a difficult section of the course. Many reasons for this perception of failure included ideas that no matter how much effort and time the participants invested in math, they would never be successful. They carried negative attitudes and self-doubt from prior math courses with them into developmental math courses. Bandura (1997) cautions that high self-efficacy does not assure success, but self-doubt spawns failure. This statement was most clearly evident in Adam's and Sarah's higher efficacy scores albeit failing the same developmental math course twice apiece. The rest of the participants were not confident in their math abilities and openly discussed with an apathetic attitude in the interviews, that math had always been a struggle and they would never understand math. The fixed mindset and perhaps, external locus of control displayed in the participants kept the participants from feeling truly successful, even in the beginning of the course. Although participants experienced some successes within the course, these successes were easily outweighed by the frustrations and difficulties of progressing.

Bandura's (1997) ideas surrounding self-efficacy, along with Howard and Whitaker's (2011) research provided a foundation for studying participants' prior math history and the developmental math courses. Figure 16 illustrates how low math self-efficacy fuels a negative

perception of math ability, which in turn, yields an unsuccessful math experience. Unsuccessful experiences solidify feelings of low self-efficacy.

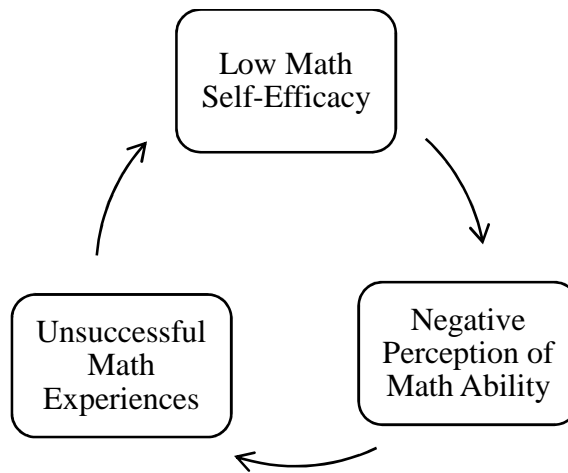


Figure 16. Low self-efficacy perpetuates negative perceptions and unsuccessfully experiences.

Howard and Whitaker (2011) found in their study that successful developmental math students did not report positive math experiences in kindergarten through twelfth grade. In addition, successful developmental math students had a turning point in a developmental math course where they had a successful experience in a developmental math course, which allowed them to have a positive perception of their math ability and aided in the rising of their math self-efficacy. A positive self-efficacy resulted in greater successful math experiences. Figure 17 illustrates this idea of the positive cyclic idea of successful experiences propelling positive perceptions and increased math efficacy.

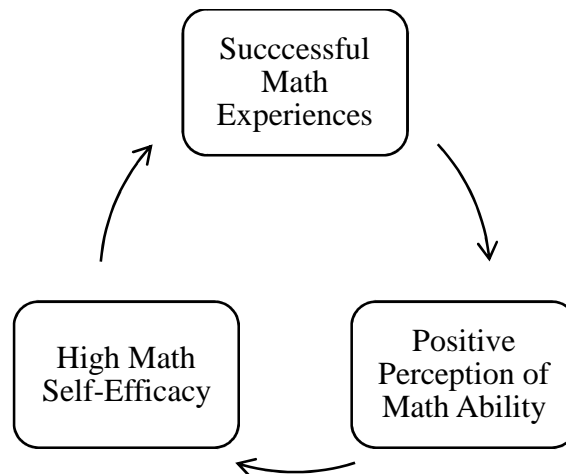


Figure 17. Successful math experiences perpetuates positive perceptions and increased efficacy.

Although Howard and Whitaker's (2011) research showed how successful developmental math students can move from the low math efficacy to the cycle of increased math efficacy through a successful math experience, some of the participants in my study had prior successful math experience in middle school and high school, but they did not continue on the cycle of positive perception of math ability and increased self-efficacy. In fact, the participants in the study pointed out the fact that their success in prior math courses were due to the teacher and not to their abilities. This aligns with the idea that the participants had an external locus of control, or the idea that success or failure is due to external factors that are uncontrollable. This confirmed my initial suspicions that unsuccessful developmental math students will blame their low cognitive abilities on low performances and attribute any successful experiences to external factors. (See Appendix I.) Interestingly, negative experiences with teachers confirmed feelings of inadequacy in middle and high school math courses and further solidified the feelings of low math efficacy. A logical progression of thought would assume that students who attribute successful experiences to a teacher, would also attribute struggling experiences to a teacher;

however, this was not the case. This solidifies the idea that the participants exhibited external locus of control, where all successes and failures are determined by external factors.

Tinto's Retention Theory

Tinto's (2012a) retention theory focuses on retaining postsecondary students through specific university action. The four conditions universities must provide for students to maximize retention are (a) expectations, (b) support, (c) assessment and feedback, and (d) involvement (Tinto, 2012a).

Expectations are a clear determinate of student success. Tinto (2012a) states universities must have consistent, clear, and high expectations of students. Tinto (2012a) warns universities to carefully examine labels attached to students. Labels indicate a message of a lower standard and can have a negative effect on student success. The math emporium model addresses many of Tinto's (2012a) concerns about student retention. The model places high and strict criteria for success within the developmental courses; in fact, all of the participants struggled to earn a mastery level score on a unit which led to increased time spent on one section and falling behind their peers. Unfortunately, the consistent, clear, and high expectations of the developmental math students did not translate into success in the course. Furthermore, 11 participants stated they expected placement into developmental math courses and the placement was good for their math level. Although the participants did not report initial reactions of negativity surrounding placement like the participants in Koch, Slate, and Moore's (2012) study, my participants quickly identified themes of self-doubt and negative attitudes about the math emporium model and developmental math courses. Some participants expressed embarrassment and negativity surrounding the stigma of being enrolled in "Stupid People Math" courses in the "Hell Hole" of the Math Emporium.

Another condition of the retention theory (Tinto, 2012a) was assessment and feedback. The math emporium model utilized immediate feedback, continually assessment, and increased student participation; however, the majority of participants felt unintentional isolation from the content, their peers, and their instructor. Many participants desperately wanted a change from the math emporium model to reflect a traditional classroom setting. Although the condition of the retention theory was met, participants were not successful in the course and desired a change.

Implications

The findings of this study reinforced the theoretical framework of Bandura (1997) and Tinto (2011); however, the lack of qualitative studies on developmental math students have limited the ability to connect this study to prior research. Many quantitative studies have been conducted with the purpose of improving developmental math courses through course redesigns (Ashby et al., 2011; Bettinger & Long, 2009; Hooker, 2011; Navarro, 2007; Rodgers et al., 2011; Silverman & Seidman, 2011; Trenholm, 2009). Unfortunately, these studies did not examine any qualitative factors of the course redesign on developmental math students. The purpose of this study was to examine the experiences of struggling developmental math students, discuss implications and offer recommendations for future developmental math students, faculty, and administrators. Students who struggle to complete a developmental math course within a math emporium model can expect (a) isolation, (b) self-doubt and negative attitudes, (c) success clouded by inability to progress, (d) fixed mindset, (e) positive and negative experiences with teachers, (f) expected and good placement, (g) desire for change, (h) overall positive experience with staff and (i) change in math confidence.

