A PHENOMENOLOGICAL STUDY OF THE SHARED EXPERIENCES OF FORMER DEVELOPMENTAL-MATH STUDENTS WHO SUCCESSFULLY COMPLETED A COLLEGE-LEVEL MATH COURSE

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

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ABSTRACT

The purpose of this transcendental phenomenological study was to describe the shared experiences of former developmental-math students who have successfully completed a college-level math course at a college in the U.S. The theory guiding this study is Schlossberg's transition theory as it explains the transitions the students make when entering college-level math, taking the college-level math course, and successfully completing the college-level math course (Schlossberg, 1981). The data was drawn from interviews, an online discussion group, focus groups, and questionnaires. The modified Moustakas method was applied to analyzing the data. The data was examined first by horizonalizing the data, giving equal weight to all of the ideas and topics presented in the interview. The data was analyzed to identify and organize the meaning units and then cluster them into common themes. These themes were distilled into the essence of the phenomenon (Moustakas, 1994). The data was carefully examined to discover common themes and arrive at the essence of the phenomenon. Participants in this study were college students who were enrolled in developmental math and continued on to successfully complete a college-level math course. The main question framing the study was: What are the shared experiences of former developmental-math students who have successfully completed a college-level math course? Sub-questions sought to explore the students' experiences in math classes that preceded enrollment in college-level math courses, their experiences in the college-level math course, and their expectations for the future now that the students have successfully completed a college-level math class.

Keywords: college readiness, developmental math, college success, college-level math, transition theory.

Dedication

To Dan Herman who so very patiently listened to me read this paper over and over again and may have actually been interested.

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List of Abbreviations

American College Test (ACT)

Florida Department of Education (FLDOE)

Institutional Review Board (IRB)

Postsecondary Educational Readiness Test (PERT)

Qualitative Data Analysis Software (QDAS)

Saint Johns River State College (SJRSC)

Scholastic Aptitude Test (SAT)

Virginia Placement Test (VPT)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this transcendental phenomenological study is to describe the experiences of former developmental-math students who have successfully completed a college-level math course. The students are from various colleges in the United States. Chapter One contains a brief explanation of the significance, problem, and purpose of the study. The chapter gives a brief introduction to the research questions and explains the need for this research. The chapter also includes a description of my role within the research, and concludes with definitions pertinent to the study.

Background

A significant number of recent high school graduates and non-traditional students are unprepared or underprepared for college-level work (Bahr, 2008; Hudesman, Crosby, Ziehmke, Everson, Isaac, Flugman, & Moylan, 2014; Sommo, Boynton, Collado, Diamond, Gardenhire, Ratledge, Rudd, & Weiss, 2014). This is a major concern for all stakeholders. One researcher has described these students as college eligible but not college ready (Zelkowski, 2011). They are college eligible because they have completed all of the required high school courses, but they are not college ready because they have not attained a suitable score on a college placement test in several subjects, including math (Zelkowski, 2011).

Current research in the area of developmental education primarily focuses on improving the delivery and completion of developmental math (Benken, Ramirez, & Wetendorf, 2015; Hsu, Gehring, & Society for Research on Educational Effectiveness, 2016; Sommo, Boynton, Collado, Diamon, Gardenhire, Ratledge, Rudd, & Weiss, 2014; Weisburst, Daugherty, Miller, Martorell, & Cossairt, 2017). The studies that do examine persistence into college-level courses

are largely quantitative (Williams & Siwatu, 2017; Wolfle, 2012; Wolfle & Williams, 2014). There are no qualitative studies exploring the experiences of former developmental-math students who successfully complete a college-level math course.

Historical Context

Developmental education has been around for centuries. As early as 1636, Harvard University established remedial classes for students who did not have enough background in Latin to be successful in the courses offered at the school (Dotzler, 2003). Over the next two centuries remediation was provided in the form of tutors (Abraham, Slate, Saxon, & Barnes, 2014). In 1849, the University of Wisconsin founded the first developmental education program. It was called the Department of Preparatory Studies and offered courses in reading, writing, and arithmetic. More than 80% of the University's students were enrolled in at least one of these courses (Abraham et al., 2014). During the 1960s research in developmental education began in the areas of pedagogy, psychology, content, and administration. This research continues today (Dotzler et al., 2003).

Today, developmental mathematics is considered the gateway to college success (Merseth, 2011). The reported statistics on how many students require remediation and their levels of success or failure are varied; nonetheless the statistics are alarming. Hudesman et al. (2014) found that nearly half of the students entering two year colleges required remediation in math, and 60-70% of these students either failed or dropped the developmental-math course. Additionally, only about half of the students who successfully completed the remediation went on to be successful in college-level math classes (Hudesman et al., 2014). Bachman (2013) reported that a third of community college students enrolled in developmental courses. These

remedial courses cost money and affected GPA, but they did not apply toward degree or certification requirements (Bahr, 2008; Hudesman et al., 2014).

Many states have been making significant changes in their developmental-math programs. For example, in the spring of 2012, community colleges in Virginia redesigned their developmental-math program, with four goals in mind:

1. Decrease the number of students enrolling in developmental education,
2. Increase the number of students completing developmental education requirements within one year,
3. Increase the number of students successfully completing college-level math courses, and
4. Increase student success in terms of persistence, graduation, and transfer.

(Virginia's Community Colleges, 2014)

According to the Virginia's Community Colleges 2014 report, these goals were met with varying degrees of success. Enrollment in developmental math decreased from 37% to 30%. Completions of developmental math within one year grew from 35% to 40%. Enrollment in college-level math courses increased by 19%. Successful completion of college-level math courses increased by 17%. It was more difficult to measure the difference in students' success in terms of graduation and transfer; however, success in terms of persistence increased by about 30% (Virginia's Community Colleges, 2014). While these improvements are laudable, researchers still found that 41% of former developmental-math students did not pass their first attempt at a college-level math course. Eventually, 70% passed a college-level math course within two years of completing developmental math (Virginia's Community Colleges, 2014).

Many other states have undergone similar reforms. Florida's MAT1033, Intermediate Algebra, was the focus of one college's Quality Enhancement Program (St. Johns River State College, 2013). The college found that 36% of students who initially enrolled in Intermediate Algebra either dropped or failed the course. Seventy percent of these students dropped out of college within one year. Only 20% of students who were required to take Intermediate Algebra earned their Associate of Arts or Associate of Sciences degree within two years. Students who successfully completed Intermediate Algebra earned elective (not math) credits, and satisfied the prerequisite for a college-level math course (St. Johns River State College, 2013).

The overall prospect for students requiring remediation is bleak (Bahr, 2008, Hudesman et al., 2014). Nationally, less than 25% of developmental students graduated within eight years of their initial enrollment. Many of these students were required to take multiple developmental courses over several semesters. According to another researcher in developmental mathematics, only 31% of students successfully completed the developmental sequence and only half of these students went on to complete a college-level math course (Bailey, Jeong, & Cho, 2010).

Community colleges have been addressing this issue for several years. In 2004, a national initiative called Achieving the Dream was founded by the Lumina Foundation (About Us, 2015). They joined with other leaders in higher education, seeking to maintain academic excellence while also improving student performance. One of the strategies employed by Achieving the Dream involved assisting colleges with their remedial or developmental programs in reading, writing, and mathematics. The goal of Achieving the Dream involved broad institutional change based on student data (About Us, 2015). Achieving the Dream worked with more than 200 colleges in 34 states and the District of Columbia. The program had several areas of focus, which included equity, faculty and student engagement, financial literacy, institutional

change, knowledge sharing, scaling change, state policy reforms, student-centered supports, technology in education, visionary leadership, and workforce preparation (Focus-Areas, 2015). Interestingly, this list did not include anything pertaining to persistence to degree completion.

State legislatures have also initiated programs to address the issue at the high school level. In California, the State Board of Education, the California Department of Education, and the California State University collaborated in establishing the Early Assessment Program. This program attempted to ensure that students were college ready prior to graduating from high school, avoiding the need for remediation in college (Early Assessment Program, 2015).

In Florida, Senate Bill 1908 was passed in 2008, requiring high schools to offer two additional courses, Math for College Success and Math for College Readiness. These courses were intended to mirror MAT1024, Beginning Algebra and MAT1033, Intermediate Algebra. The goal was to provide the remediation students needed prior to their entrance into college or university (Bilsky & Tappen, 2008).

Like Florida, Virginia has introduced a high school math course for seniors who are deemed not yet ready for college-level math, Capstone Math. Capstone Math is designed to "add to students' preparation for college and the workplace by 1) enhancing skills in number and quantity, functions and algebra, geometry, and statistics and probability; and 2) simultaneously reinforcing readiness skills and dispositions in adaptability and flexibility, creativity and innovation, leadership, team work, collaboration, and work ethic (Virginia's College and Career Ready Initiative Grade 12 Mathematics Capstone Course Content and Performance Expectations, 2017, p. 1). Prior to enrolling in Capstone Math, students take the Virginia Placement Test (VPT). If they achieve a qualifying score, they transfer to a different math course. The

remaining students will take the VPT again in the spring (Virginia's College and Career Ready Initiative Grade 12 Mathematics Capstone Course Content and Performance Expectations, 2017).

Social Context

It is in the best interest of society and the individual for college readiness to be addressed. A college degree is considered the "key to a middle-class lifestyle" (Demming & Dynarski, 2009, p. 1). One researcher sums it up nicely:

> The main arguments in favor of earning a college degree are based on college graduates' larger earnings over a lifetime, lower unemployment rates, better health, higher marriage rates, and greater civic involvement. While these advantages for those with four-year degrees are substantial, two-year college graduates also have earnings and other outcomes that are better than high school graduates' are. (Rose, 2013, pp. 25-26)

Students who were not college ready had a significantly lower rate of completing their course of study and attaining their degree (Hudesman et al., 2014).

The writers at Education Corner outlined five benefits of a college education for the individual (Education Corner, 2018). The first was the fact that college graduates make more money. The typical high school graduate will make about $30,000 in a year, while an individual with a bachelor's degree makes about $50,000, and someone with a higher degree makes about $70,000 (Education Corner, 2018). Multiplied over a lifetime of earnings, the differences are even more substantial. The second benefit of a college education includes the benefits that come with a better job such as health insurance, retirement benefits, and other perks (Education Corner, 2018). The third and fourth benefits are tied together in better career opportunities and improved job security and satisfaction. They describe the fifth benefit of a college education as "an investment in your future" (p. 1). The authors point out:

> The benefits of a college education also extend beyond generations. Families of college graduates are generally better off economically and socially. But it is also more likely that the next generation of children will attend college. So you can look at it as an investment in the future of your family. (Education Corner, 2018, p. 1)

While the lack of college readiness impacts society in general, it is particularly concerning for several subgroups of the population. Even though "racial and ethnic gaps in college enrollment have shrunk. The one area in which postsecondary racial gaps have not improved is in college completion" (Roderick, Holsapple, Kelley-Kemple, & Johnson, 2014). In examining racial disparity in STEM programs, one study pointed out that individuals employed in STEM fields "currently earn twice the U.S. median income on average and are characterized by high levels of occupational prestige" (Alvarado & Muniz, 2015, p. 2).

It is clear that the benefits of a college education are substantial and worthy of note. Students who are not college ready will be unable to enjoy these benefits. Students who are unable to make the transition from developmental math to college-level math will also not be able to complete their degree program and enjoy the benefits that a college degree offers.

Theoretical Context

Transition theory, developed by Nancy Schlossberg (1981) has been used for several years as the lens through which to view transitions that college students experience as they progress through various programs. Recently, transition theory was used to investigate the experiences of college students as Supplemental Instructional Leaders (Eller, 2016), high school students with conditional admittance into college (DeVilbiss, 2014), and low-income minority students experiencing "summer melt" (Rall, 2016, p. 462). College is a time of great transition for all students (Chickering & Schlossberg, 1995). Schlossberg's transition theory clearly

applies to the transitions that developmental-math students experience as they navigate their way through developmental math and on to college-level math.

Situation to Self

There are several reasons why this study interests me. I have been involved at all three levels of education in higher level math. I have taught many different high school math courses, including Capstone Math in Virginia and Math for College Readiness in Florida. These courses are designed to mimic the developmental-math courses at the local community colleges. I have taught both developmental math and college-level math at a local community college. I am very interested in encouraging/enabling students to persist through to success in college-level math. High school or college can have a great developmental-math program with students successfully completing the developmental-math course sequence, but what good is that if they cannot or do not continue on with success in college-level math? As a teacher, I have a variety of opinions about why students do or do not persist in their math educations. I am interested in the students' point of view. I believe this information is of value to all stakeholders.

I approach this research from a constructivist point of view: "Constructivism as a paradigm or worldview posits that learning is an active, constructive process. The learner is an information constructor. People actively construct or create their own subjective representations of objective reality" (David, 2015, p. 1). Because learners are active participants in the learning process, it is important to explore their views, thus, a qualitative approach is appropriate.

This constructivist point of view comes out of an ontological perspective where "reality is multiple as seen through many views" (Creswell, 2013, p. 21). By interviewing multiple students, rather than a single student, greater insights will be obtained. Also, by interviewing students from varied geographical locations, the results of this study are strengthened.

Epistemologically, it is important that I am careful with my questions. It is important that the researcher "relies on quotes as evidence from the participant" (Creswell, 2013, p. 21). I have been a stakeholder in this issue; therefore, it is especially important that I strive to separate my views from the views of the students I am interviewing. This will also be important in formulating the research questions and sub-questions. It is vital that I not lead the participants in any particular direction.

Problem Statement

The problem is that a large number of high school graduates are entering college unprepared for college-level math (Cafarella, 2014; Davidson & Petrosko, 2014; Fong, Melguizo, & Prather, 2015; Hudesman, Crosby, Ziehmke, Everson, Isaac, Flugman, & Moylan, 2014). Forty to sixty percent of community college freshmen need developmental education (US Department of Education, 2017), and more need math than anything else (Davidson & Petrosko, 2015). Furthermore, as many as 80% of the students enrolled in developmental math do not go on to successfully complete any college-level math courses (Sommo, Boynton, Collado, Diamond, Gardenhire, & Ratledge, 2014). Recent research on this subject is largely quantitative (Williams & Siwatu, 2017; Wolfle, 2012; Wolfle & Williams, 2014). The qualitative studies are concerned with the instructors' perspectives of the developmental-math students' experiences, or with the students who are successful in developmental math with no mention of college-level math (Bachman, 2013; Howard & Whitaker, 2011; Zientek, Schneider, & Onwuegbuzie, 2014). There is currently no research giving voice to successful college-level math students who began their math education in developmental math.

Purpose Statement

The purpose of this transcendental phenomenological study is to describe the shared experiences of former developmental-math students who have successfully completed a college-level math course in various community or state colleges in the United States. At this stage of the research, former developmental-math students are understood to be students who were either required or encouraged to enroll in developmental math at a community or state college, or were required or encouraged to enroll in an equivalent class their senior year of high school. The theory guiding this study is Schlossberg's transition theory, as it explains the transitions the students make entering college, enrolling in and successfully completing developmental math, followed by enrolling in and successfully completing college-level math, and finally making plans for the future (Schlossberg, 1981).

Significance of the Study

The inability to successfully complete developmental math is the most common reason that college students do not complete their programs and/or graduate (St. Johns River State College, 2013); however, completing developmental math does not necessarily mean that college-level math will be successfully completed. According to Hudesman et al. (2014), 50% of students who successfully completed developmental math did not continue on to successfully complete college-level math. Investigating the factors that enabled the 50% who were successful would be significant. From a practical point of view, the common experiences of successful, college math students who were formerly enrolled in developmental math may very well inform the practices of stakeholders in developmental and college-level math, students, teachers, administrators, and institutions. Okimoto and Heck (2015) pointed out: "completing developmental requirements, passing college-level math, and earning a year of college-level

credits seem to be critical milestones toward eventual degree attainment" (p. 633). Koch, Slate, and Moore (2012) investigated the perceptions of students who were enrolled in developmental math. No one has examined the experiences of these students as they progress through college-level math. This empirical perspective is vital to understanding why these students were successful in transitioning from developmental math to college-level math. Theoretically, exploring the lived experiences of successful, college-level students will inform the development and delivery of both developmental math and college-level math, so the institutions and instructors can better serve their students.

The results of this study add to research on how Schlossberg's transition theory (1981) applies to the experiences of adult learners as they transition out of developmental math and into college-level math. The results of this study also add to research on college readiness and on how to help developmental students continue on their educational journeys as well as achieve their goals. Ultimately society benefits as more adults enter the workforce with college degrees.

Research Questions

This study explores the shared experiences of former, developmental-math students who have successfully completed a college-level math course. The data is gathered directly from the students. Schlossberg's transition theory (1981) is the lens through which the data is analyzed, with a focus on the students' related experiences as they transitioned out of developmental math and through college-level math.

Central Research Question.

What are the shared experiences of former, developmental-math students who have successfully completed a college-level math course?

It is not enough that students successfully complete developmental-math courses. They must continue in the course sequence and complete the math courses necessary for their degree or certificate (Okimoto & Heck, 2015). Using the lens of Schlossberg's transition theory (1981), the progress of the students moving into college-level math via developmental math, moving through college-level math, and moving out of college-level math is examined (Schlossberg, Waters, & Goodman, 1994).