Isolation

Working in a math emporium minimizes instructor involvement and control while encouraging self-regulated, independent learners (Trenholm, 2009). Although very different from a traditional classroom, struggling developmental math learners must understand the need for them to develop self-regulation skills and learn to become a more independent, self-directed learners. The independence and minimal instructor involvement translates to feelings of isolation; however, struggling students must learn how to self-regulate and proactively ask for help when needed. Self-regulation is key in setting goals, evaluating progress, and seeking help in the learning process. Students with high self-efficacy often are more self-regulatory and aware of their progression towards their goals (Fong & Krause, 2014).

Students who struggle in the math emporium model have to overcome more than basic math skill deficiencies and cognitive shortcomings. Some students might perform poorly because they cannot self-regulate their learning or lack the ability to take control of the learning environment. Students with low self-efficacy view struggles and failures as an indicator of poor cognitive abilities (Bandura, 1997); however, this might not be the case. Struggling developmental math students should be prepared to sacrifice feeling the need for more instructor contact in order to develop skills necessary for more independent thinking and learning. Although prior educational experiences in elementary, middle, and high school classes have high levels of instructor control, postsecondary courses require students to take more control of their learning. Developmental math students need to learn how to self-regulate and persist even in difficult courses.

Regardless of whether the isolation is unintended or intended, struggling developmental math students should proactively engage with their instructors, tutors, and peers. Bandura (1997)

explains how perceptions of peers' ability and positive feedback influence self-efficacy beliefs. Instructors, tutors, and peers can provide valuable feedback and realistic amounts of work required to successfully complete a course. Furthermore, building relationships with instructors, tutors, and peers can help in creating a more positive outlook on math courses. Hughes and Chen (2011) discussed the importance of both teacher and peer relationships on academic outcomes and behaviors exhibited by students. Fostering these relationships can have a significant impact on positive attitudes and self-confidence in the classroom.

Self-doubt and Negative Attitudes

Self-doubt and negative attitudes about the math emporium model impede the learning process. These thoughts and attitudes keep struggling students from progressing in a developmental math course and decrease students' motivation for attending math classes and required emporium hours. Furthermore, self-doubt and negative attitudes do not encourage students to be successful in the course, but rather breed discontentment with the math emporium model and increase frustration. Increased frustration, decreased self-esteem, and higher attrition rates are consequences from poor academic achievement (Bettinger et al., 2013).

The biggest concern in this theme was the prevalent negative attitude surrounding the math emporium model and math. Struggling developmental math students should surround themselves with positive peers who can encourage persistence and a more positive outlook. Scheduling emporium time with a friend can help keep students accountable and progressing, even on days when negativity and self-doubt are high.

Wiseman (2003) found that the thoughts and behaviors of people are largely responsible for good fortune, or luck. Wiseman's (2003) ten-year study examined lucky and unlucky people and revealed luck is not innate, magical, or random chance. People have the ability to generate

their own luck based on four guiding principles (a) create or notice unintended opportunities, (b) listen to intuition, (c) positive expectation, and (d) resilient attitude towards misfortune (Wiseman, 2003). Wiseman (2003) suggests people with good fortune deal better with misfortune than unfortunate people. Fortunate people are able to minimize the emotional impact of unlucky events, while people who view themselves as unlucky are more emotionally tense and anxious (Wiseman, 2003). Using the four principles, instructors can help students start to view their unexpected circumstances in a more positive light. There is a potential for change through thoughts and behaviors (Wiseman, 2003). Instructors can help students realize the unforeseen experience of failing a course as an opportunity for positive growth and a change in thoughts and behaviors.

Success Clouded by Inability to Progress

Successfully completing a developmental math course can be incredibly challenging for students who are struggling to understand basic math concepts. Transitioning from instructor-controlled learning environments to more independent learning in the math emporium model can be quite difficult for students with low self-efficacy and math confidence. Struggling developmental math students can expect success within the math emporium model, but there will be units that will require extra work and time beyond the required emporium hours. In order to progress past the difficult units, struggling students must be proactive in asking for assistance, willing to spend more hours than the required time on a unit outside of the emporium, and employ a growth mindset.

Although employing a growth mindset is a long process, one way to start is to encourage struggling developmental math students to change their perspective. Struggling students need to be able to recognize personal success within the math emporium model in other ways besides a

grade earned. Instructors should be readily available to help struggling students identify both academic and nonacademic victories within the math emporium model. Modeling progress for a struggling student and identifying nonacademic victories can provide the necessary encouragement to persist even in the face of difficulties.

Fixed Mindset

A fixed mindset reinforces negative attitudes, behaviors, and unsuccessful outcomes, while a growth mindset can encourage students to view the likelihood that additional effort can lead to successful outcomes. Instructors need to show struggling students that hard work can lead to successful outcomes. Students need instructors to model that unexpected events are normal and can be expected throughout their life (Krumboltz, 1998). The happenstance learning theory (Krumboltz, 2011) focuses on the ability of people to view unplanned circumstances as opportunities for success and provides a guide to follow for helping students. Although struggling developmental math students have failed a course, instructors need to generate a course of action with the student to capitalize on the opportunity to retake a developmental math course.

Krumboltz (2011) recommends specific ideas as guidance to viewing adversity as an opportunity. These ideas are (a) clarify the goal, (b) empathize with the situation, (c) develop a course of action, (d) communicate a course of action, (e) reinforce the action, and (f) overcome fear (Krumboltz, 2011). Instructors need to meet with struggling developmental math students to clarify whether or not successful completion of the course is a goal. Furthermore, the instructor needs to assure students that they understand the struggling students' situation and the feelings associated with the situation. In order to utilize the happenstance theory, instructors and students must together develop, implement, and track the progress of a plan of action. A predetermined

list of new due dates to catch the struggling students up to the rest of the class is not sufficient for empathetically understanding the students' situation and creating a course of action for the student.

In addition, students need to be aware that years of self-doubt and struggles might not be overcome in a single semester. The math emporium model allows students to self-pace; however, struggling students want to finish with their peers and report unsuccessful feelings when they do not complete the course in a traditional semester. Instructors need to help the students realize that persistence that leads to successfully completing the course, regardless of the time frame, is success. Instructors need to help students start to identify innate personal successes and model how to reflect on experiences for areas of weakness and strength. Bandura (1997) warned that low self-efficacy impedes the ability to see successful experiences on internal factors. Instructors need to teach students how to identify internal factors that lead to success and help change the fixed mindset of students.

Experiences with Teachers

Struggling students were quick to reason successful math experiences to past teacher's abilities and relationships. Students insisted unsuccessful math experiences were due to the personal inability to successfully complete any math course regardless of time spent or effort exerted. The inability for struggling students to reflect on the external factors that could have impacted a negative experience is quite concerning. Students need to be able to identify reasons for unsuccessful and successful math experiences while taking responsibility for controllable factors, such as time spent on topics, behaviors that restricted learning, and dismissing uncontrollable factors such as instructional methods used or negative teacher attitudes. Students should be able to recognize how uncontrollable factors play into unsuccessful experiences.

These factors do not reinforce negative abilities but help the students recognize that unsuccessfully experiences can be from nonacademic factors. Unsuccessful experiences do not equate to a cognitive inability. Research suggests that positive relationships between teachers and students can impact the academic and behavioral outcomes in students (Hughes & Chen, 2011). These positive relationships are key for struggling students to help identify that they are capable of completing the course and instructors care about the students (Hughes & Chen, 2011).

Expected and Good Placement

Although prior research suggests placement into developmental math is entirely negative, this study reports students expecting the placement and feeling the placement is good for their college experience (Koch et al., 2011). Tinto (2011) warns the negative labels of developmental education can place a lower expectation on students and lead to students having negative perceptions of abilities. In the study, there was a clear divide between the initial feelings of acceptance and excitement for the developmental math course in the math emporium model and the negative attitudes and self-doubt that plagued the students once the course began. Unfortunately, the expectations of the students did not last very long into the semester and as soon as students experienced difficulty, feelings of apathy and negativity took over. Participants started to identify with past feelings of failures and the perception of the inability to be successful in a math course. Although the math emporium model presented math in a different way than students had previously done math, once students experienced any level of struggle, they quickly resorted back to old patterns of behavior. This makes sense due to the external locus of control of the participants. Students' idea of a successful experience due to the math emporium model was predetermined before the start of the course.

When a struggle ensued with the math content, the external locus of control allows the student to focus and blame the failure on the model and away from internal factors; however, this only accounts for the negative attitudes towards the math emporium model and the desire to change the model. Students still reported low levels of self-efficacy and the inability to successfully perform in a math course. One way to combat external locus of control and low self-efficacy is through the relationships between students and instructors. Instructors need to help identify areas of student control. Students need to move from an external locus of control to an internal locus of control. This can happen by helping students realize how the math emporium model remediates math deficiencies, encourages mastery, and aids in future math success. The math emporium model is only successful when students take ownership of their learning. Students need to be exposed to many examples of persistence in the face of struggles by the instructors. Students need to be able to identify with other successful role models and keep their focus on hard work and persistence.

Desire for Change

Struggling students in the math emporium model want to change the instructional methods or time requirements in developmental math courses. The high independence of the math emporium model may impact students' abilities to persist through difficulties and increase negative attitudes in the math courses. Furthermore, the low instructor control and overreliance of technology to remediate struggle students can lead to jaded attitudes about the math emporium model. Although providing more options for developmental math students through the use of the math emporium model and traditional courses can remedy this situation, providing additional support through increased face-to-face time with instructors can help struggling students see the increased benefits of computer-based instruction models.

Math emporium models that use a class meeting day or lecture course should recognize that all learners are self-paced. Lectures that cover that week's materials may not be appropriate for the struggling student and instructors should make adjustments to reach these types of learners. Postsecondary institutions offering weekly class meetings for the math emporium model need to determine if these class meetings are beneficial for students to attend. If these classes are found to be important to the successful outcomes of students, then schools need to establish weekly classes to cover content for struggling students, too. Students cannot be expected to listen to the instructor, take notes, and apply concepts to future weeks when they are behind in the course. According to the participants, the lecture classes only covered material for the upcoming unit. Struggling developmental math students need applicable lessons delivered face-to-face for their current content and not future content.

Overall Positive Experience with Staff

Helpful and knowledgeable staff is important in the math emporium model. Providing positive feedback and immediate assistance is crucial to the delivery of quality experiences in the math emporium model. Overall the participants were pleased and complimentary of the staff in the Math Emporium. The positive atmosphere created by faculty, staff, and tutors is important to developmental math students. Interestingly, this theme emerged directly from the interview question that asked students to state their thoughts of the Math Emporium. The probe for the interview question asked students to identify things they liked and did not like about the Emporium. In every interview, I had to probe to find out what the students liked about the Emporium. I did not have to probe for something the participants did not like about the Math Emporium. When I asked the participants what they liked about the Math Emporium, most of

them only reported liking the staff. There were no other answers that were given to this question.

Change in Math Confidence

There were inconsistencies in the reports of math confidence due to the math emporium model. Although narrowly, participants reported more decreases in math confidence due to the math emporium model. The aforementioned need for instructor-student relationships could help students identify increases in math confidence due to the math emporium model. These relationships are key for struggling developmental math students.

Recommendations

Challenges are expected for struggling developmental math students in the math emporium model; however, struggling students can overcome these challenges. Struggling developmental math students, developmental faculty members, and administration can use the findings of this study to develop better skills and strategies to employ within the math emporium model to increase student outcomes. Purposefully, there are very little recommendations for struggling developmental math students. These students do not know what they do not know. While students need to learn how to self-regulate and become independent learners, faculty and staff need to provide structured support and opportunities to teach students nonacademic skills necessary for success in college. Faculty and administration cannot expect struggling students to be able to identify areas of weakness, research ways to address the weakness, and implement the change while taking courses at a postsecondary institution. Requiring developmental math students to learn skills on their own is a recipe for disaster. The bulk of recommendations due to this study are placed on faculty and administration because faculty and administration should be able to identify areas of weakness within the curriculum and accordingly adjust the content and

curriculum. Faculty and administration are responsible for remediating developmental math students and should be looking for ways to address developmental students' deficiencies in more areas than just math.

Struggling Developmental Math Students

Expectation of placement into developmental math does not ensure positive feelings and attitudes; in fact, this study illustrated this exact point. Prior research indicated unexpected placement into developmental math courses increased levels of negativity (Koch et al., 2009). Students need learn how to prolong the view that developmental math placement is good and persist in spite of negative feelings.

Decrease in credit hours. Struggling developmental math students can expect to increase the amount of time spent on difficult concepts in order to keep pace with peers in the math emporium model. Struggling developmental math students should understand the recommendation for four hours in the Math Emporium is the minimum amount of time for passing each unit, but a realistic amount of time might be much higher during times of difficulty. Taking a lower number of credit hours while enrolled in a developmental math course can help struggling developmental math students make more time in their schedules to work on longer math concepts.

Delay enrollment in developmental courses. The transition from high school to college is more than academic. Students must learn how to balance academic and social lives while living on their own for the first time. Time management, study skills, and learning environments are all changed from high school to college. Time management and the independence required to be successful in developmental math courses in the math emporium model are crucial. Some first-time freshmen are not socially or academically prepared to handle this independence. The

majority of the participants in the study were freshmen while taking the developmental course, but listed themselves as sophomores due to their current standing with the university. Delayed enrollment in a developmental math course can help students with low math self-efficacy and prior unsuccessful math experiences adjust to the time requirements and independence college requires before taking a developmental math course.