Sub-question One

What were the early, prior-to-college, experiences of the participants?

Many early factors influence college readiness in recent high school graduates. High school GPA was found to be the best indicator of future college success (Acosta, North, & Avello, 2016). Course choice in high school did not guarantee college readiness (Benken, Ramirez, Li, & Wetendorf, 2015). Developmental students believed that they were not adequately prepared for college education in high school (Bachman, 2013).

Sub-question Two

How do the participants describe the impact that developmental math had on their success in the college-level math?

For some individuals, developmental math became a barrier for persistence into college-level math (Hsu & Gehring, 2016). The delivery method of developmental education does not serve as a predictor for college-level success (Acosta, North, & Avella, 2016).

Sub-question Three

Why do the participants believe they were successful in college-level math?

There is some research about why students believe they were successful in developmental math (Bachman, 2013; Howard & Whitaker, 2011). There is no research exploring why students were successful in college-level math.

Sub-question Four

What does the completion of a college-level math course mean for the future of the participants?

The inability to successfully complete college-level math has proven to be a major barrier to degree completion (St. Johns River State College, 2013). When students successfully complete college-level math, they are much more likely to complete their program of studies (Okimoto & Heck, 2015).

Definitions

There are several terms that are specific to this research. The following is a list of terms used throughout this research. These terms may have various meanings in other contexts therefore they are being defined based on the literature used to investigate this topic.

1. *Developmental math* – college remedial math courses designed to prepare students for college-level math courses. These courses cost money but do not count toward the pursued degree (Hudesman et al., 2014).
2. *College-level math* – math courses that are credit bearing and apply toward an associate degree (Davidson, 2016).
3. *Community College or State College* – a local post-secondary institution with open enrollment (Beebe, 2015).
4. *Transitions* – a process over time that results in a multitude of changes (Schlossberg, Waters, & Goodman, 1994).

5. *Moving in* – the first of three stages of a transition, when the transition is new and unknown (Schlossberg, Waters, & Goodman, 1994).
6. *Moving through* – the second of three stages of a transition, when the transition is ongoing and being lived (Schlossberg, Waters, & Goodman, 1994).
7. *Moving out* – the third of three stages of a transition, when the transition is wrapping up (Schlossberg, Waters, & Goodman, 1994).
8. *Transcendental phenomenological research* – the process of gathering data from multiple sources in various formats, bracketing out the opinions, ideas, and preconceived notions of self, and analyzing and reducing the data into themes to identify the essence of a phenomena (Creswell, 2013).

Summary

Many incoming college freshmen are unprepared for college-level work, especially in math (Hudesman, Crosby, Ziehmke, Everson, Isaac, Flugman, & Moylan, 2014; Sommo, Boynton, Collado, Diamond, Gardenhire, Ratledge, Rudd, & Weiss, 2014). There is a high degree of interest and effort in enabling students to be successful in developmental math (Cafarella, 2016). Even when students are successful in developmental math, many do not continue on to success in college-level math (Hudesman et al., 2014; Virginia's Community Colleges, 2014). Qualitative research investigating the factors that lead to success in transitioning from developmental math through college-level math and beyond is needed. The viewpoints of students who began their postsecondary educations in developmental math and made it successfully through college-level math is of value to all stakeholders in mathematics education.

CHAPTER TWO: LITERATURE REVIEW

Overview

This chapter gives an overview of the literature and theoretical framework that guides this research on success in college-level math. It will include a discussion of the theoretical framework as well as research in improving developmental math, college readiness, persistence into college-level math, and the role of college placement tests. Specifically, the chapter will include a brief description of developmental-math education, a description of the available college placement tests and how they are used, a definition of college and career readiness, and a synthesis of the current research concerning developmental-math education and persistence into college-level math. The chapter will conclude with a description of the gap in the literature pertaining to successful completion of college-level math following successful completion of developmental math.

Theoretical Framework

The theoretical framework is the foundation for the research plan in a study. It is the lens through which the data is viewed, analyzed, and synthesized (Grant & Osanloo, 2014). It guides the development of the purpose statement, problem statement, significance, and research questions (Grant & Osanloo, 2014). In this section the theoretical framework that is the foundation for this study will be outlined and explained.

Transition Theory

Transition theory was developed by Nancy Schlossberg (1981). She began developing her transition theory as she was experiencing personal transitions (Schlossberg, 2011). At the time, she was a newlywed who had moved due to her husband's job to a new city. She was having difficulty processing why the move was so challenging for her. This experience

eventually morphed into an interest in how geographical moves affected adults. Originally she applied her theory in the context of counseling, particularly counseling adults in transition (Schlossberg, 2011). She later expanded to applications in education, retirement planning, and employment counseling. She has written several books about adults in transition. Her most recent publication is about how to enjoy retirement (Schlossberg, 2017).

Schlossberg applied transition theory to adults moving in, moving through, and moving out of life events involving transitions. These transitions include both anticipated and unanticipated events. Anticipated events could include such things as, graduation from high school or college, the birth of a baby, marriage, job changes, etc. Unanticipated events could include such things as a death in the family, job loss or relocation, a long illness, a debilitating accident, etc. Transitions also include what Schlossberg called non-events. Non-events are anticipated events that do not occur, such as not receiving a promotion, or not being accepted into graduate school. Often, these non-events are also silent or private. When a family relocates everyone is aware of the transition. When an individual does not receive a promotion, it is often not discussed. The individual deals with it alone (Schlossberg, Waters, & Goodman, 1994).

In dealing with transitions, Schlossberg identified four key elements or resources. They have become known as the four S's, supports, self, situation, and strategies. Schlossberg maintained that the difficulty or success of the transition depends on the strength of these four elements. She also identified three major parts of the transition model, approaching transitions, taking stock of coping resources, and taking charge (Schlossberg et al., 1994).

When approaching transitions, the transition itself and the transition process need to be identified. A transition is "any event, or non-event, that results in changed relationships, routines, assumptions, and roles" (Schlossberg et al., 1994, p. 27). Transitions do not refer to a

single event, although they may originate from a single event. Transitions occur over time. This process of time could be a few weeks, or multiple years. It depends on the nature of the originating event and the type of transition (Schlossberg et al., 1994).

Taking stock of resources refers to the four S's, situation, self, support, and strategies. Schlossberg identified these four elements as crucial for effectively coping with any kind of transition. Individuals bring varying degrees of strength or weakness in each of these areas. In dealing with a transition, it is important for the individual to be able to identify strengths and weaknesses in each of the four S's in order to more effectively cope with the transition at hand (Schlossberg et al., 1994).

Situation encompasses multiple aspects of transition. Situation refers to the origination of the transition. What is the catalyst for the transition? It could be the result of a normal life transition such as graduation, or it could be the result of a trauma such as the illness or sudden death of a loved one. Situation also refers to the timing of the transition. Is this transition expected or unexpected, sudden or gradual? Situation refers to the perceived benefits or consequences of the transition. Does the individual experiencing the transition look forward to the change or dread it? Previous similar experiences are part of the situation aspect of a transition. Perceived control over the situation also comes under the situation aspect. The length of time the transition will involve as well as co-occurring stressors are part of the situation aspect of a transition. Finally the possible required role changes involved in the transition are part of the situation aspect of a transition (Schlossberg et al., 1994).

Self factors are both demographical and psychological. Demographic factors are those things that can be quantified. These include things like age, gender, ethnicity, socioeconomic status, level of education, and health. Psychological factors are those things that can be

evaluated. They include sense of self, commitment, values, and psychological health (Schlossberg et al., 1994).

Support structures include a variety of support sources. These are things like the support of family and friends. Does the extended family support or recognize the challenges in the transition? Another form of support can come from institutions. Colleges have support systems in place for the students. Are these supports effectively meeting the needs? The community may also provide some form of support, such as the public health department (Schlossberg et al., 1994).

Strategies for navigating a transition include things that modify the situation, control the meaning of the situation, or aid in managing the stress of the situation (Patton, Renn, Guido, & Quaye, 1998). For example, a transition that involves a move could be modified by part of the family moving first, with the other part moving later. Controlling the meaning of the problem could involve deliberately investigating the positive outcomes of the transition. Managing the stress of the transition could include involvement in formal or informal support groups for people dealing with similar transitions, such as a group for parents of college age students (Schlossberg et al., 1994).

Taking charge during the transition involves strengthening one's resources. With anticipated, planned transitions an individual, family, or group is able to identify their strong resources, and the resources that might need strengthening. For example, when a family is facing a move family members can make specific plans to find ways to connect with people in their new location. With an unanticipated transition, these resources can be accessed and strengthened during the process of the transition. For example, when facing a sudden illness or

loss, individuals or families can seek out emotional and psychological help (Schlossberg et al., 1994).

Transition theory lends itself well to studying colleges, college students, and their experiences. This theory is so applicable in this arena that several books have been written about it. Chickering and Schlossberg coauthored *Getting the Most out of College* (1995), a book directed to the student. Prior to writing this book, Lynch, Schlossberg, and Chickering wrote *Improving Higher Education Environments for Adults: Responsive Programs and Services from Entry to Departure*, a book directed to institutions.

Chickering and Schlossberg's advice to students who are in the moving in stage of their transition was to be aware that "your daily routines, relationships, and responsibilities will change. You will assume some new roles, engage in a variety of new activities, meet a complex set of new challenges" (Chickering & Schlossberg, 1995, p. 3). This is the beginning of the college transition. The students need to evaluate the impact of this transition on their lives by considering how it changes relationships such as child, family member, student, or friend. The transition will affect routines, relationships, and assumptions about oneself. All of these things must be considered in order to best navigate the transition (Chickering & Schlossberg, 1995). It is also during the moving in period in a transition that students need to take stock of the resources that are available, the four S's, situation, self, supports, and strategies (Chickering & Schlossberg, 1995).

During the moving through part of the transition the students must become aware of and use strategies for gaining the most from the college experience. These strategies may involve learning how to take notes, study, form study groups in order to improve learning in the

classroom. They may also involve adjusting to college life outside of the classroom (Chickering & Schlossberg, 1995).

Finally, college students must work through the moving on stage of the transition, answering the question of what's next. Ironically, this question marks the end of the college transition and the beginning of the transition into the working world. Chickering and Schlossberg point out that transitions are challenging and can make one feel unsettled, but these unsettled feelings will not last forever. Individuals have varied resources to deal with transitions (Chickering & Schlossberg, 1995).

Transition theory applies so well to the transitions that college students experience that many researchers have used it as the lens to study a wide variety of transitions that college students face. Transition theory was used to analyze the experiences of adult learners transitioning into college (Karmelita, 2017). Schlossberg's transition theory was used to examine the experiences of students who have been conditionally admitted into college (Devilbiss, 2014). The experiences of minority students have been examined through the lens of transition theory as they transition into a predominantly white institution (McCoy, 2014). Transition theory has been used to examine the career development of an African immigrant in the United States (Mims, Mims, & Newland, 2009). It has been the theory underlying a study examining the wellbeing of individuals who experienced divorce after the age of fifty (Bowen & Jensen, 2017). The experiences of first year teachers who are career switchers have been analyzed using transition theory (Haim & Amdur, 2016). There have even been studies examining the role of librarians in college students' transitions into their second year (Black, 2014), as well as coaches' perspectives of athletes' transitions in college (Bjornsen & Dinkel, 2017) using transition theory as the theoretical framework. Multiple studies have been done with

transition theory as the lens to investigate the experiences of veterans in entering and remaining in college (Griffin & Gilbert, 2015; Heitzman & Somers, 2015; Schiavone & Gentry, 2014).

The current study adds to the literature in the area of transition theory by investigating the experiences of successful, college-math students following developmental-math enrollment through the lens of transition theory. Students who began their college-math experience in developmental math and successfully completed a college-level math class likely made use of the resources Chickering and Schlossberg (1994) describe in order to make this transition that many students are unable to successfully complete. Hopefully, the results of this research will add to the long list of previous research that has both utilized and supported transition theory. Much of this research has been in the area of developmental-math education.

Related Literature

The literature related to this topic is varied. It includes studies in developmental math, persistence, college readiness, and college placement exams. Included in the studies concerning developmental math are many current programs (Cafarella, 2016). Persistence is defined as continuing in a course sequence, persisting to degree, or persisting to certification (Choy, 2001). College readiness encompasses both academic readiness and the soft skills necessary for college success (Conley, 2012). College placement exams are the means by which college readiness is often evaluated (Balfanz, DePaoli, Ingram, Bridgeland, Fox, Civic, & Johns Hopkins University, 2016). This section will begin with an examination of the current research in developmental math and continue with a discussion about persistence, before describing the concept of college readiness. Finally the role of college placement exams will be examined.

Developmental Math

Students needing remediation in college are either required or encouraged to enroll in their school's developmental program. Most, but not all, developmental college education is accomplished at the local, community or state college (Bachman, 2013; Bahr, 2008). One group of researchers in Louisiana found that "students who completed developmental-mathematics courses at a four-year university were 20% less likely to successfully complete college algebra than students who completed developmental mathematics at a community college" (Williams & Siwatu, 2017, p. 24). Other researchers found that the developmental programs offered at universities, often called bridge programs, were quite effective (Duranczyk & Higbee, 2006; Frost & Dreher, 2017). Wherever it is offered, developmental mathematics is considered the gateway to college success (Merseth, 2011). The reported statistics on how many students require remediation and their levels of success or failure are varied; nonetheless the statistics are alarming. Hudesman et al., (2014) found that nearly half of the students entering two year colleges required remediation in math. They reported that 60-70% of the students requiring remediation either failed or dropped the course. Additionally, only about half of the students who successfully completed the remediation went on to be successful in college-level math classes (Hudesman et al., 2014). Bachman (2013) reported that a third of community college students enrolled in developmental courses. This is particularly concerning for low-income and minority students (Carnegie Foundation for the Advancement of Teaching, 2017). These remedial courses cost money and affected GPA, but they did not apply toward the degree or certification (Bahr, 2008; Hudesman et al., 2014).

The increasing numbers of college students requiring remediation has drawn media attention. Members of the public are asking why so many students need remediation after successful completion of high school, and who is paying for it? When remedial students earn a

degree against the odds, their income is significantly and positively affected (Attewell, Lavin, Domina, & Levey, 2006). As a society, it will benefit us economically to improve developmental programs so a much higher percentage of these students can be successful. Imagine the benefits if a significant percentage of the students enrolled in developmental classes go on to graduate: "Completing developmental requirements, passing college-level math, and earning a year of college-level credits seem to be critical milestones toward eventual degree attainment" (Okimoto & Heck, 2015, p. 634). Stephen Rose (2013), in his article "The Value of a College Degree," pointed out that "The main arguments that are in favor of earning a college degree are based on college graduates' larger earnings over a lifetime, lower unemployment rates, better health, high marriage rates, and greater civic involvement" (p. 24). In the conclusion of his article, he identifies the importance of producing high school graduates with stronger academic skills, preparing them for success in college (Rose, 2013).

One group of researchers pointed out that it is incorrect to assume only unskilled students enroll in collegiate remedial courses. Many of the students enrolled in remedial courses were actually students who performed well in high school. There are also many students who graduated in the lower quartile of their high school class who avoid remedial coursework. At the same time, there are many students who graduated in the upper quartile of their high school class who enroll in remedial courses (Attewell et al., 2006). This observation would seem to contradict the notion that high school GPA is the best predictor of college success (Atkinson & Geiser, 2009). Acosta, North, and Avella discovered that GPA in developmental-math courses was the best predictor of success in college-level math (2016).

Developmental or remedial math programs have been around for decades (Dotzler, 2003). In recent years they have come under scrutiny for their effectiveness (Cafarella, 2016).

Most colleges and universities have some kind of remedial program in place, yet a discouragingly large number of students are not completing developmental math and getting through the gateway of college math (Bailey, Jeong, & Cho, 2010).

Developmental-math programs have been examined, evaluated, and redesigned for several years (Cafarella, 2016). A developmental-math course is considered successful if a large number of the students enrolled in development math complete their recommended course sequence (Acosta et al., 2016). Most redesign efforts involved switching to the emporium model, compressing multiple developmental courses into one course, or eliminating developmental math (Cafarella, 2016). Both qualitative and quantitative studies have been conducted investigating the commonalities, successes, and failures of developmental-math programs and their redesigns (Benken, Ramiriz, Li, & Wetendorf, 2015; Cafarella, 2016; Fong, Melguizo, & Prather, 2015). These studies have defined success as completion of the developmental course sequences. A project undertaken by the Carnegie Foundation for the Advancement of Teaching, however, defines success differently (Clyburn, 2013; Edwards & Beattie, 2016).

The Carnegie Foundation for the Advancement of Teaching was founded in 1905 by Andrew Carnegie. Its purpose is to collaborate with individuals, institutions, and designers to develop solutions to problems of educational practice. They embrace the philosophy of improvement science in their endeavors to enhance teaching and learning (Who We Are, n.d.). The Carnegie Foundation for the Advancement of Teaching has worked in collaboration with community colleges to positively affect the persistence of developmental-math students into and through college-level math. They have developed two different pathways from developmental math to college-level math, Quantway and Statway. In both models, the students were placed in

developmental math. In the Quantway model, the developmental math is integrated with college-level quantitative reasoning. In the Statway model, the material is integrated with college-level statistics. Both models are designed to be completed in one year, notably shorter than traditional schedules. The students choose a model based upon their area of study. Quantway and Statway have demonstrated remarkable success (Clyburn, 2013; Edwards & Beattie, 2016).