This recommendation must be handled very carefully due to prior research on the time elapsed between the last math course and lower performance in developmental math (Boylan, 2011); however, the research does not indicate if delaying developmental math for students who already have large time gaps between algebra and developmental math leads to lower performance. Institutional research should take place before initiating this recommendation. The university should examine current underperforming developmental math students to determine if the placement score and the time lapse between high school algebra and enrollment in developmental math are all related. Further studies should examine if delaying these underperformers one or two semesters to allow for adjustment to college lends to higher success rates among lower performing developmental math students before fully initiating this recommendation.

Developmental Math Faculty

Participants expressed the need for understanding from instructors and relationships between instructors and students. Prior research indicated, developmental math students have a hard time finding the relevance of the course material and report faculty members lack understanding and are disinterested in teaching (Sierpinska, Bobos, & Knipping, 2008). According to the U.S. Department of Education, the hardest course to pass in four-year institutions is a developmental math course (Bonham & Boylan, 2011). Students view

developmental math as an insurmountable obstacle that will eventually, for some, lead to withdraw or failure (Bonham & Boylan, 2011). Instructors must be aware of the pitfall of overreliance on technology within the math emporium model to remediate math deficiencies among struggling students. There must be safeguards in place to ensure there are interventions in place outside of technology when students are experiencing difficulties (Bonham & Boylan, 2011).

This semester instructors at the university decided to create a quiz review form for students who do not meet the minimum requirements on a quiz. Students have three attempts to pass a quiz with an 80% or higher before they can progress to the next unit. Students who fail all three attempts must fill out a quiz attempt form. This requires the student to comb through all the wrong answers in all three attempts and write them on a chart. Students are instructed to try to solve the incorrect problems correctly and then they meet with a tutor one-on-one. The tutors go over the incorrect problems and help the students identify similar mistakes on the quizzes. After the tutors are confident in the student's ability to retake the quiz, the tutors sign the chart and students bring the chart to a faculty member. The faculty member unlocks a fourth quiz attempt for the student to try again. This remediation technique removes the focus away from technology and forces struggling students to ask for help. In addition, this technique helps students build relationships with tutors and allows them to build confidence in asking for help. This is an excellent way to increase face-to-face instructional time between students and faculty members. In addition, when faculty members are not present, students must rely on a staff tutor or student tutor to remediate the concepts before taking the quiz a fourth time. Modeling how to ask for help and how to reflect on poor performances are great affective strategies that can help

struggling developmental math students learn how to shift from an external locus of control to an internal locus of control.

Another way to help struggling developmental math students is to create firm deadlines for assignments like a traditional math course. Presently, units are divided by weeks. Students must complete all assignments in the unit before the weekly class meeting. This includes watching videos, taking notes, multiple homework assignments, quizzes, practice tests, and tests. While all the assignments have due dates, the due dates are typically all on the same day. This allows students to procrastinate in doing all assignments the night before they are due. Splitting the homework due dates across the week would mirror a traditional course. Traditionally, a student would attend a lecture class and then, work on the assigned homework that would be due before the next class meeting. Likewise, students are required to attend class on their assigned class days in the Math Emporium on non-class days. Students should have assignments due on these class days. Furthermore, incentives can be built into the syllabus that encourage students to work ahead on assignments and pass quizzes with a mastery score prior to the due dates. Faculty should work together to determine incentives, but based on the participants in this study, a decrease in the number of hours for the week would be a starting point.

Instructors in the Math Emporium should be aware of the challenges, both academic and nonacademic, developmental math students bring with them into developmental math courses. A focus on understanding these challenges and researching the best ways to address these deficiencies can help bridge the gap between technology and the need for students to build relationships with the instructor. Developmental math instructors are a large part of student success (Boylan, 2011). Bloom (1976) attributes 25% of math success to instructors, 25% to affective skills and 50% to cognitive abilities. According to Dr. Nolting, "Instructors who know

their students' math background, math study skills level, and learning styles are in a better position to help students succeed in mathematics" (Boylan, 2012, p. 22). Instructors should be required to attend continuing education courses on nonacademic factors that impact unsuccessful students. A focus on self-regulation strategies, increasing engagement, time management, and building relationships with students should be mandatory for developmental math faculty.

Administration

Although similar themes emerged from the experience of struggling in a developmental math course, individual voices were heartbreaking to hear. The struggling developmental math students may need the development of nonacademic skills necessary to successfully complete courses with high levels of independence and low instructor control. The addition of self-regulation skills, enrollment of students into cohorts, or developing traditional sections of math courses specifically for students who have failed in the math emporium model are three ways to address struggling developmental math students. In addition, exit interviews are discussed as a method for gathering data on struggling developmental math students, so that the administration can identify areas of improvement for developmental math.

Self-regulation skills. At this university, a large number of developmental math students are enrolled in the Math Emporium. Understandably, the large ratio of students to instructors make checking in on students and building relationships near impossible. However, there are ways to decrease the ratio, so that instructors are in the Math Emporium more when their students are working on math. Maximizing contact between instructors and students is an important and necessary factor in computer-based learning environments (Jackson, 2014). Building relationships with struggling students can help motivate the students to be more successful and identify ways to teach self-regulatory skills to struggling developmental math

students. In the study, participants recalled positive experiences with teachers and the success they encountered in that specific math course. Furthermore, in the study participants were more willing to ask for help from an instructor than a tutor. Prior research indicates the decreased likelihood of students with low self-efficacy and poor self-regulatory skills of asking for help or monitoring progress. Ensuring instructors are in the Math Emporium and available to struggling students can help students learn to ask for help, provide instructor support for monitoring progress, and help the struggling students push past the unit where they previously were unable to pass.

Cohorts. Furthermore, prior quantitative research compares developmental math students with college-ready math students. Comparing without noting differences that exist between these two student groups can give biased results of outcomes. Bettinger, Boatman, and Long (2013) noted that student motivation and ability are two differences between developmental math students and college-ready math students that are not taken into account in studies and leads to assumptions by the researchers on whether student outcomes are caused by enrollment into developmental courses or due to developmental math students' under-preparedness. Non-academic factors can influence a student's ability to successfully complete a course. Providing services for students enrolled in a developmental math course, such as mentoring or learning strategies, can help underprepared students learn study skills and identify specific academic resources available at the college (Bettinger et al., 2013).

Enrolling developmental math students into a cohort, or a learning community, that pairs a developmental math course with a college-level course, could provide the additional nonacademic resources to improve student achievement within the developmental math course. Learning community models are extensively used among colleges for first-year freshman

(Bettinger et al., 2013). Concurrently enrolling developmental math students into smaller mentoring or learning strategy courses would increase student contact with instructors and allow relationships to develop between instructors and peers while providing skills such as time management, test taking strategies, and other nonacademic skills needed for success in college. Mentoring programs have been shown to increase developmental math student success and retention (Sperling & Massachusetts Community College, 2009; Visser, Butcher, & Cerna, 2010).

Boylan (2011) reported that students who score in the bottom 25% on the math placement exam usually fail the developmental math course. Research should be conducted at the university to determine if this number adequately reflects the developmental math population. If the university determines that the lower quarter of developmental math students are consistently failing the course, the university should require students who test into the bottom 25% on the placement exam to concurrently enroll in a developmental math course and mentoring course focusing on affective skills such as reducing math anxiety, test taking strategies, math study skills, and ways to improve math efficacy (Boylan, 2011).

Instructional method change. Lastly, struggling students identified a desire to change instructional methods and time required in the Math Emporium. Some students had multiple unsuccessful attempts in the math emporium model. Recognizing the nonacademic factors such as student attitude towards math have a large effect on student achievement (DeCorte, Verschaffel, & Depaepe, 2008). In addition, attitude towards math directly impacts self-efficacy, math confidence levels, and student anxiety (Bates, 2007; Bonham, 2008; Bonham & Boylan, 2011; Hall & Ponton, 2005). The influence of affective factors should be examined and addressed when improving developmental math course performance. The disconnect between

positive student expectations and negative feelings in the Math Emporium should spur administration and faculty to examine alternative ways to provide differentiated delivery methods to customize developmental math courses based on student deficiencies in order to increase self-efficacy, math confidence, and overall attitude among struggling developmental math students. Administration should look to partner with advising to create courses for students with the lowest placement exam scores that focus on higher instructor control and less independence on the learner.

Instead of creating different courses, instructor control can be increased through the aforementioned recommendation of more firm due dates on each assignment, instead of weekly due dates. This can assist the instructor in monitoring students who are falling behind more quickly; therefore, addressing the procrastination or delay the day after the one assignment is due versus multiple assignments after a week's worth of work. There can be courses created with less time in the Math Emporium and more face-to-face time with the instructor. Furthermore, courses can be created with the aforementioned cohort courses that will help remediate academic and nonacademic skills necessary for college completion.

Exit interviews. Presently the math emporium model does very little to encourage feedback from students. The setting of the study used end-of-course surveys that allow instructors and administrators a small glimpse into students' experiences in the math emporium model, but this way of collecting data can be impersonal and nonspecific. Many of the participants were thankful for the opportunity to answer questions about their experiences in the Math Emporium and share life experiences. There needs to be a stronger focus on remediating struggling developmental math students in more than just math skills. Bettinger, Boatman, and

Long (2013) suggested viewing developmental education as “an on-ramp to the college experience” instead of a “roadblock” (p. 107).

This illustration requires administration and faculty to identify areas of improvement within the developmental course sequence and provide more support to developmental math students instead of treating developmental math as separate from the college course sequence. The perception from the participants indicated the focus of the math emporium model was to remediate math deficiencies. The weekly class meetings were a way to instruct students on the upcoming week’s material. In addition, participants reported being excused from the class meeting so that they could work on homework because they were behind. Identifying and implementing academic and nonacademic curriculum goals into developmental education can increase students’ feelings of efficacy, motivation, and attitudes towards developmental math. If nonacademic skills were covered in the weekly class meetings, the struggling developmental math students did not receive instructions due to being excused to work on late assignments.

In order to identify areas of improvement, more research is needed on the student population in the Math Emporium at the university. One way to gather this information would be to require all students who fail or withdraw from a developmental math course to interview with the coordinator of the Math Emporium or a faculty member. Questions should be developed by the faculty and staff in the Math Emporium to investigate student perceptions of the math emporium model, motivation, math attitude, self-regulatory skills, and reasons the student believes led to the failure. Results from this interview can help administration and faculty members decide which aforementioned change is necessary to implement in the math emporium model to increase struggling students’ success.

Without changing the curriculum or support a student receives after failing a developmental math course, the more likely the student will repeat that failure (Boylan, 2011). In fact, the likelihood a student will pass a developmental math course will decrease with each subsequent failure when there is no change in the course (Boylan, 2011). Adam, Sarah, Caleb, and Jeannette had taken the same developmental math course 11 times between the four of them. They repeatedly failed the same math course delivered in the same manner in the math emporium model. This is consistent with research that reports students who fail typically receive the same type of instruction that originally led to failure (Boylan, 2011). How many times is it acceptable to fail a developmental math course? Furthermore, at what point do students drop out of college due to repeated failures in developmental math courses?

In addition, exit interviews allow instructors time to meet with students and talk about how unplanned events are not the end of their educational career, but an opportunity to capitalize (Krumboltz, 1998; Krumboltz, 2011). Instructors can clarify students' goals for college and help develop and implement a course of action towards these goals. Assisting students in creating a course of action through reflecting on prior behaviors and actions that impeded successful completion of the course benefits the students and helps develop self-regulation skills. Furthermore, this meeting will help establish a stronger relationship where students feel caring and concern on the part of the faculty and administration.

Delimitations and Limitations

The delimitations of the study were a set of boundaries put in place by me in order to focus the study. I chose to focus the study on struggling developmental math students in a math emporium model who failed to meet the university standard of passing. I wanted to examine the phenomenon of struggling to complete a developmental math course, so I purposeful excluded

students who successfully completed a developmental math course in the math emporium. In addition, I excluded any participants who failed a developmental math course in a learning environment other than the math emporium model. In addition, because the focus was on the students' perceptions and experiences, faculty members and administration were excluded from the study.

The limitations of the study were conditions that potentially limit the scope or affect the outcome of the study. Limitations cannot be controlled. One limitation of the study was the homogeneity of the participants. The experiences and perceptions between a more diverse groups of participants might have yielded different themes. The specific math emporium model used at the university was a limiting factor. The high levels of technology, limited instructor-student contact to one weekly meeting, content delivery and high learner independence in this model affected the learning outcomes of the students. Different math emporium models have differing levels of technology, weekly meetings, content delivery, and student independence. These factors all affect the outcomes of the study. Another limitation was the participants' memory and interpretation of their past mathematics experiences. This will be subjective for each participant and selective based on the memory of the individual. In addition, participants may respond to interview questions in a different way because they know they are participating in a research study. They may try to interpret what is wanted from them, and attempt to produce answers that would please me. Furthermore, the delimitation of excluding faculty members and administration was a limiting factor. This limited the study to only the students' perceptions and experiences, which was the focus, but did not allow for faculty and administrative perspectives.

Future Research

The voice of developmental math students is missing from research, especially struggling developmental math students. Replicating this study with a larger sample across multiple postsecondary universities would provide a richer and fuller description of the phenomenon. In addition, this study should be replicated with the addition of faculty perceptions and experiences. Adding both the students' and faculties' perceptions and experiences together could provide a more balanced perspective and yield more robust recommendations.

While there are numerous course redesigns and quantitative studies to accompany the redesigns, qualitative research is necessary to provide a full, well-rounded view of developmental education. Because of this study, there are many more questions to be answered.

- Is there a relationship between student-faculty contact and increased achievement rates among struggling developmental math students?
- How do instructors perceive the math emporium model?
- How do all developmental math students perceive the math emporium model?
- Does the math emporium model increase math confidence in developmental math students?
- Does instructor perception of the math emporium model affect student learning outcomes?
- In what ways can universities and faculty members better identify, track, and help struggling developmental math students with the resources available?
- Are struggling developmental math students good self-regulators?
- Do struggling developmental math students use the available resources in the math emporium model to help them succeed?