Much of this success comes from the design of the courses, and the training and resources provided to the instructors: "Central to the effectiveness of the Pathways is instruction that incorporates two key catalysts for powerful student learning: (1) the Learning Opportunities — productive struggle, deliberate practice, and explicit connections; and (2) Productive Persistence - promoting students' tenacity and good strategies" (Edwards & Beattie, 2016, p. 30). Productive struggle occurs when a student is presented with a problem to solve that is designed to make the student struggle to incorporate already understood concepts with developing ideas that might be a little bit out of the student's reach. It is not meant to be impossibly difficult. "The ultimate goal of productive struggle is to encourage students to make meaning of mathematical content for themselves" (Edwards & Beattie, 2016, p. 31). Deliberate practice is not the same thing as repetitive practice. Deliberate practice involves creating problems that deliberately reinforce concepts necessary for understanding the material (Edwards & Beattie, 2016). Explicit connections mean that some things are best explained explicitly, with direct instruction. Productive persistence encompasses several attitudes and factors, encouraging students to believe that it is possible to learn; helping students to feel socially tied to peers, faculty, and the course; showing students that the material has value; ensuring that students have the skills, habits, and know-how to succeed in a college setting; and enabling faculty and

colleges to support students' mindsets and skills (Edwards & Beattie, 2016). Quantitative studies have been conducted to investigate the effectiveness of these pathways. Yamada and Bryk (2016) found that Statway was quite successful in enabling developmental-math students to acquire college-level math skills and earn credit for college-level math courses.

Quantitative studies of developmental-math programs or students are numerous. Several studies investigated the efficacy of online or distance learning for developmental-math students (Coleman, Skidmore, & Martirosyan, 2017). The dropout rate in online developmental-math courses is even higher than the dropout rate in traditional courses (Chekour, 2017). Efficacy is measured by successful completion of the course (Coleman, Skidmore, & Martirosyan, 2017). Another pair of researchers investigated the types of learning that was occurring in developmental-math courses and if the types of learning were associated with college outcomes. They were specifically interested in persistence: "Measurements of progress toward a degree include grades, term-to-term retention, the number of credits earned, and whether the student earned a degree or certificate" (Quarles & Davis, 2017, p. 33). They found that procedural knowledge impacted grades in developmental math, but not college math. Procedural knowledge was the bulk of what was taught in developmental math. They also found that scoring well in the developmental-math course that was teaching and measuring procedural knowledge did not correlate with degree completion. On the other hand, developing conceptual knowledge did correlate with degree completion. They argue that what is taught in developmental math needs to be reevaluated and revised to emphasize conceptual learning (Quarles & Davis, 2017). These results coupled with the results of a qualitative study of instructors' perceptions of barriers to learning and best practices (Cafarella, 2014) present an interesting paradox.

Cafarella interviewed a number of developmental-math instructors to determine what they viewed as best practices in developmental math. Cafarella deliberately sought out instructors who had taught multiple sections of developmental math and had a pass rate above 60%. Best practices were defined as:

> the methods, techniques, or strategies that have consistently shown positive results such as increased student success rates and student retention. It is worthy of note that these were practices that were effective on a consistent basis for the participants as opposed to practices that worked simply once or twice" (Cafarella, 2014, p. 48).

Among the best practices that were identified were the use of mnemonic devices for algorithms for solving linear equations and remembering the steps for long division, and better student organization. The organization that the instructors identified was both the general organization of materials and the organization of the processes involved in solving various math problems (Cafarella, 2014). In short, the best practices appear to be emphasizing procedural knowledge. According to Quarles and Davis (2017), this is exactly what does not need to be happening.

Many qualitative studies have been conducted to investigate or explore a variety of topics in developmental-math education. They have investigated the attitudes and knowledge of successful developmental-math students (Benken, Ramirez, Li, & Wetendorf, 2015), the professors' perceptions of successful students in developmental math (Zientek, Schneider, & Onwuegbuzie, 2014), the students' and instructors' views of a modular format for developmental math (Ariovich & Walker, 2014), the efficacy of group quizzes in developmental math (Sorenson, 2012), the perceived best practices of successful instructors (Cafarella, 2014), and successful students' perceptions of what enabled them to be successful in developmental math (Howard & Whitaker, 2011). A mixed methods research study examined the perceptions of

developmental-math students concerning their placement into basic mathematics (Goeller, 2013). In all but one of these cases, success in developmental math was defined as completing the course sequence in developmental math (Benken et al., 2015; Zientek et al., 2014). In the remaining study, successful developmental-math students were identified as being the top two students in the developmental-math class (Howard & Whitaker, 2011). Nowhere are successful developmental-math students described as those who persist and successfully complete a college-level math course.

It was found that previous coursework in high school did not impact the need for remediation (Benken et al., 2015). The same study concluded that students' perceptions of how well they would do in the developmental course were inaccurate (Benken et al., 2015). They tended to think they would do better than they actually did (Zientek et al., 2014). This appears to contradict the study that found that the students' who believed that they could learn and do well ultimately did do well (Howard & Whitaker, 2011). Professors tended to believe that poor basic math skills and time delay between high school math and college were the biggest factors in why students were placed in developmental math (Zientek et al., 2014). Professors also believed that effort and study skills had the strongest impact on the students' success or lack of success in developmental math (Zientek et al., 2014), or that a lack of personal responsibility and work ethic was a barrier to learning (Cafarella, 2014). In a study designed to investigate the views of both teachers and students in a developmental-math program that used a modular design, professors embraced the notion of mastery, where students were required to demonstrate that they had attended to the lessons by submitting notes on each section, and completing a correction analysis of any failed assessment. In the same study, students viewed this documentation of mastery as too time consuming (Ariovich & Walker, 2014). Students and teachers agreed on one

major benefit of using a modular approach to developmental math. The students could start where they needed. Teachers did not have to struggle with teaching at a level too high for some students and too low for others. Both teachers and students liked that the course was self-paced (Ariovich & Walker, 2014). In a different study, students said that they liked collaborating on group quizzes. The researchers found that the group quizzes enhanced the students' learning (Sorenson, 2012). Collaboration was identified as a best practice among successful developmental-math instructors at a community college in Florida (Cafarella, 2014). These instructors identified both student barriers to success and instructor best practices in developmental math. Their perceived barriers to success included calculator dependence, poor attendance, students' lack of work ethic and self-responsibility, lack of organization, unwillingness to put in the time or take advantage of office hours or the tutoring center, and outside pressures like jobs and family obligations. The best practices that they identified included effective communication, recognizing that developmental students are not like first year university students, a midterm review of progress and grade, frequent low-stakes assessments, actively reaching out to missing students, test corrections and journaling about what they get or don't get, mnemonic devices, use of graph paper as both a manipulative and a way to write math more neatly, and, finally, using real-life applications (Cafarella, 2014). Students identify a host of factors contributing to their lack of success in college in general and math in particular (Acee, Barry, Flaggs, Holschuh, Daniels, & Schrauth, 2017). In a study designed to investigate the perceptions of both students and faculty about remedial education, the researchers found that the students and professors had vastly different views of the benefits on the course. The students did not feel that the remedial course helped very much and thought that it took too much time. The professors believed that the program was quite beneficial and that the students fared much better

in subsequent courses (Bachman, 2013). When developmental-math students were questioned about their placement into developmental math, the vast majority of them felt that they had been correctly placed in their class. Also, most of them believed that the course should move at a faster pace. Many of the students placed into the lowest level of developmental math had completed Algebra 2 in high school with a C or better. They also believed that they had been correctly placed (Goeller, 2013). Another study comparing the perceptions of instructors and students found that they had widely differing views about the learning processes in both developmental and college-level math courses:

> Students are interested in developing competence, expect and believe they can handle challenging work, avoid self-handicapping behaviors, and exhibit a positive mathematics self-concept. However, interviews with faculty members teaching the courses in which the students were enrolled revealed that instructors had a more negative perspective (Mesa, 2012, p. 46).

These studies are a small sample of the research that has been conducted in developmental math.

Clearly improving developmental math is a priority among institutions; however, improvement in developmental math does not matter if the students do not go on to complete college-level math. The transition into college-level math is called persistence.

Persistence

Unlike the qualitative studies, the quantitative studies in developmental math have looked at persistence from developmental math into college-level math. These studies have examined online versus in-person developmental classes (Acosta, North, & Avella, 2016), success rates in college-level math following enrollment in developmental math (Hsu & Gehring, 2016), the effectiveness, or lack thereof, of increasing time spent in developmental math (Ngo &

Kosiewicz, 2017), the predictive power of high school GPA on persistence through developmental math and into college-level math (Acosta et al., 2016), the impact of age, gender, race, and ethnicity on persistence (Wolfle & Williams, 2014), the effect that location of developmental math courses has on persistence (Williams & Siwatu, 2017), the impact developmental education has on persistence and transfer to a four year university (Crisp & Delgado, 2014), and whether or not the time-lapse since high school impacts persistence into college-level math (Acosta et al., 2016).

In these studies investigating the persistence of students in transitioning from developmental math to college-level math there have been some surprising results. For example, contrary to conventional wisdom, more time spent in developmental math does not correlate with better grades or a higher level of persistence. Ngo and Kosiewicz (2017) found that extending time in developmental math was actually detrimental to the students' success in developmental math. They suggested that "the very intervention that is aimed at preparing students to be successful in gatekeeper college-level courses may at the same time be an obstacle and deterrent to their persistence in college" (p. 268). The authors conducted a quantitative research analysis of data about enrollment, grades, persistence, and completion in developmental to college-level math. They drew the data from the students just above and just below the cut-off point between two levels of developmental math. They compared the grades and progress of students who were just below the cutoff point and were required to enroll in two semesters of elementary algebra with the grades and progress of students who were just above the cutoff point and were required to enroll in only one elementary algebra course. There was a statistically significant difference in both grade achieved and persistence between the two groups. The students who were only required to take one elementary algebra course were more likely to receive a B or better in the

course. They were also more likely to complete the college course following elementary algebra (Ngo & Kosiewicz, 2017). The authors pointed out that previous research about extending time in math classes in middle school and high school revealed that the practice could be beneficial at those levels. They argued that for adults this is no longer true (Ngo & Kosiewicz, 2017). On the other hand, another researcher found that the best predictor of success in a college-level math course was the grade received in pre-algebra, a developmental-math course (Davidson, 2016). Students who received a C or better in pre-algebra were much more likely to successfully complete a college-level math course. Interestingly, the students who initially failed the pre-algebra course and reenrolled in pre-algebra were even more likely to successfully complete a college-level math course (Davidson, 2016). This would seem to contradict the idea that more time in developmental math is detrimental. Crisp and Delgado point out that studies like the one conducted by Ngo and Kosiewicz do not investigate the effects of enrollment in developmental math on the students who placed into the lowest level of developmental math. They highlight that:

> students who enroll in developmental courses are systematically different from community college students who do not remediate in terms of (a) gender, (b) ethnicity, (c) first-generation status, (d) academic preparation and experiences during high school, and (e) delaying entry into college immediately following high school. More importantly, results show that developmental students have characteristics including being a racial minority student or the first in their family to attend college that substantially increases their risk of dropping out of college, independent of their remediation experiences. (Crisp & Delgado, 2014)

They conducted a rigorous quantitative study to determine the effect of enrollment in developmental math on persistence in course work and transferring to a four-year university. They concluded that there was no difference in persistence rates; however, students who enrolled in developmental math were less likely to eventually transfer to a four year university (Crisp & Delgado, 2014). When a community college professor decided to collect and analyze data regarding persistence of the developmental-math students at her college she uncovered both expected and unexpected results. As she expected, students enrolled in online developmental-math courses did not fare as well as students enrolled in face-to-face developmental-math courses. She suggested that "it behooves us as developmental educators to incorporate the structural items present in a face-to-face classroom into our online classes. Such an effort could increase the success rates of our online developmental-math students" (Waycaster, 2011, p. 65). The unexpected result she discovered was that their developmental program was not doing as well as they thought because the students were not persisting and being successful in college-level math courses (Waycaster, 2011). Lastly, it is important to note that as much as 30% of the students referred to developmental math do not enroll in college at all (Crisp & Delgado, 2014). It is difficult to persist if one does not even start.

It was found that high school GPA was a good predictor of completing college-level math following enrollment in developmental math (Acosta et al., 2016). Additionally, the grade earned in a math class taken the first semester of college enrollment is an extremely strong predictor of persistence into a second year of college. Interestingly, the level of math class did not matter, just the grade. Students who earned a B or better in their first math class of any level were twice as likely to return for a second year of college. Students who did not take a math class their first year of college were five times more likely to not return for a second year of

college. This was true for both STEM and non-STEM majors (Callahan & Belcheir, 2017). Wolfle (2012) found that there was no difference between the success rates of college-level math students who place directly into college-level math and those students who entered college-level math via developmental math. In at least one study, it was discovered that students who completed developmental math at a community college were more likely to successfully complete a college-level math course than students who completed developmental math at a four year university (Williams & Siwatu, 2017). In a study examining the efficacy of a summer bridge program in Texas, researchers found that when students recommended for developmental math participated in a summer program prior to their first year of college, there was no effect on their persistence. Researchers concluded that "persistence in postsecondary education is a complex issue that cannot be solved with any one program" (Wathington, Pretlow, & Barnett, 2016, p. 150). Another, very practical study examined the correlation between delayed enrollment in developmental math and Fall-to-Spring or Fall-to-Fall retention. The researchers found that students who chose to postpone taking their math courses were much more likely to drop out. They suggested that community colleges should change their policies and no longer give students a choice about when to take their math courses (Fike & Fike, 2012). Lastly, neither the type of developmental-math course nor the time-lapse since high school seemed to have an impact on the likelihood of a student completing college-level math after enrollment in developmental math (Acosta et al., 2016). One group of researchers pointed out that "Developmental classes are intended to prepare students for success in subsequent college-level courses, yet most research in this area focuses on performance and retention in the developmental classes" (Acosta, North, & Avella, 2016, p. 19). Persistence into and through a college-level math course is important and merits further investigation.

Developmental education exists because of a lack of college readiness in both recent high school graduates and adults returning to college later in life. The concept of college readiness has always been a consideration in education circles. Recently, it has become a topic of interest in the broader community (Balfanz, DePaoli, Ingram, Bridgeland, Fox, Civic, & Johns Hopkins University, 2016).

College Readiness

A significant number of high school graduates and returning students are unprepared or underprepared for college-level work (Bahr, 2008; Fong, Melguizo, & Prather, 2015; Gaertner & McClarty, 2015; Hudesman, Crosby, Ziehmke, Everson, Isaac, Flugman, & Moylan, 2014). This dilemma has become known as college readiness. Many consider students to be college ready when they have completed all required high school coursework and reached a benchmark score on a college-placement exam. Students who have completed the prerequisite coursework but not attained a satisfactory score on a college placement test are considered college eligible but not college ready (Zelkowksi, 2012). Using a college placement exam to determine college readiness is a superficial assessment. David T. Conley, Director of the Center for Educational Policy Research at the University of Oregon, is considered an expert on college readiness and a national thought leader in this area (David T. Conley, 2018). He offers a much more comprehensive description of college and career readiness.

According to Conley (2012), college readiness means that a student is both qualified for and able to succeed in a college-level course or certificate program, without the need for remediation. Conley also points out that college readiness can mean different things for different people, depending on their chosen course of study (2012). Conley describes four keys for college and career readiness: key cognitive strategies, key content knowledge, key transition

knowledge and skills, and key learning and skills techniques. Without some degree of mastery in each of the four keys, students are not college and career ready (2012).

Key cognitive strategies include how students think critically and approach problem solving. Key content knowledge refers to both the main concepts in specific content areas, how that knowledge applies to a chosen field of study, and the willingness to expend effort in acquiring and applying that knowledge. Key learning skills and techniques cover student ownership of learning and specific learning techniques. Student ownership of learning concerns "goal setting, persistence, self-awareness, motivation, progress monitoring, help seeking, and self-efficacy" (Conley, 2012, p. 2). Specific learning techniques concern time management, study skills, strategic reading, memorization techniques, collaborative learning, technology skills, and self-monitoring" (Conley, 2012, p. 2). Key transition knowledge and skills include those things that are often not universally accessible: knowing how to prepare for and what to expect from postsecondary educational institutions, knowing how to self-advocate in these institutions, and understanding financial aid, to name a few (Conley, 2012).