- What nonacademic/affective skills are taught in the math emporium model?

Summary

Utilizing the theoretical framework of Bandura (1997) and Tinto (2012), this study aimed to describe the phenomenon of struggling in a developmental math course. Participants identified themes of (a) isolation, (b) self-doubt and negative attitudes towards developmental math, (c) success clouded by inability to progress, (d) fixed mindset, (e) experiences with teachers, (f) expected placement, (g) good placement, (h) desire for change, (i) overall positive experience with staff, and (j) change in math confidence. Although these themes emerged from all the participants, the unique stories of the individual participants were interesting and necessary for understanding the history of each struggling student.

Because math is not a struggle for me, listening to the participants recall story after story of struggling in math classes allowed me to view developmental math students differently. No longer did I see students who were making excuses, but students who had never been successful and lacked nonacademic skills necessary to be successful in a math emporium model. In addition, the powerful effect of words on students' perceptions of themselves was eye-opening. This study illustrated the power of a teacher's word. A teacher has the ability to inspire and encourage or tear down and discourage. Struggling developmental math students need to hear more encouragement. Quite possibly, a struggling developmental math student has had a history of negative math experiences that cannot be erased in one semester in any developmental math course.

The math emporium model, while effective for remediating math deficiencies, can lead to instructors' overreliance on technology (Bonham & Boylan, 2011). Furthermore, the perception of the participants focused solely on the academic deficiencies and did not address nonacademic

skills necessary for success in the math emporium model. Struggling developmental math students need additional support from faculty members and increased focus on building self-regulatory skills. The biggest factor in helping struggling developmental math students is building caring relationships between instructors and students.

Faculty and administration are responsible for identifying the needs of struggling developmental math students and providing the necessary framework for success within the developmental math course curriculum. While the math emporium model has high success rates, students are still failing developmental math courses offered in this specific course redesign. Administration and faculty members should look for ways to increase student passing rates, even if those rates are low. Although the setting of the study has low failure rates, a focus on increasing student success rates in the math emporium model through affective strategies and remediating students who repeatedly fail in the math emporium model through a different method could further decrease the failure rates. One size does not fit all developmental learners. All learners need to be taught with a variety of strategies to help improve math success (Boylan, 2011). Developmental math students need variety from manipulatives, study skills, and peer interaction (Boylan, 2011).

Regardless of the redesign, administration and faculty members should be identifying weaknesses in the redesign, implementing changes, and tracking student progress through more than just quantitative ways. Through this study, I have been able to see struggling developmental math students have large academic and nonacademic deficiencies. Course redesigns that focus specifically on remediating math deficiencies are missing the larger picture of preparing students for college success through developmental courses. Developmental curriculum should address academic and nonacademic deficiencies. These courses should be

viewed as the process towards a degree and not a stopping point before continuing a degree. These courses need to provide skills necessary for college success and applicable to the developmental student. Implementing nonacademic skills into developmental courses will help students with low self-efficacy learn valuable skills and increase efficacy in all courses. While the focus of this study was developmental math students and recommendations for faculty and administration, it is impractical to assume all remediation must occur within the developmental math department or the developmental math courses. The recommendations for cohorts or learning communities invites other departments to partner with the developmental math faculty to remediate nonacademic skills and help foster more success within the developmental math courses.

This study provides a start for investigating struggling students' perceptions in the math emporium model. There are many questions left unanswered about students who struggle to successfully complete a developmental math course in a math emporium model. A focus on the development of nonacademic skills and ways to address these deficiencies within the math emporium model is definitely a step in the right direction. Furthermore, administration and faculty members should be more aware of these factors and how they can affect the learning process. Truly, there is a need for more qualitative studies on developmental math students in order to understand the whole picture of developmental math education. While redesigned courses are effective at increasing passing rates among developmental students, there are students who are failing in redesigned courses. Further attention to the affective factors that affect developmental math can provide ideas for improvement within redesigned courses and increase struggling students' success, progression, and graduation rates.

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APPENDIX A

Description of the Study

Dear Developmental Math Student:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. Last month, an email was sent to you inviting you to participate in a research study. This follow-up email is being sent to remind you to respond to the link below if you would like to participate and have not already done so. You are eligible to participate in the study if you have taken a developmental math course (Math 100 or Math 110) at Liberty University and received a D or F in the course (or a numeric grade lower than 70%). The deadline for participation is August 31, 2014. If you agree to participate in the study, you will receive your choice of a \$10 Starbucks *or* \$10 iTunes gift card.

If you choose to participate, you will be asked to complete an online questionnaire lasting less than 10 minutes, an online formal response document lasting roughly 20 minutes, and an audio recorded interview via Skype lasting 15-30 minutes. Your name will be requested as part of your participation, but will be kept confidential and your participation will be anonymous.

To participate, click on the link provided below and complete the informed consent form. The informed consent document contains additional information about my research. Please click the submit button at the end of the informed consent document to indicate that you have read it and would like to take part in the survey. The form will be submitted to me and I will provide you with the link to the questionnaire and formal response questions after receiving the document. In addition, we will schedule a convenient time to complete the interview.

Informed consent document:

<https://docs.google.com/forms/d/1DbxLxCfgKoZLoNtupOupDFXhzuG75xrEsTqtMYIBZWQ/v>
[iewform](#)

Sincerely,

Megan Cordes

LUO Graduate Student

mcordes@liberty.edu

9910)382-3958

APPENDIX B

Informed Consent

You are being invited to be a part of a research study that is investigating the experiences of developmental math students. You are a potential participant because you are a Liberty University student who has unsuccessfully taken a developmental math course in the Math Emporium.

This informed consent outlines the study. After reading and signing the document, you are giving consent to participate in the research study. This study is being conducted by Megan Cordes, a doctoral candidate from Liberty University's School of Education. If there are any questions or concerns about the study, please email me at mcordes@liberty.edu.

Participation in this study is voluntary and will not influence your relationship with myself or the university.

How to Withdraw from the Study: You may withdraw from the study at any time without penalty by emailing me at mcordes@liberty.edu and requesting to be withdrawn from the study.

As a result of participating in this study, you will be asked to reflect on your time in the Math Emporium. As a result, you might be aware of unpleasant thoughts or negative experiences in the past surrounding your time in the Math Emporium. There are no foreseeable risks for your participation; however, if you find that you need help managing the stresses or experiences you encountered in developmental math courses, please contact the student advocacy office via email: studentadvocate@liberty.edu or via phone: 434.582.7200. The student advocacy office will be able to connect you with any needed services.

You will receive a \$10 iTunes or Starbucks gift card as compensation for your participation in this study. I will ensure you remain anonymous to protect your identity. You will be given a pseudonym for the study. All digital documents will be stored on a password protected computer and in a password protected folder on my computer. I will not share these passwords with anyone. I will delete all documentation after three years.

What you will do in the study: After signing informed consent, you will receive an email from me. In this email, you will be given a link to fill out a formal response questionnaire. This should take approximately 20 minutes to complete. Afterwards, you will receive an email scheduling an interview and lastly, a link to complete a quick, multiple-choice questionnaire that should take you less than 15 minutes to complete. The interview on Skype will last for approximately 45 minutes and will be audio recorded.

I have read and understand the description of the study and contents of this document. I have had an opportunity to ask questions and have all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this study. I understand that I must be 18 years or older to sign this informed consent and participate in this study. I understand that should I have any questions about this research and its conduct, I should contact the researcher listed above. If I have any questions about rights or this form, I should contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 or email at irb@liberty.edu.

By clicking yes, I agree to participate in this study.

Name: _____

Email Address: _____

Phone Number: _____

Skype Name (if you have an account): _____

Best days/times to schedule a 45-minute interview: _____

APPENDIX C

First Email to Participant: SDQ III Link

Dear Participant,

Thank you for agreeing to participate in my study! Please complete the Self Description Questionnaire III (SDQ III) at:

https://docs.google.com/forms/d/1MBmLWaLx86_gxZIOigRzz5DEotAzj1SuVHaj2iQze-8/viewform?usp=send_form

This questionnaire should take you less than 10 minutes to complete.

You noted the best times for your 45-minute interview is (insert day of the week) at (insert times). Would (insert date and time of interview) work for you? The interview will be conducted online via Skype. The interviews will be audio recorded, so that I can transcribe the interviews for the study.

If you have any questions or concerns, please do not hesitate to contact me.

Thank you,

Megan Cordes
Doctoral Candidate
Liberty University
(910) 382-3958
mcordes@liberty.edu

APPENDIX D
SDQIII©
INSTRUMENT

PLEASE READ THESE INSTRUCTIONS FIRST

This is not a test – there are no right or wrong answers. This is a chance for you to consider how you think and feel about yourself.

This is not a test – there are no right or wrong answers, and everyone will have different responses. The purpose of this study is to determine how people describe themselves and what characteristics are most important to how people feel about themselves.

On the following page is a series of statements that are more or less true (or more or less false) descriptions of you. Please use the following eight-point response scale to indicate how true (or false) each item is as a description of you. Respond to the items as you now feel even if you felt differently at some other time in your life. In a few instances, an item may no longer be appropriate to you, though it was at an earlier period of your life (e.g., an item about your present relationship with your parents if they are no longer alive). In such cases, respond to the item as you would have when it was appropriate. Try to avoid leaving any items blank.

1	2	3	4	5	6	7	8
Definitely False	False	Mostly False	More False Than True	More True Than False	Mostly True	True	Definitely True

_____	1.	I find many mathematical problems interesting and challenging.	_____	16.	I have trouble understanding anything that is based upon mathematics.
_____	2.	I enjoy doing work for most academic subjects.	_____	17.	I am not particularly interested in most academic subjects.
_____	3.	I am never able to think up answers to problems that haven't already been figured out.	_____	18.	I have a lot of intellectual curiosity.
_____	4.	I have hesitated to take courses that involve mathematics.	_____	19.	I have always done well in mathematics classes.
_____	5.	I hate studying for many academic subjects.	_____	20.	I learn quickly in most academic subjects.
_____	6.	I am good at combining ideas in ways that others have not tried.	_____	21.	I am not very original in my ideas, thoughts, and actions.
_____	7.	I have generally done better in mathematics courses than other courses.	_____	22.	I never do well on tests that require mathematical reasoning.
_____	8.	I like most academic subjects.	_____	23.	I hate most academic subjects.
_____	9.	I wish I had more imagination and originality.	_____	24.	I am an imaginative person.
_____	10.	Mathematics makes me feel inadequate.	_____	25.	At school, my friends always came to me for help in mathematics.
_____	11.	I have trouble with most academic subjects.	_____	26.	I get good marks in most academic subjects.
_____	12.	I enjoy working out new ways of solving problems.	_____	27.	I would have no interest in being an inventor.
_____	13.	I am quite good at mathematics.	_____	28.	I have never been very excited about mathematics.
_____	14.	I am good at most academic subjects.	_____	29.	I could never achieve academic honors, even if I worked harder.
_____	15.	I am not much good at problem solving.	_____	30.	I can often see better ways of doing routine tasks.

APPENDIX E

Second Email to Participant: Formal Response Questions

Dear Participant,

Thank you for completing the SDQ III and confirming our interview for (insert date and time).

Please complete the following formal response questionnaire before our interview. The questions can be located at:

<https://docs.google.com/forms/d/1X5QayWF3Mg-Wsb6dfrZFxp0u6Dc50A2rwac5KNiN1Vk/viewform>

The formal response questions should take you approximately 20 minutes to complete. Please try to be as thorough as possible.

I look forward to our interview! If you have any questions or concerns, please do not hesitate to contact me.

Thank you,

Megan Cordes
Doctoral Candidate
Liberty University
(910) 382-3958
mcordes@liberty.edu

APPENDIX F

Formal Response Questions

1. Describe your typical week in the Math Emporium. (Include what you did in class, where you sat, what you brought to class, who you talked to, if/how you asked for help, how you learned the material, etc.)
2. How many hours did you log in the Math Emporium each week?
3. When you encountered trouble, did you go to your professor for help? (Why or why not? What happened?)
4. Did you use the tutors at the Math Emporium? (If yes: Did you find the tutors helpful? In what ways did it help? If no: What is the reason you did not use the tutors in the Math Emporium?)
5. Did the Math Emporium help you feel more or less confident in your math ability? Why?
6. If you could redo your last math course, what would you do differently?
7. What would have helped you successfully complete your last math course?
8. What advice would you give a student who is about to start their first developmental math course in the Math Emporium?

APPENDIX G

Interview Protocol

Before the interview, all participants:

- Will return a signed copy of the consent letter or sign a consent letter.
- Will be reminded that the interview will be audio recorded.
- Will be reassured of anonymity during the study and when the results are published.
- Will be informed that they can discontinue the interview or study at any time.

The following questions will be asked of each participant.

Before Developmental Math Courses

Interviewer Introduction: *The first series of questions are going to ask you about your math experience prior to your current developmental math course. I would like you to think about your elementary, middle, and high school math classes.*

1. Try to remember one of the last times you felt successful in math class and tell me about the situation.

Probe: How did you feel?

Probe: How did you act?

Probe: What did you do?

2. Tell me when you started to identify yourself as unsuccessful at math.

Probe: How did you know you were unsuccessful at math?

Probe: How did you feel?

Probe: How did you act?

Probe: Was there any experience that occurred that confirmed this feeling of being unsuccessful in math?

3. Please describe your teachers' perceptions of you in math class in elementary, middle and high school.

Probe: Were their views similar or different from yours?

Probe: How did you know?

4. Knowing what you know now, what would you change about your K-12 math experience that would help you be more successful in math?

Interviewer Script: *Now, I want you to think about your placement in your current developmental math course.*

5. Tell me how you felt when you found out you would have to take a developmental math course in college?

Probe: Was this placement expected or a surprise?