Conley's definition and description of college readiness (2012) and Schlossberg's transition theory (Schlossberg et al., 1994) are quite compatible. Conley's four keys and Schlossberg's four S's (at work during the moving through stage of a transition) have many commonalities (Chickering & Schlossberg, 1994). Conley's four keys, emphasize the importance of learning and skills techniques. Among other things, these involve goal setting, persistence, and self-awareness (Conley, 2012). These concepts go hand in hand with Schlossberg's concept of self in the four S's. Self refers to both the demographical and psychological factors in play during a transition (Schlossberg et al., 1994). Schlossberg's concept of strategies (Schlossberg et al., 1994) includes Conley's key transition knowledge and

skills that include things like the knowledge necessary to navigate financial aid, and the awareness of the nuances of college culture (Conley, 2012). Conley urges institutions to have supports in place to help the students who are not quite ready for college (Conley, 2012), an idea that coheres with Schlossberg's support concept (Schlossberg et al., 1994). Schlossberg's transition theory concerns the use of the college readiness skills that Conley describes (Schlossberg et al., 1994; Conley, 2012).

In his key transition knowledge and skills, Conley points out that this area deals with the knowledge and skills that may not be readily accessible by historically underrepresented populations (Conley, 2012). Another pair of researchers discussed this same idea when examining what they called the "developmental education pipeline" (Henry & Stahl, 2017, p. 611). They argue that the developmental education programs are like a leaky pipeline, losing many students along the way. They also imply that there was a somewhat sinister motive behind Academia's embrace of developmental education. They said "postsecondary faculty and administrators welcomed the pipeline effect so colleges could promote societal mandates for diversification and access to higher education yet keep struggling and underprepared students out of real college classes where they were seen as not belonging" (Henry & Stahl, 2017, p. 615). Fortunately this trend appears to be changing. The same authors point out "the failed basic-skills stepladder models of developmental education are being abandoned in favor of programming that reduces time to degree, thus reducing the number on noncredit courses required" (p. 615). One study in particular found that allowing the students who previously would have been required to enroll in developmental-math courses, to enroll in a college-level statistics course and providing the students extra support while they were in the college course, enabled the students to be successful in the college-level course without first enrolling in developmental math, thus

eliminating the need for developmental math altogether. It was found that the students in the college-level course with extra support performed even better than similar students in developmental-math courses with extra support: "They were more likely to pass their initial math course and, three semesters after the experiment, had completed more college credits overall. In short, our study suggests that many students consigned to remediation can pass credit-bearing quantitative courses right away" (Logue, Douglas, & Watanabe-Rose, 2017, pp. 79-80). Other studies investigating college readiness are taking an even broader approach.

College readiness is a topic of interest at all levels. Elementary schools (Pulliam & Bartek, 2018), students with and without disabilities (Lobardi, Freeman, & Rifenbark, 2018), high school principals (Malin & Hackmann, 2017), high school pedagogical practices (Bonner & Thomas, 2017), and state education departments (Center on Standards and Assessments Implementation, 2016) have each been a part of studies concerning college readiness, just to name a few. Elementary school counselors are being encouraged to include college and career readiness in their curricula. Pulliam and Bartek (2018) advocate that college and career readiness should begin in early elementary school. They cite several different theoretical frameworks that take a developmental approach to career counseling. The attributes that elementary age students are learning include attitudes, interests, capacity, and self-concepts such as self-awareness, self-esteem, and self-knowledge (Pulliam & Bartek, 2018). It is interesting to note that these concepts mesh well with Conley's key learning skills and techniques (Conley, 2012). Similarly, in discussing the college and career readiness of adolescents with and without disabilities, researchers point out the need for a college and career readiness framework that "emphasizes both academic and nonacademic skills: academic engagement, mind-sets, learning processes, critical thinking, interpersonal engagement, and transition competencies" (Lombardi,

Freeman, & Rifenbark, 2017, p. 161). Researchers have examined the way high school principals promote college and career readiness in their schools (Malin & Hackmann, 2017). State departments of education have developed standards and/or definitions of college and career readiness, and adjusted their course requirements to attempt to meet these standards (Center on Standards and Assessments Implementation, 2016). The pedagogical strategy of requiring middle-ability students to act as peer facilitators in the math course that they had completed in the previous year appeared to have a significant impact on their college and career readiness. It was particularly interesting that the researchers measured the success of the program in terms of college readiness and not by using grades or test scores. In this study, sophomore students who were considered middle performing math students, not top performers, were enrolled in a course designed to help them facilitate the math instruction in the course they had completed the previous year. The researchers had already determined that the activity did not impact the performance of the younger students in either direction. In this study, they investigated the impact on the learning of the older students. They found that the intervention had a positive impact on the middle level students doing the facilitating. These students, half of whom had entered high school below grade level in math, upon graduation were ready to enroll in college-level course work with no need for remediation. This intervention appeared to provide the students with the opportunity to develop metacognitive skills and content knowledge as well as self-esteem and college awareness (Bonner & Thomas, 2017).

The crisis in college readiness peaked in the latter part of the 20th century. Beginning in the 1980s colleges began offering more remedial classes and expanding and improving their developmental-math programs (Gaertner & McClarty, 2015). In recent years, major educational initiatives have focused on the issue of college readiness. In spite of many of these initiatives,

college readiness, or the lack of it, continues to be an issue today. Even though it has been repeatedly shown that college placement tests are not the best predictor of college success, the primary means of identifying a lack of readiness is by college placement exams (Balfanz, DePaoli, Ingram, Bridgeland, Fox, Civic, & Johns Hopkins University, 2016).

College Placement Exams

On the national level, there are two well accepted college admission exams, the SAT [formerly the "Scholastic Aptitude Test," then the "Scholastic Assessment Test," and now simply the SAT (Kaplan, 2015)] and the ACT, "Academic College Test." The original "Scholastic Aptitude Test." SAT, was administered in 1926. It was designed to measure general aptitude for learning and resembled early IQ tests (Atkinson & Geiser, 2009). Since that time, the SAT has undergone multiple name changes as well as changes in what it purports to measure. It is currently named simply SAT. Its current aim is to measure the student's ability to think critically, reason, and analyze—all crucial qualities for college success (Atkinson & Geiser, 2009). It consists of three subtests, critical reading (formally known as the verbal section), writing, and mathematics (also known as the quantitative or calculations section). According to the College Board, students who score 1340 (an average of 445 on each subtest) have a 65% probability of maintaining a B average in college (Harvey, Slate, Moore, Barnes, & Martinez-Garcia, 2013). The SAT recently underwent a major overhaul, and the new version debuted in 2016 (Test Specifications for the Redesigned SAT, 2015). It more closely aligns with the Common Core Standards that have been adopted by several states (Tepe, 2014).

The Academic College Test (ACT) was first administered in 1959. It grew out of the Iowa Test of Basic Skills at the University of Iowa under the guidance of E. F. Lindquist. (Atkinson & Geiser, 2009). In 1996 the test's name changed to simply ACT. While its

founders were from the University of Iowa, the ACT has always been a separate entity (Careers, n.d.).

Unlike the SAT, the ACT was designed to test academic knowledge and achievement. Ideally, a student's score would be affected by the level of effort exerted in one's studies, rather than innate ability (Atkinson & Geiser, 2009). The ACT scores range from 1 to 36. According to ACT, a student who scores 22 or higher has a 50% probability of attaining a B or better in College Algebra and a 75% probability of attaining a C or better. The SAT and ACT are used to assist colleges with placing students into the appropriate math course so they can be successful.

Many states have developed their own tests. Unlike the ACT or SAT, college admissions tests, these state-developed tests are placement tests. Florida uses the Postsecondary Education Readiness Test (PERT) as well as the ACT and the SAT. The PERT was first administered in October 2010. It is an adaptive test designed to assess the students' college readiness in three areas—reading, writing, and mathematics. The test adapts to the ability and skill level of the individual student. The test begins with questions in the middle level of difficulty; the test then becomes easier or harder, depending on the accuracy of the student's answers. The mathematics section of the test consists of 30 questions. Possible scores range from 50 to 150. A score of 114 indicates college readiness. Students who score 114-122 are deemed ready for MAT1033, Intermediate Algebra (Common Placement Testing, 2015). Intermediate Algebra is a 3-credit elective. It does not count as a math class but is a prerequisite for MAC1105, College Algebra (SJRSTATE catalogue). Students who score 123-150 are deemed ready for College Algebra or higher (Common Placement Testing, 2015). The content of the PERT was determined by the Florida faculty (from both high schools and colleges) who developed the Postsecondary

Readiness Competencies. The competencies consist of 46 topics or skills from algebra and coordinate geometry (College and Career Readiness, 2015).

Prior to the fall of 2014, students scoring below 113 on the PERT were required to enroll in developmental-math courses (Quality Enhancement Plan, 2013). These courses were remedial, cost money, were included in the student's GPA, but were not eligible for college credit. In 2014, students were not required to enroll in developmental courses but were given the opportunity, regardless of their scores. The students may enroll in an entire course or just a part of it. They may enroll in the developmental course while they are also enrolled in Intermediate Algebra (Quality Enhancement Plan, 2013). This new policy is an effort to increase the success rate of Intermediate Algebra. The goal is to have more students enrolled in and successfully completing Intermediate Algebra and successive math courses (SJRSTATE, personal communication).

In Florida, the PERT is administered to all eleventh grade students who do not have a suitable score on any other college placement test. Juniors who score below 114 (previously 113) must enroll in math for college readiness senior year, even if they already have the required 4 math credits: The course is a graduation requirement, but it can also be met with a suitable score on either the SAT or ACT. A score of 440 on the Math portion of the SAT, or a score of 19 on the math portion of the ACT, indicates college readiness and fulfills the requirement in Florida (Mokher, Jacobson, & Society for Research on Educational Effectiveness, 2016).

Before the spring of 2012, community colleges in Virginia offered remedial courses similar to those in Florida and other states: Arithmetic, Pre-algebra, Beginning Algebra, and Intermediate Algebra. In 2012, in an effort to improve the developmental-math program, enabling more students to successfully complete their math sequence requirements, Virginia

introduced the Virginia Placement Test (VPT) (Rodriguez, 2014). The VPT, SAT, or ACT are the means that the colleges use to place students in appropriate levels of math (Do You Need to Take the Placement Test, 2017). Like the PERT in Florida, the VPT is an adaptive online test. The test presents questions to students based on how they did on the previous questions. The VPT is arranged into nine modules. Each module tests a specific content area. The modules begin with arithmetic and proceed to graphing functions and solving polynomial equations, topics typically found in Algebra 2. Each module stands alone. Students may pass one, several, or all modules at one time (Rodriguez, 2014). In Virginia, liberal arts majors are required to pass modules 1-5 in order to enroll in a college-level math course appropriate for their majors. Students intending to enter a STEM field must pass all nine modules to enroll in Pre-calculus (Do You Need to Take the Placement Test, 2017).

Virginia community colleges will also accept SAT or ACT scores as proof of college readiness. An SAT math score of 530 or above or an ACT score of 22 or above are both equivalent to passing all nine modules. An SAT score of 510-530 or an ACT score of 19-21 are both equivalent to passing modules 1-5 ("Do You Need to Take the Placement Test," 2017). Virginia has recently made additions to its math-placement measures that do not require a placement test. Recent high school graduates who have a GPA of at least 3.0 and successfully completed an algebra intensive course above Algebra 2, such as Trigonometry or Pre-calculus, are exempt from taking a placement test and can enroll in Pre-calculus. This course sequence combined with the grade point average are considered equivalent to passing all nine modules of the VPT. Completing Algebra 2 and having a 3.0 grade point average is considered equivalent to passing the first five modules. Finally scoring 165 or above on the math sections of the GED is

considered equivalent to passing the first five modules (Do You Need to Take the Placement Test, 2017).

The College Board, the organization responsible for the ACT, also administers a college placement test called the COMPASS. This test is similar to both the PERT and VPT in that it is an adaptive test, designed to get either easier or harder as the student progresses through the test (How the ACT COMPASS Is Used, n.d.). Unlike the PERT and VPT, the COMPASS is being phased out due to continuing outcry about placing too many students into noncredit-bearing remedial courses (Fain, 2012).

Even though the COMPASS has been getting phased out for the last several years, it has still been the center of some studies. As recently as 2016, researchers investigated whether or not the COMPASS scores could predict students' success in their first online course (MacGregor, O'Reilly, & Matt, 2017). They found that the COMPASS scores in reading and writing accurately predicted success in online social science, natural science, and humanities courses. The math test scores predicted success in both natural science courses and math courses (MacGregor, O'Reilly, & Matt, 2017). Another study found that a combination of COMPASS score information and high school GPA was the best predictor of college success. The combination was better than either factor alone; however, the predictive power of grade point average grew weaker the longer the student had been out of high school (Westrick, Allen, & ACT, 2014).

It has been well documented that in addition to college placement exam results, high school GPA and the student's own self-efficacy beliefs are the best predictors of college success (Atkinson & Geiser, 2009; Mattern & Shaw, 2015); nevertheless, college preparatory exams carry a significant weight in college admissions and placement (Atkinson & Geiser, 2009). It is

in the best interest of high school students to score well on either the SAT, ACT, or other state specific exams like the PERT or the VPT. Often these scores will determine whether or not a student is required or recommended to enroll in developmental education (Atkinson & Geiser, 2009).

Summary

The literature is clear that developmental education is necessary and improving (Balfanz, DePaoli, Ingram, Bridgeland, Fox, Civic, & Johns Hopkins University, 2016; Virginia Community Colleges, 2014). Numerous studies have explored what works and what does not work in improving or creating effective developmental-math education (Acosta, North, & Avella, 2016; Benkne, Ramirez, Li, & Wetendorf, 2015; Howard & Whitaker, 2011; Hsu & Gehring, 2016). In most of these studies, success was defined as successfully completing developmental math. Many of these studies have sought the perspective of the instructors or students in the developmental-math process (Bachman, 2013; Howard & Whitaker, 2011). Several quantitative studies have explored the factors that impact the persistence of former developmental-math students into college-level math (Acosta et al., 2016; Hsu & Gehring, 2016; Williams & Siwatu, 2017; Wolfle & Williams, 2014). There appear to be no qualitative studies that explore the perspectives of developmental-math students after they have successfully completed college-level math. The ultimate goal of developmental education is to prepare students for a successful experience in college-level work. It would be beneficial to explore the experiences of students who have persisted and transitioned out of developmental math into and through college-level math. Their experiences would shed light on what works and why it works.

CHAPTER THREE: METHODS

Overview

A significant number of incoming freshman at community colleges are unprepared for college-level math (Bahr, 2008; Hudesman et al., 2014; Sommo et al., 2014). Most of these students will enroll in developmental math (Bachman, 2013; Bahr, 2008). Ideally, developmental-math courses prepare the student to eventually complete college-level math successfully. This is not occurring for many former developmental-math students (Bremer, Center, Opsal, Medhanie, Jang, & Geise, 2013; Hudesman et al., 2015). The purpose of this transcendental phenomenological study is to investigate the experiences of former developmental-math students who successfully completed a college-level math course after enrolling in developmental math. The chapter will present the procedures, research design, setting, participant selection, and data analysis for this study. The chapter will include a discussion of how trustworthiness will be maintained, as well as a discussion of the ethical considerations.

Design

The study was a transcendental phenomenological and qualitative one designed to explore the common experiences of the participants, who were former developmental-math students and who have successfully completed a college-level math course. A qualitative design was appropriate in this instance because the experiences and perspectives of the participants were the relevant content (Creswell, 2013; Moustakas, 1994; Waters, 2016). There are two major types of phenomenological studies, hermeneutical and transcendental (Creswell, 2013; Moustakas, 1994). In hermeneutical phenomenology, the researcher's preconceived ideas, judgements, and opinions are a part of the analysis of the shared experiences of the participants.

The researcher takes on the role of interpreter (Creswell, 2013). In transcendental phenomenology, the researcher endeavors to set aside preconceived ideas, judgements, and opinions. The researcher takes on the role of observer (Creswell, 2013). In this process, it is critical that the researcher brackets out her own preconceived ideas about the answers to the questions being asked, or the reasons for the existence of the phenomenon in question. This process is called the *Epoche* by many researchers (Moustakas, 1994). Because the researcher takes on the role of observer, the researcher's opinions and ideas are inconsequential. It will require a deliberate effort on the part of the researcher to not allow these prejudgments and preexisting ideas to influence the interpretation of the data (Moustakas, 1994).

Research Questions

This transcendental phenomenological study was guided by the following research questions.

Central Research Question

What are the shared experiences of former developmental-math students who have successfully completed a college-level math course?

Sub-question One

What were the early, prior-to-college, experiences of the participants?

Sub-question Two

How do the participants describe the impact that developmental math had on their success in college-level math?

Sub-question Three

Why do the participants believe that they were successful in college-level math?

Sub-question Four

What does the completion of a college-level math course mean for the future of the participants?

Setting

The setting for this study was various colleges in the United States. The vast majority of remedial education is accomplished in the community college setting (Bachman, 2013; Bahr, 2008; Bremer et al., 2013). Some research has suggested that developmental-math education is both quantitatively and qualitatively different at a two-year community college than at a traditional four-year institution (Williams & Siwatu, 2017). Other research has indicated that developmental-math education is also being conducted at four-year universities.

Participants

The participants in this study were recent high-school graduates, who graduated from high school within the last 13 years. The focus on recent graduates was necessary because research has shown that the college experience, particularly in developmental math, is different for recent high-school graduates than for older graduates returning to education (Wolfle & Williams, 2014). The participants were eight students from various colleges identified as having been enrolled in at least one semester of developmental math and having successfully completed at least one semester of college-level math. The participants were identified via a combination of purposeful sampling, criterion sampling, convenience sampling, and snowball sampling (Creswell, 2013). Criterion sampling involves finding a group of potential participants who all meet the criteria of the study. Convenience sampling involves finding participants who are easy to access. Convenience sampling has both pros and cons: It tends to be less expensive and more efficient than other forms of sampling, but it has the potential to negatively impact the quality of the information and the credibility of the study (Creswell, 2013). Snowball sampling happens

when identified participants recruit or refer other potential participants to the study. Snowball sampling was appropriate because participants, once identified, were able to easily locate additional participants (Creswell, 2013) among former classmates in developmental-math or college-level math courses.

The researcher contacted various community colleges and community college students, current and former, to recruit participants for the study. Demographic information from each of the participants was gathered and recorded. The participants were also asked to provide information about their majors, their progress in their studies, and their ultimate educational goals. Finally, participants were asked to provide documentation showing that they meet the study criteria. The documentation was in the form of either transcripts, or a letter from a math teacher, or the math department, or an advisor, confirming that the student was enrolled in a developmental-math course prior to enrolling in, and successfully completing, a college-level math course.

Procedures

Institutional Review Board (IRB) approval was obtained prior to beginning the study. Participants were recruited via word of mouth and through the math departments at various community colleges. Social media such as Facebook was used to recruit individuals who might fit the study criteria. Once a few students were identified as possible participants, they were asked to refer other potential participants to the study. A questionnaire was administered to determine demographics and background information for each participant. The results of the questionnaire were used to narrow the participant pool. When the necessary participants were identified, individual interviews were conducted as were an online discussion group and focus groups to gather data. All communications were recorded. Before and after each interview, I

kept a record of my thoughts and feelings regarding the interview. The participants were thanked with a 25 dollar gift card of their choice. As the data was gathered, the interviews were transcribed by me. I then analyzed the data, searching for common themes. The online discussion group and focus groups were used to verify the findings from the data analysis.

The Researcher's Role

I was the human instrument in this research (Creswell, 2013). As such, I brought a host of opinions and ideas to the study. I am intimately acquainted with the developmental math to college-level math transition. I have taught college preparatory math at the high-school level, developmental math at the college level, and college-level math in both a high-school setting and college setting. In my current position as a high-school teacher, I am preparing to teach a dual-enrollment course for a local community college. In my previous position as a high-school teacher in another state, I taught dual-enrollment courses for a local state college. I have taught Capstone Math and Math for College Readiness—courses designed to mirror the developmental courses at community colleges. While I have extensive experience as an instructor in developmental math, I was not a student in developmental math. Because I am involved in this process as an instructor, it was necessary that I bracket myself in this study (Creswell, 2013; Moustakas, 1994). In this way, I attempted to minimize the impact of my own bias on the study.

Data Collection

This transcendental phenomenological study was designed to explore the shared experiences of former developmental-math students who were also successful in college-level math. These students were from various colleges. After I received approval from the Institutional Review Board, I began the data collection process with the participants. I used a questionnaire to gather background information, interviews to gather data about themes and

experiences of the participants, an online discussion group and focus groups to add credibility to the findings. I piloted the data gathering tools with two former students who began their postsecondary math education in developmental math and have since completed their programs of study.

Questionnaire

The first part of the data collection process was done with a questionnaire. The questionnaire was used to identify if a potential participant qualified to be in the study. A sample questionnaire is available in Appendix B. Once I identified the potential participants, I arranged for them to talk with me on the phone to discuss their participation in the study and provide them with the appropriate informed consent information. I then scheduled a time to do each participant's interview.

Interviews

I spoke with each participant individually to conduct the interview. I endeavored to use appropriate questions to explore the experiences in math education of each participant. The questions were arranged in four groups. The first group of questions included an ice breaker question to try to make the participant comfortable and build rapport (Creswell, 2013). This group of questions also included questions about background information. The second group of questions was concerned with the participants' experiences in math education prior to entering a college-level math course. These experiences may have been in high school and/or college. These questions addressed the moving in part of the transition process (Schlossberg, Waters, & Goodman, 1994). The third group of questions was concerned with the participants' experiences during the college-level math course. These questions addressed the moving through part of the transition process (Schlossberg, Waters, & Goodman, 1994). The last group of questions was

concerned with the participants' experiences and expectations moving forward, now that they have completed a college-level math course. These questions address the moving out part of the transition process (Schlossberg, Waters, & Goodman, 1994). The questions were reviewed by a peer educator with experience in both developmental and college-level math education. They were also piloted with the same individuals who piloted the questionnaire.

The standardized open ended questions were:

Introduction questions

1. Please tell me about yourself, where you grew up, and your family of origin, what you are studying.
2. Please tell me about you school experiences, extra-curricular activities, academics; anything that you think is important or interesting.
3. Why did you choose this particular college?
4. Before you came here to school, what were you looking forward to?
5. Before you came here to school, what were you most concerned about?
6. What are you educational goals?
    a. What is your major?
    b. What math is required for your major?
    c. What are you planning to do with your major?
7. Before we start, what are your thoughts or feelings about participating in this study?

Moving in to the transition questions

8. Please describe you math education experiences prior to entering college.
    a. What was challenging or not challenging?

   b. How were your grades? Do you believe that your grades reflected your level of understanding?
   c. What was your time investment like?

9. Please describe your math education experiences in developmental math.
   a. Describe how you ended up in developmental math.
10. What were your thoughts and/or feelings about math in high school?
11. Why do you think you were successful or unsuccessful in high school math?
12. What were your thoughts and/or feelings about math while you were in developmental math?
13. How did you feel about being in developmental math?
14. Why do you think you were successful in developmental math?

Moving through the transition questions

15. Please describe you college-level math course.
16. Why did you take this particular course?
17. What were your concerns, if any, about taking this course?
18. What were the challenges, personal or academic, about this course, and how did you deal with them?
19. What did you find to not be challenging during this course? Why do you think these things were not challenging?
20. What prepared you to be successful in this course?
21. How did your classmates impact your experience in this course?
22. How did you impact your classmate's experiences in this course?

Moving out of the transition questions

23. What is next for you?
24. How has your experience in college-level math prepared you for what is next?
25. What recommendations would you make to other students experiencing the same route through math education?
26. What are any additional comments you would like to make about your math education experiences?

Transition theory has been applied to numerous adult transitions (Pellegrina & Hoggan, 2015). College is a major time of transition for young adults. Several researchers have used transition theory as the theoretical framework for their studies about the experiences of college students or college professors (Black, 2014; Bjornsen & Dinkel, 2017; Devilbiss, 2014; Griffin & Gilbert, 2015; Heitzman & Somers, 2015; Karmelita, 2017; McCoy, 2014; Schiavone & Gentry, 2014; Schlossberg, & Chickering 1995). Schlossberg identifies four coping factors during transitions referred to as the 4 S's. They are situation, self, support, and strategies (Schlossberg, 1981). Each of the above questions is concerned with one or more of these coping factors. Questions one through seven, the introduction questions, are primarily concerned with self. Questions eight through ten explore the situations the participants were in during the transition into college-level math. Questions eleven through fourteen are concerned with supports and strategies used or needed to transition in to college-level math. Questions fifteen to seventeen relate to situation and self during the moving-through part of the participants' transitions. Questions eighteen through twenty-one pertain to supports and strategies during the transition through the class. Questions twenty-two and twenty-three are concerned with the participants' perceptions of self during the moving-out process of the transition. Question

twenty-four is concerned with supports and strategies during this part of the transition. The last two questions serve to wrap up the interview and leave the door open for future contact.

Focus Groups

After all the individual interviews were completed, focus groups were conducted. The focus groups were used to member check the transcripts and data collected from the questionnaires and interviews. The focus groups were organized in a manner that was convenient for the participants. Each focus group consisted of students from more than one college. The questions were posed to the groups in the same manner as the interview questions, using Schlossberg's moving in, through, and out of transitions as a framework for the questions. Each question delved into the topic from the perspective of self, situation, strategies, or supports (Schlossberg et al., 1994).

Open-Ended Focus Group Questions

1. Let's get to know one another. Please introduce yourself and share where you are going to college and what you are studying.
2. What were the primary reasons you enrolled in developmental math?
3. What was challenging about developmental math?
4. Why were you successful in developmental math?
5. How did developmental math help you in college-level math?
6. What was challenging about college-level math?
7. Why were you successful in college-level math?
8. Based on your experience moving in, though, and out of college-level math, what advice would you give to incoming developmental-math students, or to incoming college-level math students?

9. What are the most exciting or concerning issues about next steps in your math or college education?

Question one serves as an ice breaker for the group, helping them to relax and open up: "Often the phenomenological interview begins with a social conversation or a brief meditative activity aimed at creating a relaxed and trusting atmosphere" (Moustakas, 1994, p. 114). Question two addresses the aspect of self in the moving in process, the first of the 4 S's in transition theory (Chickering & Schlossberg, 1994). Questions three through eight pertain to the supports and strategies involved with moving in, though, and out of college-level math, the second and third of the 4 S's in transition theory (Chickering & Schlossberg, 1994). Finally, question nine returns to the self aspect of moving out of a college-level math course (Chickering & Schlossberg, 1994).

Online Discussion Group

Similar to the focus groups, the online discussion group was conducted to allow the participants to answer questions in a group setting. The online discussion group differed from the focus groups in that the participants did not need to be present at the same time to answer the questions (BusinessDictionary.com, 2018). The participants were also more likely to be from different geographical locations and have attended different colleges. With the online discussion group, the conversations occurred in writing rather than face-to-face, allowing the participants to contemplate their responses prior to offering them, and allowing them to choose to whom and to what they responded. The online discussion group served to further substantiate the data collected in the in-person interviews.

Data Analysis

Moustakas (1994) outlines three "core processes that facilitate derivation of knowledge: Epoche, Transcendental Phenomenological Reduction, and Imaginative Variations" (p. 33). Epoche involves the setting aside of preconceived ideas, opinions, and experiences in order to view a phenomenon with fresh eyes and without bias (Creswell, 2013; Moustakas, 1994). I bracketed my own opinions and judgements outside of the experiences of the students. I tried to do this by journaling before and after encounters with the participants. The journaling served to document my attempt to be impartial and not allow my own preconceived ideas, judgements, and opinions to influence the analysis of the data. Following the Epoche, is the process of Transcendental Phenomenological Reduction. This process overlaps with the Epoche in that it involves transcending or rising above the phenomenon to observe it with fresh eyes. Reduction refers to returning to the original meaning (Moustakas, 1994). I endeavored to view the phenomenon with fresh eyes and analyze the data to reduce it to a description of the original phenomenon. The Imaginative Variations involves the discovery and description of the essence of the phenomenon (Moustakas, 1994).

The questionnaire is the first data gathering tool that was used. Twenty possible participants filled out the questionnaire. The questionnaire elicited information about years since high school was completed, quantity of developmental-math course work, and specifics of college-level course work (Moustakas, 1994). The results of the questionnaire were used to narrow the participant pool in order to ensure that the participants had in fact experienced the phenomenon being investigated and represented a good cross section of individuals (Moustakas, 1994). Prior to reviewing the interviews of the participants, I reviewed the memos and notes that were made before, during, and after the interviews with the participants in an effort to bracket

out my personal views, opinions, and experiences. Moustakas (1994) referred to this as "the Epoche process" (p. 85).

The recorded and transcribed interviews were coded and organized in a chart. I determined the codes as topics or ideas present in the transcribed interviews. Examples of these codes include things like "liked the teacher" and "family influence." Initially there were a large number of these topics or ideas identified because it is important to be "receptive to every statement of the co-researcher's experience, granting each comment equal value" (Moustakas, 1994, p. 122). By carefully examining and reexamining the data from multiple participants, I attempted to gain an accurate perception of the views of many individuals:

> Each looking opens new awarenesses that connect with one another, new perspectives that relate to each other, new folds of the manifold features that exist in every phenomenon and that we explicate as we look again and again and again—keeping our eyes turned to the center of the experience and studying what is just before us, exactly as it appears. (Moustakas, 1994, p. 92)

A thorough and in-depth analysis hopefully led to an accurate picture of the essence of the phenomenon. These topics and ideas were sorted into "meaning units" (Moustakas, 1994, p. 118) and then were further categorized into themes (Moustakas, 1994). These meaning units and themes were used to develop a thick, rich, description of the phenomenon in order to discover and describe the essence of the experiences (Moustakas, 1994).

The focus groups and online discussion group were used to validate the data culled from the individual interviews. Moustakas (1994) advocated for determining that the themes are either explicitly expressed or compatible with the transcription: "If they are not explicit or compatible, they are not relevant to the co-researcher's experience and should be deleted" (p.

121). The descriptions of the phenomenon include both individual descriptions for each participant, and a composite description for the group (Moustakas, 1994). Analyzing data from questionnaires, individual interviews, memoing, focus groups, and online discussions serves to triangulate the data to ensure an accurate analysis of the common experiences of the participants (Lincoln & Guba, 1985).

Trustworthiness

According to Lincoln and Guba (1985), the four parts of establishing trustworthiness in a qualitative study include credibility, transferability, dependability, and confirmability. In order for research to be considered trustworthy, these four constructs must be considered. Each of these constructs has its own description and definition.

Credibility

Credibility speaks to the extent that there is truth in the findings. Credibility can be established by a variety of means. In this study, credibility was established by member checking and peer debriefing via the focus groups and online discussion (Lincoln & Guba, 1985). The feedback from the participants during the focus groups or in the online discussion was used to modify the conclusions in the study if necessary.

Dependability and Confirmability

Dependability and confirmability refer to the ability to show that the findings are consistent. They also pertain to the degree of neutrality established by the researcher via bracketing. These were achieved by member checking via focus groups and by having a significant number of participants, ensuring that the results were repeatable. I also used bracketing by keeping a reflective journal both before and after I conducted the interviews. Triangulation was used to confirm the findings. I used the data gathered via the questionnaires,

interviews, focus groups, and online discussion to ensure that there were no discrepancies in the description of the essence of the phenomenon. Also, rich detail about the setting and participants was provided (Creswell, 2013; Lincoln & Guba, 1985).

Transferability

Transferability refers to the applicability of the findings to other settings. It is concerned with whether or not the conclusions would be accurate in other settings. Because the participants of this study come from varied colleges across the country, the findings can be assumed to be transferable to other colleges (Lincoln & Guba, 1985).

Ethical Considerations

Ethical considerations include confidentiality, privacy, data storage, influence, conflict of interest, and IRB approval. To ensure confidentiality, pseudonyms were used for both the names of the colleges and the names of the participants. Data is stored in locked cabinets and password-protected computers. The participants have not had any prior connection with the researcher. They were not former or potential future students of the researcher. The researcher did not have a relationship with their instructors. No data was gathered prior to IRB approval

Summary

The purpose of this transcendental phenomenological qualitative study was to explore the shared experiences of former developmental-math students who have been successful in college-level math. This chapter provided a detailed description of the participant selection, participants, settings, research design, data collection, data analysis, researcher's role, trustworthiness, and ethical considerations involved in the study.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this transcendental phenomenological study was to describe the shared experiences of former developmental-math students who successfully completed at least one college-level math course. Chapter four provides a description of the participants and their experiences in math education from high school through developmental-math programs and college-level math classes. I used four methods of data collection, a questionnaire, personal interviews, focus groups, and an online discussion group in order to investigate and answer the following central research question and four sub-questions.

CQ: What are the shared experiences of former developmental-math students who have successfully completed a college-level math course?

Q1: What were the early, prior-to-college, experiences of the participants?

Q2: How do the participants describe the impact that developmental math had on their success in the college-level math?

Q3: Why do the participants believe that they were successful in college-level math?

Q4: What does the completion of a college-level math course mean for the future of the participants?

The data from the four forms of data collection was analyzed and Moustakas' (1994) three-core process of Epoche, Transcendental Phenomenological Reduction, and Imaginative Variation was applied. I used journaling before and after each personal interview and focus groups in order to separate myself and my personal views, biases, and judgements from the participants' answers and comments. When I analyzed the questionnaires, interviews, focus groups, and online discussion group, results were garnered by identifying a wide range of

common topics, then reclassifying them and reducing them to a smaller set of common themes, and finally bringing all of the data together with a thick, rich description of the essence of the phenomenon. The chapter concludes with a description of the themes discovered in this process.

Participants

A dozen people responded to the recruiting posts that were disseminated over Facebook and at the math departments of local community colleges. Four of those people qualified for the study. Each one was able to refer a second qualified person to the study, resulting in eight qualified participants. Seven of the eight participants are young adult females. The eighth individual is a young adult male. All of them are Caucasian. They come from four east-coast metropolitan areas. There are two people from each area. Six different community colleges are represented and five different universities. One participant is a student in a graduate program. The names recorded here are pseudonyms to protect the confidentiality of the participants.

Taylor

Taylor was the first to respond to the recruiting post. She graduated from high school in 2012. She initially attended a community college near her home in a Northeastern state. She graduated with her associate degree in American Sign Language and transferred to a local university. She graduated from the university with a bachelor's in speech language pathology and audiology and is now enrolled in a graduate program in a city near her family's home; she is pursuing her Master's in speech language pathology and audiology. She is the younger of two daughters. She has a large outgoing Irish/Italian extended family with whom she is close. She was required to take two semesters of developmental math at the community college before she could enroll in any college-level math courses. While at the community college, she successfully completed two college-level math courses.