Probe: Do you feel this was a good placement?

Probe: Why or why not?

During Developmental Math Courses

Interviewer Script: *The last few questions are going to ask specifically about your current developmental math course.*

6. What feelings were generated when you first started your developmental math course?
7. Can you tell me about any successful math experiences you have encountered in your developmental math course?

Probe: How did you know you were successful?

8. How do you feel unsuccessful in your developmental math course?

Probe: How did you know you were successful?

Probe: Did you ask for help to be successful?

Probe: Who did you ask help from?

Probe: How often did you ask for help in the course?

9. Tell me your thoughts on the math emporium?

Probe: Recreate a typical hour in the math emporium.

Probe: What do you like and dislike about the math emporium?

10. What are some changes the university could make to the math emporium to help you be successful?
11. Are there any other thoughts or significant experiences concerning your developmental math course that you would like to share?

APPENDIX H

Third Email to Participants: Request for Review of Interview and Descriptions

Dear Participant,

Thank you for your willingness to participate in my research study. You will find a copy of your interview and a short description of the phenomenon of struggling within a developmental math course attached to this email. Please read over the interview and description. If you would like to clarify or add to any answers, please add your comments to the bottom of the document. After you have read and commented on the document, please send me the edited version of the document. Even if you make no changes to the interview or description, please email

I appreciate the time and effort you have given to this study. You are greatly appreciated. I wish you all the best in your academic and personal endeavors.

Sincerely,

Megan Cordes
Doctoral Candidate
Liberty University
mcordes@liberty.edu

APPENDIX I

My Bracketing Experience

I was an adjunct professor who taught developmental math courses at Hawaii Pacific University on Oahu, Hawaii. In addition, I have taught mathematics refresher courses for students who do not test high enough to get into developmental math courses at a university through Windward School for Adults in Kailua, Hawaii. I have taught math in North Carolina at the middle school and one developmental math course at Coastal Carolina Community College in Jacksonville, North Carolina. Currently, I am completing my Educational Doctorate in Curriculum and Instruction at Liberty University. I obtained my Master's in Elementary Education and Bachelor of Science in Elementary Education from Campbell University in Buies Creek, North Carolina. In addition, I hold a valid North Carolina teaching license certified in elementary education (K-6), math (6-9), science (6-9) and academically and intellectually gifted education (K-12).

Because I am the human instrument during this transcendental phenomenological study, all writing will be in my voice. My voice is influenced by my past experiences and personal thinking processes. I have never struggled in math as a student. In elementary and middle school, I was in the Academically and Intellectually Gifted Program (AIG) for math. While graduate level statistics online during my doctoral degree gave me a difficult time, I attribute this to the instructional method of the course, the instructor, and my life situations at the time. While I attribute a lower grade to outside circumstances, I suspect most of my students attribute lower math grades to a lower cognitive ability. This closely aligns with Bandura's social cognitive theory. Self-efficacy within students are based on four factors (a) prior performance, (b) perceptions of other students' learning, (c) positive feedback, and (d) emotional response of the

learner (Bandura, 1997). In teaching developmental math, I have seen self-efficacy in students through utterances of “I’ve never been good at math,” “I’m good at English, so I can’t be good at math, too!” and “my mom/dad is horrible at math, I get it from her/him”. These statements are powerful indicators of self-doubt and agree with Grassl’s (2010) findings that students’ levels of math self-efficacy are rooted in past math performances. I suspect that students in this study will have a negative perception of their mathematics ability and mention prior poor performance as a reason to explain their current performance in their developmental course. Furthermore, I expect students to discuss a problem with the format and delivery of the math material as a source for low performance. Although this does not align with Bandura’s (1997) self-efficacy thoughts, I feel that this current generation takes very little personal responsibility for their low performances and looks to explain lower performances on external factors. Bandura (1997) would claim that students who struggle with low self-efficacy will blame themselves for low performance. In addition, students with low self-efficacy will explain high performance on external factors, too.

During my teaching experience, there have been very few students who could not handle the concepts covered in developmental math courses. Students have the cognitive ability to complete the course, but consistently tell me that they are not good in math. My past students assume that if they are good in English that means that it is normal to struggle in math. In addition, students can pinpoint when math became difficult and they no longer liked being in class. Another observation from teaching developmental math courses comes from students who are overworked and attending school full time. I have had a number of students get less than two hours of sleep and attempt to attend my math course. They fall asleep in class. While this situation is not cognitive, students will fail to recognize and admit that not getting enough sleep

could affect their math grades. More often than not, students will attribute a low grade to their cognitive ability. In addition, students will often attribute a high grade to a situation and not their cognitive ability.

APPENDIX J

IRB Approval Form

June 27, 2014

Megan L. Cordes

IRB Approval 1908.062714: A Transcendental Phenomenological Study of Experiences and Perceptions of Developmental Math Students

Dear Megan,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Please retain this letter for your records. Also, if you are conducting research as part of the requirements for a master's thesis or doctoral dissertation, this approval letter should be included as an appendix to your completed thesis or dissertation.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D. *Professor, IRB Chair* **Counseling (434) 592-4054**

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APPENDIX K

Permission to Reproduce SDQ III Items

From: Herb Marsh [<mailto:Herb.Marsh@acu.edu.au>]

Sent: Wednesday, November 05, 2014 6:21 PM

To: Cordes, Megan

Subject: RE: SDQ III Dissertation Permission

Happy for you to reproduce some of the SDQIII items as part of your thesis. We are in the process of rebuilding our website.

Send me a copy of your thesis (if convenient) or an extended abstract so I can see what you have done with SDQ data.

Thanks for getting back to me.

HERB

As of 24 February, 2014

Professor Herb Marsh

Herb.Marsh@acu.edu.au

Institute for Positive Psychology and Education

Australian Catholic University, Strathfield NSW 2135

Emeritus Professor Herb Marsh, Education, Oxford University

15 Norham Gardens Rd Oxford OX2 6PY UK

PH:01865 274 041(or +44 1865 274041);FAX:01865 274027

Email: herb.marsh@education.ox.ac.uk

From: Cordes, Megan [<mailto:mcordes@liberty.edu>]

Sent: Thursday, 6 November 2014 8:17 AM

To: Herb Marsh

Subject: SDQ III Dissertation Permission

Importance: High

Dr. Marsh,

Last year while researching data collection tools for my dissertation, I was able to access the SDQ III at the SELF website. The contingency upon using the instrument was to report all findings to the site. Last week, I successfully defended my dissertation and upon returning to the site, there is no place to report my findings. In fact, the website is completely changed. Would you please advise me as to what I need to do with my data that I collected, so that I am following the correct procedures for using the instrument?

In addition, in order to publish my dissertation with questions from the SDQ III, I will need your permission. Would you grant me permission to include the mathematics, problem-solving, and academic portion of the SDQ III in the Appendix section of my dissertation?

Kindly,

Megan L. Cordes
Liberty University
Doctoral Candidate, School of Education