Amanda

Amanda is a friend of Taylor's. She attended the same community college as Taylor. Amanda is still enrolled in the community college. She has two more classes to take in order to graduate. She is the younger of two daughters. She grew up in a major metropolitan area in the Northeastern United States. She graduated from high school in 2012. She is pursuing an associate degree in liberal arts. She plans to transfer to a university out of state to get her Bachelor of Science in library science. She was required to take two developmental-math courses before she could enroll in college-level math courses. She has successfully completed both of the required math courses for her associate degree.

Catherine

Catherine graduated from high school in 2015. She attended community college in a major metropolitan area in the Central Eastern United States. She then transferred to a university in a major metropolitan area in the same state. She is the older of two children, and she has a much younger brother. Her extended family is spread out over several states. At the community college, she was required to take one developmental-level math course before she could enroll in any college-level math courses. She then successfully completed one college-level math course at the community college. She is currently taking her second college-level math course at the university. She transferred to the university before she earned an associate degree from the community college. Initially, she was majoring in dental hygiene but, she is in the process of changing her major.

Cary

Cary is an acquaintance of Catherine's. She graduated from high school in 2006. She grew up in a rural area of her state. She has an older brother and grew up with extended family

nearby. Initially, she attended community college near her home in the Central Eastern United States, where she enrolled in and completed a developmental-math course. Prior to completing her associate degree, she transferred to a state university, passed her college-level math courses, and earned her bachelor's degree in sociology. She is currently working as a social worker.

Sharon

Sharon graduated from high school in 2013. Sharon grew up in a major metropolitan area in the Central Eastern United States. She is the youngest of three siblings, with an older brother and sister. She has a large extended family with whom she is close. Initially, she attended a local, technical community college. She then transferred to a local university before completing her associate degree. She is graduating this summer from the university with a bachelor's degree in communications. When she was at the community college, she was required to take two developmental-math classes before she could enroll in any college-level math courses. When she transferred to the university, she successfully completed two college-level math courses. She plans to pursue a career in marketing or human resources.

Michelle

Michelle is Sharon's sister-in-law. She is married to Sharon's older brother. Michelle graduated from high school in 2012. She is the third child in a family with four children. She grew up in a rural area but moved to a metropolitan area in the Central Eastern United States when she was in high school. She did not attend community college. She enrolled directly in a major local university; however, she was required to enroll in its bridge program for math, the university's equivalent of developmental math. Had she not passed, she would have been unable to continue in her program of study. She successfully completed the bridge program during her freshman year and then completed two college-level math courses. She majored in health

promotion and wellness, and graduated last year. She is currently working at a restaurant and is applying for jobs in the nonprofit sector.

Mary

Mary graduated from high school in 2008 in a major metropolitan area in the Northeastern United States. She is the older of two daughters. She attended the local community college, where she earned her associate degree in criminal justice. While she was in community college, she was required to take developmental math. She successfully completed two college-level math classes in order to earn her degree. She is now working as a supervisor for a security company.

Richard

Richard is Mary's boyfriend. Richard graduated from high school in 2008 in a major metropolitan area in the Northeastern United States. He lived in the same general area as Mary but did not attend the same high school or college. Mary and Richard did not meet until after college. Richard is the only son in his family; He has four sisters. A year after finishing high school, Richard enrolled in the local community college. He was required to take developmental math before he could enroll in college-level math. He completed all of the coursework for his associate degree in psychology but has not been awarded the degree due to unpaid tuition bills. He is currently working as a Communications Technician for a cable company.

Results

The results described in this section are culled from the questionnaire, individual interviews, focus group discussions, and the online discussion group. It was clear early on that the participants in this study had many similar experiences in both high school and college regarding their math educations. I transcribed the interviews myself in order to more thoroughly

review them. After transcribing the interviews and reading them several more times, I created a chart with significant statements identified in the interviews. In the chart, I indicated when a participant made a reference to a similar statement. Initially, there were nearly 100 concepts or statements listed. I then coded them and sorted them into meaning statements. Next I took the meaning statements and distilled them into common themes, using my research questions to filter the themes. The theme development and the answers to the research questions are summarized below.

Questionnaire

I invited all of the participants to complete a short demographic questionnaire. Some of them completed it on their own; the rest answered the questions for me on the phone during their personal interviews.

Interviews

Originally, I had planned to interview local participants in person and distant participants via Facetime, Skype, or telephone. Once I conducted the first interview via Google Voice, I decided to complete the remainder of the interviews the same way, so my facial expressions or body language would not interfere with the participants' responses. First, the participants completed the consent form (see appendix C). Second, I had them call me on my Google Voice number, and I recorded the phone call. After I accepted the call, I pressed the 4 button and a recording said "this call is now being recorded." As a result, participants knew that our discussions were being recorded. I did all eight interviews within a two month span. Each interview took from 20 to 40 minutes to complete. The recordings were sent to my voicemail then airdropped to my computer, where they were saved in a password-protected file. Before and after each interview, I journaled about my reactions to and observations of the interviews. I

have many ideas and opinions about why a student may or may not be successful in a math class. I was really hoping to be surprised by the participants' responses. The most difficult part for me was remaining neutral and refraining from saying something like, "I hadn't thought of that!" I was surprised, not by the answers, but by their consistency and vehemence. I was also surprised by some of the patterns in the participants' course experiences, especially considering that these experiences occurred at eight different high schools, and ten different community colleges or universities across four states. After transcribing each interview, I emailed a copy to the participant for review, allowing for member-checking of the interview and transcription process. No changes were made.

Focus Groups

I organized two focus groups. They were conducted as group phone calls on a cell phone or via Facebook messenger and recorded with a second cell phone. I transcribed the focus groups myself and saved both the recording and the transcription on a password-protected computer.

Online Discussion Group

Every participant was invited to participate in the online discussion group, which was conducted via Facebook Messenger. I provided a handful of questions and asked that each participant answer at least two questions and respond to at least two of the posted answers of other participants. I encouraged the participants to interact even more if they wished. As a result, participants had time to think about their answers and were able to exchange ideas.

Themes

I collected data from the participants using a questionnaire, interviews, focus groups, and online discussion group. I was originally going to send my recordings to a transcription service

however I transcribed the first interview myself in an effort to reduce costs, and I discovered that transcribing the interviews was an excellent way to thoroughly review them. As I conducted the interviews, I kept a journal before and after each interview. I also kept a journal while I was transcribing the interview in an attempt to distance myself from my own thoughts and opinions and focus entirely on the participants' experiences and ideas. I took screen shots of the discussion group.

Table 1
Themes and Codes from Significant Statements

CODE	FREQUENCY	THEME
Involved High School and College Student	28	School Good, Math Hard
Conscientious Student, Excited about College	18	
Math Was always Challenging	18	
Remedial other than Math	8	Developmental Math, Needed but Resented
Refresher/Positive Experience	31	
Obstacles, Resentments, and Wake-up Call	19	
Commitment	14	
Applied Myself	15	Persistence, Determination and Maturity
Recognized the Importance of Math	17	
Strategies	6	
Math Labs/Help Centers	13	
Repeated a Math Class	11	
Tutors	13	It Was the Teacher!
Teachers	16	

School Is Good but Math Is Hard

This perception was a common theme found early on in all but one of the interviews. All of the participants were significantly involved in high school activities and were excited about college plans. Participants were members of high school basketball, softball, swim, and even bowling teams. They were involved in History Club, Students Against Destructive Decisions (SADD), American Sign Language Club, and JROTC. During high school, the participants were looking forward to college experiences for a variety of reasons:

- I was excited for the independence of being in college that, you know in high school you are a little bit more hand held. I had to be responsible for my own school work and my own time. (Taylor, personal communication, November 5, 2018)
- I think the main thing I was looking forward to was, this made sound cheesy, just learning, and being able to find something like a career that I know once I go to college I can further my career and make a job out of it for the rest of my life. So, I guess I can say, yes I was interested in making new friends and you know meeting a ton of new people after high school but I guess I was interested in learning and gaining new knowledge to further my career. (Sharon, personal communication, January 1, 2019)
- I was excited to go to [college] because I knew some people who were going and a little bit more independence. (Cary, personal communication, January 5, 2019)
- So, I was definitely looking forward to that and having to actually get to experience the college life. (Catherine, personal communication, January 5, 2019)

At the same time, the participants also had concerns about college. Taylor was specifically concerned about the school work "because I did have academic problems. I did have an IEP. I

was resource room. I was concerned that I wouldn't be able to do it, but I did it" (Taylor, personal communication, November 5, 2018). Sharon was concerned about more practical issues:

> I guess you could say, I was the most concerned about my schedule and how I would be able to afford working and going to school and paying my bills as well as making sure, being a full-time student making sure that I had time to work. I still had time to hang out with friends and not feel too stressed taking five classes. Even last semester, I took six classes. So I was definitely concerned about the stress of all of it. (Sharon, personal communication, January 1, 2019)

Like Taylor, Michelle was concerned about the difficulty level of the coursework: "You know I was worried about how hard it was going to be" (Michelle, personal communication, January 4, 2019). On a different note, Mary and Richard were a bit more goal focused with their concerns. Mary was worried about "getting the degree and meeting all the requirements in math and English" (Mary, personal communication, January 5, 2019). Richard was frustrated with "the fact that I did need to start at a remedial level. So I was worried that it was going to take longer to graduate college" (Richard, personal communication, January 5, 2019).

The most significant commonality to come out of the first set of questions was that all of the women said that math was challenging for them well before they got to college. Taylor said "I've always struggled with math, ever since I was a child. I never liked math. I didn't choose a profession that was math based" (Taylor, personal communication, November 5, 2018). Sharon's issues started later: "Mainly in middle school I had a lot of problems with most of my math classes" (Sharon, personal communication, January 1, 2019). Michelle didn't just say that math was hard or challenging, she described it as scary: "So math has never really been. . . It's

always been kind of a scary thing for me. I've always been more of an English/History type of person" (Michelle, personal communication, January 4, 2019). Mary described what teachers often observe, a student who appears to be paying attention and understanding but is not testing well:

> My grades weren't great. I struggled for a C, maybe a B. Math was difficult for me, so I guess maybe they did reflect my understanding. I understood more in the classroom when I was being taught but, then, when it came to doing the homework and the tests, I never delivered, but, I could never pin point what I didn't understand until it was time for the test. (Mary, personal communication, January 5, 2019)

Many of the participants said that their remedial-math educations began long before they entered college: "I did remedial math in high school. I was never very good at it. I did Algebra 1 part 1 and part 2. I split it into parts so that I didn't learn it all at once so that I could learn it at a slower pace" (Cary, personal communication, January 5, 2019). Also, most of the participants shared Catherine's feelings about Geometry: "I took geometry my junior year of high school and that was definitely one of the hardest classes for me to get by. I couldn't do it" (Catherine, personal communication, January 5, 2019). Geometry was singled out as the most challenging high school math course. Amanda, however, said "I found all of it challenging" (Amanda, personal communication, December 27, 2018).

Interestingly, the young man that was interviewed had a different perspective. In response to a question about what was challenging about math in high school, he said, "It wasn't too challenging. If I had it down and remembered the formulas and the postulates and all the rules, it would have been significantly easier, but I had no interest in studying, so I never memorized them" (Richard, personal communication, January 5, 2019). His comments about

postulates and rules are a reference to Geometry, and, when discussing challenging high school math, he was clearly thinking about Geometry.

Overall, the participants seemed to have a positive school experience in both high school and college. They all appeared to be well-rounded students, yet the majority of them struggled a great deal with math throughout most of their academic lives. The cause of their struggles was split down gender lines—in this very small sample—the women's perspectives were that math was hard for them. The man's perspective was that he did not apply himself; nonetheless, an overarching theme for this group of participants is that they were unsuccessful in math long before beginning college.

Developmental Math, Needed but Resented

The next theme that presented itself quite clearly in the interviews was the resentment the participants felt about being in the developmental-math program. They resented being in the program for a variety of reasons. First, they were paying for a class that did not count for graduation. Amanda said, "It did bother me because I did have to pay for a class that did not give me credits for my degree" (personal communication, December 27, 2018). Michelle was even more specific saying, "also I felt like I shouldn't have had to pay for it because it didn't even count at all towards my degree or toward my credit hours whatsoever. It was four credit hours, but you don't get those credit hours" (personal communication, January 4, 2019). Richard expressed even stronger emotions about it: "I was angry that I had to pay for class so that I could take the actual college classes" (personal communication, January 5, 2019).

After the third interview, I wrote in my journal, "noticing that the participants call it remedial, even when I consistently call it developmental math" (January 1, 2019). Colleges do not use the word remedial in their programs at all. Even when colleges are trying to normalize

enrollment in developmental classes, there appears to be some embarrassment attached to inclusion in these classes. Several of the participants said that they were bothered by the required completion of developmental classes. Taylor, Sharon, and Michelle directly or indirectly addressed these feelings. Taylor, who is now in a graduate program, said, "My first day of remedial class, we went over multiplication like I was in second grade (chuckle)" (Taylor, personal communication, November 5, 2018). It seems that time and distance have given Sharon a bit of perspective. She said, "I remember being embarrassed that I had to take the two classes, and I was like you know this is kind of a bummer, you know they don't really count for credit" (Sharon, personal communication, January 1, 2019). Sharon's sister-in-law was even more direct about how she felt: "When I was in the bridge program I felt like I was dumb" (Michelle, personal communication, January 4, 2019).

Even though there was considerable resentment over the cost, in both money and time, and embarrassment of developmental math, all of the participants conceded that there was value in the program. Taylor used phrases like "wake-up call", "refresher," and "helpful," when describing the developmental courses. Amanda also used the word "refresher." Sharon admitted, "I definitely felt like they were very helpful to my learning" (personal communication, January 1, 2019). Michelle said something very similar: "It was definitely helpful, yes, it was definitely helpful" (Personal communication, January 4, 2019). Even Richard, who felt that his weakness in math had different origins than those of the women in the study, said:

> I remember it being, because I had a one-year gap from graduating and starting college, it was very useful in reminding me of the many things I had learned the years before. It was good brush up to get ready for like, it kick started me into remembering how math works. (Personal communication, January 4, 2019)

Persistence, Determination, and Maturity

The third theme that began to shine through was the persistence, determination, and maturity required of the participants in order to pass developmental-math courses, qualify to enroll in college-level math courses, and complete college-level math courses. Six of the participants shared that they had to repeat a math course during their math educations. Amanda somewhat wryly admitted, "I took two [developmental classes]… and one of them I took three times" (personal communication, December 27, 2018). All of the participants were required to pass two college-level math courses for their respective majors. Seven of the participants had already met their math requirements. The final participant is currently working on her second college-level math course. All but one of the participants had to take a statistics class. Statistics was consistently considered the participants' most challenging class. Sharon said:

> I did have some concerns about probability and statistics cause I heard it was kind of hard. I actually had to retake that class because the first time I took it I got a D+, and I had to retake it, and the second time I took it I got an A. (personal communication, January 1, 2019)

Six of the seven participants who took statistics, took it at least twice—either because, like Sharon, their grade was not high enough, or because they failed the course or dropped it before failing. One participant is about to take statistics for the third time.

I was impressed by the maturity and determination of the students. In my journal, I noted several times that I wished that my own struggling students had these students' attitudes about studying math. Taylor's account was particularly apt:

> I kinda just knew going into it I couldn't just slack in the class. I knew I had to attend every class and take detailed notes and just put in the time. I knew going into it, it wasn't

> going to be a walk through the park." (Taylor, personal communication, November 5, 2018)

I sincerely wish that more of my students approached school as Michelle did:

> One of my things was, ok, I'm sitting at the front of the class because I already know that sitting at the back of the class doesn't do anything good for me. One, I don't pay attention. Two, I have astigmatism in my left eye, so it's hard for me to see from back there. So, I sat at the front, let's give it a better try. Let's try and really pass the class this time as opposed to just barely passing. (personal communication, January 4, 2018)

Catherine's strategy for getter through her math classes involved extra instruction: "I would ask for help. I got a tutor. So, I had to go out of my way to find help in order to try to do well in the class" (Catherine, personal communication, January 5, 2019). Several other participants said something similar: "I would go to the math lab and get help if I needed" (Taylor, personal communication, November 5, 2018). Every participant persisted through developmental classes that they resented having to take, so they would be permitted to take college-math courses they knew would be challenging. The level of maturity demonstrated by the participants exceeds that of many high school and some college students. They were determined to complete their courses successfully, and their persistence and determination paid off.

It Was the Teacher!

The most exciting theme to emerge from the interviews, focus groups, and online discussion group was that the students believed it was the teacher that enabled struggling math students to be successful in college-level math. As a teacher, I would like to think that I make a difference. Teaching is not just a job; it is a calling, and teachers have the capacity to profoundly impact their students' lives. It is quite rewarding to see evidence of this impact. When the

participants were asked why they thought they were successful in either developmental or college-level math, they almost unanimously credited the teacher. Interestingly, participants did not attribute previous struggles in math to ineffective teachers. Two participants remembered having a revolving door of substitutes during a crucial year of high-school math: "It seemed like every year, sometimes teachers in middle school and high school, something would happen, and we would have to get subs most of the time. It was kind of crazy" (Sharon, personal communication, January 1, 2019). Catherine commented, "I had teachers who would leave. We had substitute teachers who would be teaching us for weeks on and on and it was just many different things" (Catherine, personal communication, January 5, 2019). The students seemed to blame circumstances rather than their teachers. On the other hand, most of the participants credited at least one math teacher or tutor with their respective college math successes. The following is a sample of the comments participants made about their experiences with a teacher or tutor who made a difference:

- I really didn't understand it until I got a tutor who really helped me work through it all. (Amanda, personal communication, December 27, 2018).
- Then, when I retook the course, I took it in the summertime. I only took that class, so that's the only class I had to focus on. I took it with another teacher. And that teacher was the best math teacher I've ever had in my life! (Sharon, personal communication, January 1, 2019)
- The teacher I had was amazing. . . . I felt more comfortable with her and going to her for help. She was just very nice and helpful and very good at explaining things to me. The same thing with my Behavioral Statistics teacher. I had her for the classroom and the lab portion. She was very good at explaining stuff. If you needed extra help, she

would be there. You could come to her office, and she would explain stuff to you if you didn't understand something the first time. She was just very patient. I'm just very thankful for both of them because they made the whole experience a lot more pleasant. (Michelle, personal communication, January 4, 2019)

- It was one professor. She taught high school math for 35 years and this was her retirement job. That woman . . . just knew how to teach multiple styles in one session. She was phenomenal. I've never understood so much information that stuck later for the test. She was just a really good professor at teaching. (Mary, personal communication, January 5, 2019)
- I think I had some really good teachers. I know I had like one in particular stands out. She was really good at what she did. She really understood that I sometimes struggled with it. (Cary, personal communication, January 5, 2019)
- I truly believe that teaching comes down to the charisma of the teacher, of course how well they know it. I can't exactly quote it but I think Einstein said something along the lines of "you can only teach something that you fully understand" or something along those lines. To explain it simply, I can't remember it. Teachers that understand it and are charismatic and enjoy what they do, definitely impact students significantly more than the teacher who is just punching a clock. (Richard, personal communication, January 5, 2019)

It is fortunate that the participants could not see my face during the interviews. Every time they said something positive about their teachers, I am sure that I was beaming. In my journal, I reminded myself to remain neutral.

Central Research Question

The Central Research Question for this study was student focused. What are the shared experiences of former developmental-math students who have successfully completed a college-level math course? I chose this question because I was genuinely interested in the student point of view. I work with teachers and professors, and I hear their opinions daily. As I listened to the participants and reviewed the transcripts of their interviews, focus groups, and online discussion group, several themes emerged. Two things were immediately clear in the interviews, focus groups, and online discussion group: the persistence and determination of the students, and: the impact of talented teachers/tutors.

The eight study participants completed the developmental-math part of their college educations at six different colleges and the developmental program of one university. The participants completed their college math courses in widely differing schools. Just two participants attended the same community college. Despite the variety in colleges, and locations, the participants had remarkably similar feelings and experiences.

Sub-question One

The first research question was: What were the early, prior-to-college, experiences of the participants? All of the participants shared that they had positive high school experiences and were involved in a variety of athletic and other extra-curricular activities. Their only academic struggles were in math. Taylor was a varsity swimmer and basketball player. She struggled in math, particularly geometry. Amanda volunteered for a service organization called Students Against Destructive Decisions and was a Girl Scout. In early elementary, school she was in a self-contained special education program:

> I started out, umm, I ended in inclusion classes, I started out in self-contained. I believe it was in fifth grade, I got put into self-contained classes, and I eventually worked myself

> out of it. I was on medication for ADHD from when I was eight. (Amanda, personal communication, December 27, 2018)

Amanda struggled academically but worked hard to meet her goals. Sharon, on the other hand followed a less traditional route to high-school graduation. She was enrolled in public school until her junior year, when she transferred to an online high school. She was active in a school history club, and she excelled academically in every area except math. She needed a tutor to pass high school math. Michelle chose a rigorous high school schedule: "In high school I wasn't really sure what I wanted to do so I took a lot of college prep courses" (Michelle, personal communication, January 5, 2019). Michelle also noted her extreme dislike of math, particularly geometry: "I hated geometry because I was terrible at it so that part was awful. Math wasn't necessarily my favorite whenever it was on my core schedule" (Michelle, personal communication, January 5, 2019). Catherine was an avid athlete during high school, playing soft ball for both school and travel teams and riding horses competitively. She was a conscientious high-school student who did well until taking geometry. Like many of the students in this study, Catherine found geometry to be very challenging. Mary, in contrast, characterized herself as a mediocre high-school student overall: "I did not spend a lot of time on anything when it came to school" (Mary, personal communication, January 5, 2019). Mary, however, was active in sports and other extra-curricular activities: "I did ROTC in high school, which I liked very much. I also did bowling. I was on the school team. I made varsity. And I was a part of the anime club" (Mary, personal communication, January 5, 2019). Cary, like Catherine, was very athletic and participated in cheerleading, volleyball, and soccer during high school. In describing her academic experiences prior to college, she said:

> It was extremely challenging. I had to do a lot of remedial math. I remember, even in elementary school, having a tutor I would meet with to kind of help me. I never qualified for any IEP or 504 plan or anything like that. I did get testing for it because I just really couldn't get it, but, since I went to such a small school, they just worked with me. (Cary, personal communication, January 5, 2019)

Richard, the final participant, was a JROTC cadet during high school. He described his academic struggles differently from the women in the study:

> I never took high school as seriously as I should have. I certainly had inspiring teachers, but I was more interested in the JROTC side of things, the science side of things. Math was never my, I didn't enjoy it as much. I didn't get past algebra classes. I never had any pre-calculus. I think I had one trigonometry and that was it. (Richard, personal communication, January 5, 2019).

All of the participants described relatively positive school experiences prior to college. No one said that she/he hated school. Some participants did say that they hated math. All of the participants acknowledged that they struggled in math.

Sub-question Two

The second question was: How do the participants describe the impact that developmental math had on their success in college-level math? At one point or another, all of the participants expressed anger, resentment, or frustration that they had to spend money and time on developmental-math courses. They all, however also acknowledged that developmental math was beneficial in the long run. Taylor's observations were especially funny (and a bit sarcastic):

> I feel like I needed it because I obviously failed the placement test, so I didn't have those fundamental skills even though at the time it was frustrating to be 18 years old and doing long division like a third grader. I did feel like I guess I needed it cause I obviously didn't know it. (Taylor, personal communication, November 5, 2018)

Sharon described the benefits of her developmental classes well:

> Those classes were pretty challenging. The first one was kind of easy, but, in both of them, we weren't able to use calculators or anything like that. So it was a lot of kind of almost remembering how to not use a calculator, but they were also good to get prepared for algebra, I think, and I definitely noticed too that my teachers at [my college] taking the remedial classes and then taking college algebra that I definitely learned a lot better. (Sharon, personal communication, January 1, 2019).

Even Richard, who felt that his deficits in math were due to his own inattention rather than the difficulty of the material said that developmental math "was very useful in reminding me of the many things I had learned the years before. It was good brush up to get ready for, like, it kick started me into remembering how math works" (Richard, personal communication, January 5, 2019).

Sub-question Three

The third question was: Why do the participants believe that they were successful in college-level math? When asked why they believed they were successful in their college-level math classes, all the participants spoke about studying, taking the work seriously, and having a great teacher or tutor. When Amanda failed statistics the first time she took it, she found a tutor and worked incredibly hard with her:

> I actually worked with her five days a week, two hours a day. . . . I actually had to go back through my high-school stuff that I didn't learn. She took me back from there and built on everything to like bring up my level of understanding. (Amanda, personal communication, December 27, 2019)

Sharon had to retake Statistics. She responded to her second professor's traditional teaching style:

> So that teacher, he had no Powerpoints. He was pretty old school. He wrote on a chalk board. He had a long chalk board across the whole class. I remember this, and he would write problems, and he had worksheets that we did that we worked on, when we would see the problem in front of us. He would go through step by step on the chalkboard. Everything, if we had questions he would go back. He would show us how to do everything on the calculator for the test. He was extremely helpful. (Sharon, personal communication, January 1, 2019)

Mary also credited an instructor with her success: "That's what really got me through my college-level math classes was having a tutor to walk me through it after the class" (Mary, personal communication, January 5, 2019).

Sub-question Four

The final question was: What does the completion of a college-level math course mean for the future of the participants? All but one of the participants has completed two college-level math courses. At the most basic level, for them, passing means that they have met that particular graduation requirement. Catherine is currently retaking statistics, her second college-level math course. She has already successfully completed college algebra. If she follows the pattern of other study participants, Catherine's second attempt at statistics will be successful. Amanda is

two (non-math) courses away from receiving her associate degree. Richard has completed all of the requirements for his associate degree. Mary has also earned her associate degree. Sharon is completing a bachelor's degree this semester. Michelle completed a bachelor's degree. Taylor earned her bachelor's degree two years ago and is currently pursuing a master's degree. Cary earned her bachelor's degree and is working as a social worker. Each of the aforementioned degrees required the successful completion of two college-level math courses. When asked about using the math they learned in the future, participants had some interesting responses. They all mentioned using math in their finances. Mary, for example observed that:

> The math I primarily use is some statistics, some fractions. Some stuff I learned in high school, but I think really just payroll and write schedule. Those are the primary things I use math for, or have used math for in my career. I don't think any of the math I learned in college was helpful for that. (Mary, personal communication, January 5, 2019)

Richard reluctantly admitted that he frequently uses math in his job.

> Oh, I am currently a communications technician. There is a lot of arithmetic, and algebra used, a lot, so I had to get better at the quick mental math, you know four minus eight is negative four, yadyadyada, and then learning if I have 50 here and 50 here that something along the line is causing attenuation. So, I plug and play with the value and the various splitters, so I know what I am going to find. When you walk into a situation, and you know the signal in the beginning, and you know the signal at the end, you can assume how many devices and the length of wires. . . . You have absolutely no idea in the future when you are going to need algebra. Sometimes you are never going to need this. In cases of calculus, sure maybe you don't, but algebra, it sneaks up, and it's very useful throughout your life. (Richard, personal communication, January 5, 2019)

Both Sharon and Taylor see a direct connection between their college statistics courses and their future careers. Sharon, who is a communications major, observed:

> I would definitely say, especially with my college-math classes, or even with my tutor, that they have, in those math classes, definitely to be a better studier, because even if I don't use probability every single day: even though I have for a few of my marketing classes: I think it has helped me to become more organized and been able to tackle more problems. Then, on top of that too, from learning all the probability and statistics, we use a lot of the same software in all of my internships and stuff, all of the marketing, all of the software programs that we use, is actually, a lot of it is statistics. We look at numbers every single day in marketing. Who's looking at the website? You know, who's interested? There's always numbers involved somehow. So, I know that if I end up getting a job in advertising or marketing, I know that probability and statistics will definitely come in handy for that because I will be using the same type of software for that. I will have to look at all the numbers of customers and stuff. (Sharon, personal communication, January 1, 2019)

Taylor, currently in a master's program for speech and language pathology noted:

> With speech language pathology, we do a lot of assessments, and, with those assessments, you have to convert them into raw scores, z-scores, percentile, rank, and a lot of statistical stuff, that, at the time, I didn't realize how much of a part it had in my field, but it does, so that has really helped me. (Taylor, personal communication, November 5, 2019)

While the participants were split about whether their college math courses actually applied to their lives after college, they all acknowledged that they used math in their lives all of the time.

Practically speaking, successfully completing their college-level math classes removed, or will remove, a major barrier to graduation for each participant.

Summary

Chapter four described the shared experiences of the participants, who had been required to take at least one developmental-math class prior to taking any college-level math courses and had successfully completed at least one college-level math course. Four themes quickly emerged from the interviews, focus groups, and online discussion group: School was good, but math was hard; developmental math was resented but needed; persistence, determination, and maturity got students through math; and, as far as the students were concerned, it was the teacher who made a difference.

The four means of data collection—a questionnaire, the interviews, focus groups, and online discussion group—were carefully reviewed in order to answer the central research question and four sub-questions. Almost immediately, it became clear that the participants felt that they had always struggled with math, even though they generally liked school and were engaged in school experiences. The participants may not have excelled in college math, but they persisted and were determined to succeed (despite any unhappiness caused by the time and money spent in developmental math). Each participant spoke glowingly of a tutor, teacher, or teachers, who enabled them to succeed regardless of former struggles.

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this transcendental phenomenological study was to describe the shared experiences of former developmental-math students who have successfully completed a college-level math course. The study was completed using four data-gathering tools, a questionnaire, personal interviews, focus groups, and an online discussion group. This chapter will provide a summary of the research findings, a discussion of both the findings and their implications in the context of the literature and theory presented in Chapter Two, methodological and practical implications, an outline of the study delimitations and limitations, and recommendations for future research.

Summary of Findings

One central research question and four sub-questions were developed in an endeavor to investigate the shared experiences of former developmental-math students who successfully completed at least one college-level math course.

CQ: What are the shared experiences of former developmental-math students who have successfully completed a college-level math course?

SQ1: What were the early, prior-to-college, experiences of the participants?

SQ2: How do the participants describe the impact that developmental math had on their success in college-level math?

SQ3: Why do the participants believe that they were successful in college-level math?

SQ4: What does the completion of a college-level math course mean for the future of the participants?

Four means of data collection were employed to gather data to answer the research questions. Each potential participant completed an initial questionnaire; then each participant was interviewed by phone. Several of the participants joined focus groups, during which they had the opportunity to discuss their answers to research questions. Finally, participants responded to online discussion group questions. Participants were asked to answer two or more questions and respond to the comments of at least two other participants. All data was recorded and transcribed. The transcripts were checked for accuracy by the participants. In accordance with Moustakas's method of reduction and imaginative variation (1994), the transcripts were reviewed several times, then coded. The resulting codes were organized into meaning clusters. Through these meaning clusters, four themes emerged: School was good, but math was hard; developmental math was resented but needed; persistence, determination, and maturity got students through math; and it was a tutor, teacher, or teachers who made the difference.

The research questions were answered by means of the four themes. The central research question was addressed primarily by the determination, persistence, and maturity of the students. Interestingly, while no participant directly said, "I was successful because I buckled down and worked really hard," that is essentially what occurred. The participants were quite generous in attributing their success to a particular tutor or teacher, while failing to acknowledge the importance of their own commitment to progress and success. Two participants admitted that they had to take a developmental class three times before finally passing it. When they did pass, they credited a tutor or teacher. They did not seem to recognize that the degree of perseverance they demonstrated was unusual.

The first research question explored the participants' backgrounds—the circumstance that brought them to developmental math. All but one of the participants shared that they had always

found math to be challenging. These participants used words like "hate," "fear," "dread," and "challenging," when referring to their experiences studying math. At the same time, they all described being happy and engaged during high school, leading to the first theme, school is good, but math is hard.

The second research question looked at the impact of developmental math on participants' overall college-math experiences. Participants were unanimous in their resentment of the cost (both in time and money) of non-credit courses. They all believed that there should be a better option. At the same time, they all acknowledged the benefits of developmental courses, leading to the second theme, developmental math is resented but needed.

The third research question addressed the core of the study—why participants thought they were successful in college-level math. The participants accounted for their success in many different ways, but, essentially, they all perceived that they had grown up and committed themselves to academic success. They all took advantage of tutoring services at their respective colleges as well as their professors' office hours. Every participant developed a personal relationship with a tutor or professor, contributing to the successful completion of required math courses. Thus, the themes persistence, determination, and maturity are key; and it was the teacher were identified.

The last research question concerned the future. Most participants did not perceive a direct link between their college-math classes and their subsequent career goals (other than the completion of a graduation requirement). Some participants, however, acknowledged the use of math for various work-related and non-work-related tasks.

The study participants shared many strikingly similar experiences, despite diversities of region, school, and course of study. They all struggled with math prior to high school, despite

their enjoyment of and engagement in school. All but one of the participants shared that they had been required to repeat one or more math courses multiple times. All participants resented paying for non-credit courses while acknowledging their benefits. All participants demonstrated a superior work ethic while failing to perceive it as such. Finally, all participants credited a particular tutor or teacher with their ultimate success in math.

Discussion

Schlossberg's Transition Theory

Schlossberg's transition theory (1981) is the theoretical framework for this study. Transition theory lends itself well to the study of college students because college is involves numerous transitions for young adults. Nancy Schlossberg has a background in counseling, and she initially developed her transition theory while dealing with a difficult transition in her own life. She had recently married and relocated and was finding the transition more challenging than she had anticipated—Schlossberg's transition theory grew out of this personal struggle. Schlossberg and her fellow researchers eventually wrote and published several books about lifetime transitions. These transitions include but are not limited to those encountered during college, after achievements or failures or tragedies, and during retirement. Currently Schlossberg is semi-retired and the co-president of TransitionWorks, a consulting firm. Her self-described mission is "to help others negotiate the inevitable transitions through life" (Schlossberg, n.d., Bio section, para. 4).

Schlossberg describes transitions as both anticipated and unanticipated events (Schlossberg, Waters, & Goodman, 1994). In this study participants experienced both types of transitions. Undoubtedly, participants anticipated the transition from high school to college. Some even anticipated the transition from community college to university. On the other hand,

participants may not have anticipated being assigned to developmental-math courses, particularly multiple developmental-math courses. Finally, participants may not have anticipated repeating math courses.

The Four S's. Schlossberg identified four key elements, or resources, for coping with transitions. These four elements are supports, self, situations, and strategies. (They became known as the 4 S's.) Schlossberg's transition model has three stages: approaching transitions, taking stock of coping strategies, and taking charge (Schlossberg et al., 1994). In their two books on college students in transition, Schlossberg and Chickering also describe the transition model sequentially as moving in, moving through, and moving out of college transitions (1989; 2002).

Schlossberg's transition theory is organized to facilitate its use by counselors assisting clients or even individuals experiencing a transition. The study participants were not aware of transition theory, though their actions cohered with its principles. The research questions, on the other hand, followed Schlossberg's sequential model of moving in, through, and out of transitions. Initial questions concerned math experiences prior-to-college. Subsequent questions concerned developmental-math, college-math, and after-college experiences, respectively. Although the questions did not include the words "situation," "self," "supports," and "strategies," these were the substance of the participants' observations.

Situations. In examining their situations, participants expressed their resentment of the required completion of non-credit courses. Interestingly, only one participant acknowledged that his actions before college led to the situation he found himself in during college. The remaining participants attributed their situations to a lack of innate math ability. Math instructors, in contrast, attribute student struggles with math to a lack of effort (Zientek et al., 2014).

Self. Self involves demographical and psychological factors (Schlossberg et al., 1994). Demographic factors relevant to this study include the participants' recent high school graduations. In addition the participants were the same race and approximately the same age. Participants universally described their families of origin as close, happy, and healthy. The only psychological factor relevant to this study was the receipt by some participants of special education services during K – 12 education. Two of the participants had IEP's and one participant was evaluated for an IEP, but did not qualify. (If participants received disability services during college, they did not mention them.)

Supports. Support factors have a wide variety of sources. Participants consistently mentioned the support of tutoring services offered at their respective colleges. Most of the participants took advantage of these services; those students who did not, found a tutor elsewhere. Interestingly, participants had various opinions of the quality of support provided by classmates. Some participants reported that the entire class worked together to create study guides and hold study sessions. Others reported that they did not even know classmates by name. All participants found significant support in either a tutor or teacher and expressed praise and gratitude for the help they received.

Strategies. Participants used a variety of strategies to navigate the transitions in, through, and out of college-level math. Taking advantage of tutoring offered by college tutors or during the professor's office hours was essential. Additional strategies included sitting in the front of class, taking good notes, practicing problems, working with classmates on a study guide, taking math classes back to back, taking a math class during the summer (so it was the only class being taken), dropping a class and restarting, etc.

The strategies employed by study participants as they transitioned in, through, and out of college math cohered with Schlossberg's transition theory. This coherence demonstrates both the participants' success as college students and the strength of transition theory as a model for effective transitions.

Developmental Math

Most developmental math is taught at community colleges (Bachman, 2013; Bahr, 2008). Increasingly, universities are also offering developmental math (Duranczyk & Higbee, 2006; Frost & Dreher, 2017). Most of the participants in the study enrolled in a traditional sequence of developmental math. One participant completed her developmental coursework via a bridge program at a university. The remaining participants completed their developmental course work at community colleges. No participants were in a program that had recently been redesigned. All participants were successful, well-rounded high school students before beginning college. This is consistent with the literature: Students requiring remediation for college math were not necessarily poor performers during high school (Attewell et al., 2006).

College instructors have identified several best practices for teaching developmental-math students. These best practices include encouraging the use of mnemonic devices to remember algorithms for solving linear equations or performing long division, teaching organizational skills (both personal and mathematic), and increasing collaboration in the classroom (Cafarella, 2014).

Interestingly, additional instructor-identified best practices for teaching developmental-math students did not appear to be on the participants' radar. Best practices *not* mentioned by participants included recognizing differences between developmental and college-ready students; providing regular feedback about grades; including shorter, more frequent assessments; reaching

out to students regarding grades and attendance; and using mnemonic devices and manipulatives (Cafarella, 2014). Participants did not self-identify as different from other college students. Participants repeatedly said that they had great instructors, but they did not mention the instructors' grading practices or frequency of assessments. Further, rather than describing professors reaching out to them, participants themselves sought out professors. In describing what they admired about their professors, participants noted instructors' approachability, availability, and ability to explain material, rather than the uses of mnemonic devices, graph paper, or manipulatives.

Bachman (2013) observed that students taking developmental-math courses found them unhelpful and time consuming. The study participants also *initially* resented the time and money spent on developmental courses; ultimately, however, they recognized that the courses were necessary. A distinction between successful (with success understood as persistence through college-level math) and unsuccessful developmental-math students seems to emerge, here; Goeller (2013) found that most developmental-math students believed that they were correctly placed but wished courses would move faster. The study participants also believed that they were correctly placed, but these (successful) students did not think their courses should have moved faster.

Ultimately, about half of the research on developmental math and developmental-math students applies to the study participants. Discrepancies may result from the fact that participants successfully completed both their developmental and college-level math requirement. Many developmental-math students who successfully complete their required developmental-math courses, do not persist in their course of study and complete required college-level math courses (Hudesman et al, 2014).

Persistence

The most surprising result from the research on persistence was the conclusion that more time spent in developmental math reduced persistence (Ngo & Kosiewicz, 2017). The experiences of some study participants contradicted this conclusion. About half of the study participants were required to take multiple developmental-math courses. Some participants were required to take developmental courses multiple times. Participants, however, were not deterred from persisting and successfully completing their college-level math courses.

Further, Davidson (2016) found that a student's grade in pre-algebra was the best predictor of success in college-level math, and students who were required to repeat pre-algebra faired even better than those who either did not take the class at all, or took it only once. The experiences of study participants were consistent with Davidson's conclusions.

Crisp and Delgado (2014) found that developmental-math students were less likely to transfer to four-year universities. Five out of eight study participants, however, transferred to four-year universities, another plans to transfer next year, and the remaining two participants are employed in fields that do not require a four-year degree. The experiences of participants defy Crisp and Delgado's study. Crisp and Delgado, however, also found that

> Students who enroll in developmental courses are systematically different from community college students who do not remediate in terms of (a) gender, (b) ethnicity, (c) first-generation status, (d) academic preparation and experiences during high school, and (e) delaying entry into college immediately following high school. (2014)

The study participants did not meet most of these criteria.

College Readiness

According the Conley (2012) there are four keys to college and career readiness: Key cognitive strategies (the ability to think critically and problem solve), key content knowledge (essential concepts, how those concepts apply to the chosen field of study, and the willingness to expend effort in acquiring and applying knowledge), key learning skills and techniques (student ownership of learning and learning techniques), key transition knowledge and skills (how to prepare for and know what to expect from college, how to self-advocate, how to understand financial aid, etc). Participants demonstrated some degree of mastery in each of these areas. In describing their progress through developmental and college-level math, participants demonstrated growth in these areas. When they approached the math courses—at either level—by retaking courses, making strategic choices about when to take courses, employing specific strategies for success (particularly after failure), participants demonstrated critical thinking, problem solving, and ownership of learning. The primary area of deficiency was in the acquiring of content knowledge essential concepts. All participants, however, demonstrated the ability to gain content knowledge and succeed as college students, demonstrating the college readiness Conley describes.

Most participants were required to take statistics. Only one participant was not required to take statistics twice. This data seems to align with the research on students who tested into developmental math but subsequently enrolled in statistics instead: These students were able to succeed in statistics as long as supports were in place (Logue, Douglas, & Watanabe-Rose, 2017). This makes one wonder if the participants in this study could have passed statistics the first time, if there had been those kinds of supports in place; or if they could have passed Statistics without the developmental math. Especially considering that they all firmly believe that their developmental courses were necessary.

Again, participants' experiences align with Conley's account of college readiness (2012). Having defied the odds and navigated both developmental and college-level math courses participants clearly demonstrated college readiness. This college readiness may be the defining difference between the successful study participants and other, less successful developmental-math students.

College Placement Exams

Interestingly, although the SAT and ACT are the national, college-level placement exams, no study participants used SAT or ACT scores for math course placement. All participants were placed in their developmental-math courses as a result of math tests administered by their colleges. Although participants knew that their scores had placed them in the developmental or bridge program, participants did not know their scores, or even remember which test they had taken.

Participants have been remarkably successful. Seven have completed all math requirements for their degrees. Four have either graduated or are about to graduate with a four-year degree. One is about to graduate with a master's degree. One has her associate degree. One has completed the coursework required for his associate degree. One is finishing her associate degree this semester. One is a junior at a university.

Implications

In Chapter Two I noted that there is an abundance of research on the factors professors think are important to student success, but very little—if any—research on the thoughts of students. In exploring the shared experiences of former developmental-math students who successfully completed college-level math, four themes emerged: School is good, but math is

hard; developmental math was resented but needed; persistence, determination, and maturity were essential to success; and, it was the teacher who made the difference.

Theoretical Implications

The theoretical implications of this study impact students, professors, and institutions. The results corroborate Schlossberg's transition theory. Students successfully navigated difficult transitions, employing many of the methods that Schlossberg describes. They accomplished this without the overt assistance of their colleges. Although participant colleges offered effective tutoring services—evident in participants' successful use of them—participants sought out those services rather than being referred to them.

As discussed in Chapter Two, many schools (community colleges in particular) have recently overhauled their developmental-math programs in order to increase students' successful completion of developmental math (Cafarella, 2016). As a result, more students are completing their developmental-math course sequences (Ngo & Kosiewicz, 2017); this success, however, has not enabled students to successfully make the transitions in and through college-level math (Ngo & Kosiewicz, 2017). The study participants all mentioned working individually with tutors or teachers. Currently, the recommendation of tutoring is not documented in the literature. As a best practice. Clearly, one-on-one tutoring should be promoted.

Empirical Implications

There are numerous qualitative and quantitative studies regarding the effectiveness of developmental-math education (Benken, Ramiriz, Li, & Wetendorf, 2015; Cafarella, 2016; Fong, Melguizo, & Prather, 2015). These studies all defined success as the completion of the developmental course sequence. Very few studies examined the persistence of developmental-math students who successfully completed college-level math courses. I was unable to find any

qualitative studies that examined the issue from the students' perspective. This study shed light on both the effective programs offered by colleges and the strategies and attitudes of students who were successful in making the transition from developmental math to college-level math. All participants took advantage of either their colleges' tutoring services or their professors' office hours. Students also demonstrated personal character qualities that are difficult, if not impossible, for an institutions or professors to teach; though professors could encourage students to develop these qualities: persistence, determination, and maturity. Lastly, several tutors and professors were described who demonstrated remarkable skill in teaching students who were struggling with and anxious about math.

Practical Implications

The practical implications of the study are many and varied. Some of the participants' deficits in math date back to middle and high school when they had a series of substitute math teachers. This lack of continuity needs to be addressed. How to address it is difficult to determine. Do we simply need to recruit more young people to train to be math teachers? Do we need to offer financial incentives? Are there school districts that have successfully addressed this problem? How did they do so? Some states are attempting to move developmental-math programs into high schools (Florida, 2008). Is this effective? According to study participants, the most important variable was instructor ability/accessibility. A better effort should be made to identify especially effective teachers and pair them with the students who most need them. Because students' own attitudes about learning played such a major role in their success (despite their universal failure to recognize this), training aimed at student attitude could be important.

Delimitations and Limitations

The study included some delimitations. I deliberately limited participants to individuals who graduated from high school within the last 12 years and began college shortly after high-school graduation. Adults who begin college several years after high school graduation face their own unique set of challenges. Participants also had to have been either encouraged or required to take at least one developmental-math course, after which they completed at least one college-level math course. I was specifically interested in students who successfully transitioned from developmental math to college-level math.

The limitations of the study were many and varied. Participant recruitment was extremely challenging—an unanticipated challenge. Ultimately, I was able to recruit several participants via Facebook and personal contacts, four of whom qualified for the study. Each participant was able to recruit an additional participant, resulting in eight participants. A major limitation of the study is the homogeneity of the sample. All the participants were Caucasians. No one appeared to come from a lower socio-economic background. There was only one male participant. Participants were majoring in fields that had minimal math requirements.

Recommendations for Future Research

In light of the study findings, delimitations, and limitations, there are several other important, potential research projects. A similar study could be held with a more diverse sample. A study could be held examining a population of first-generation college students. Although it is unusual for developmental-math students to pursue majors in STEM fields, it does occur. A qualitative study exploring the shared experiences of students in STEM majors who were required to enroll in developmental math would be quite interesting.

Summary

This research project sought to explore the shared experiences of former developmental-math students who successfully completed a college-level math course. It became obvious relatively early in the data-gathering process that the participants had worked extraordinarily hard in their developmental and college-level math courses, even when they failed to perceive this. When asked why they thought they were successful, they did not credit their own hard work. Instead, they attributed their success to a tutor or teacher. Although, as a teacher, I found participants' appreciation of instructors gratifying, nonetheless I do not want to minimize the effort and commitment demonstrated by the participants. They tended to credit something external, the teacher or the tutor, rather than something internal, their own personal commitment and drive, for their success. All in all, the study made me proud to be a teacher, and proud to live somewhere where second chances—like developmental-math education—are offered. Where, if you work hard enough, you can accomplish your goal.

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APPENDICES

APPENDIX A:IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

August 3, 2018

Karen Herman
IRB Approval 3379.080318: A Phenomenological Study of the Shared Experiences of Former Developmental Math Students Who Successfully Completed a College Level Math Course

Dear Karen Herman,

We are pleased to inform you that your study has been approved by the Liberty University IRB. This approval is extended to you for one year from the date provided above with your protocol number. 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.

Your study falls under the expedited review category (45 CFR 46.110), which is applicable to specific, minimal risk studies and minor changes to approved studies for the following reason(s):

6. Collection of data from voice, video, digital, or image recordings made for research purposes.

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

Sincerely,

[redacted]

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
The Graduate School

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APPENDIX B:Questionnaire

Questionnaire

1. Name
2. Phone number
3. Address
4. When did you graduate from high school?
5. Did you take any developmental math courses?
6. Have you completed a college level math course?
7. Are you willing to participate in a study about the experiences of former developmental math students who have completed a college level math course?
8. How did you hear about this study?

APPENDIX C:Informed Consent

CONSENT FORM

A Phenomenological Study of the Shared Experiences of Former Developmental Math Students Who Successfully Completed A College Level Math Course

Karen Park Herman
Liberty University
School of Education

You are invited to be in a research study on the shared experiences of former developmental math students who of successfully completed a college level math course. You were selected as a possible participant because someone you know thinks that you meet all of the following criteria

- at least 18 years old
- graduate from high school in 2010 or later
- enrolled in developmental math
- successfully completed a college level math course

Please read this form and ask any questions you may have before agreeing to be in the study.

Karen Herman, a doctoral candidate in the School of Education at Liberty University, is conducting this study.

Background Information: The purpose of this study is to investigate the shared experiences of former developmental math students who have successfully completed a college level math course. The inability to complete the required math coursework is the number one reason students do not finish college. The viewpoint of students who are able to overcome an initial disadvantage in this area merits investigation.

Procedures: If you agree to be in this study, I would ask you to do the following things:

1. Answer a short questionnaire about your background (10 minutes)
2. Provide documentation showing that you were enrolled in developmental math and have successfully completed a college level math course, either official or unofficial transcripts or a letter from your advisor or professor
3. Participate in a one-on-one interview either in person, on the phone, or online (about 1 hour). This interview will be audio recorded and transcribed.
4. Participate in either a focus group discussion with other participants or an online discussion groups (about 1 hour). The focus group will be audio recorded and transcribed.

Risks: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

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

Compensation: Participants will be compensated for participating in this study. Participants will receive a $25 Amazon gift card at the conclusion of the focus group or online discussion group. Additionally, each participants' name will be entered in a drawing for an additional $25 gift card.

Confidentiality: The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records. I may share the data I collect from you for use in future research studies or with other researchers; if I share the data that I collect about you, I will remove any information that could identify you, if applicable, before I share the data.

Participants will be assigned a pseudonym. I will conduct the interviews in a location where others will not easily overhear the conversation. Data will be stored on a password locked computer and may be used in future presentations. After three years, all electronic records will be deleted. Interviews will be recorded and transcribed. Recordings will be stored on a password locked computer for three years and then erased. Only the researcher will have access to these recordings. I cannot assure participants that other members of the focus group will not share what was discussed with persons outside of the group.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time..

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

Contacts and Questions: The researcher conducting this study is Karen Herman. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at kpherman@liberty.edu, (804) 539-2752. You may also contact the researcher's faculty chair, Dr. Steve McDonald at, samcdonald@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 1887, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the researcher if you would like a copy of this information for your records.

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

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

_____

Signature of Participant Date

_____

Signature of Investigator Date

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