Nontraditional Student Success in Entry-Level Mathematics Courses:

An Explanatory Case Study

by

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Abstract

The percentage of nontraditional students, or students age 25 and older, is increasing on college campuses in the United States (Caruth, 2014). Knowledge of mathematics is necessary for success in the technology-driven U.S. society (Kus, 2018). Research has been conducted on best practices for teaching mathematics to nontraditional students, but a gap in the literature remains on the motivational profiles of nontraditional students in entry-level postsecondary mathematics courses (Rothes, Lemos, & Gonçalves, 2017). Self-determination theory provided the conceptual framework for the qualitative case study. The purpose of the qualitative explanatory case study was to describe factors which may impact the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. The population was nontraditional students age 25 and older enrolled in entry-level mathematics courses, and the sample size was 21 participants enrolled in entry-level mathematics courses at a community college in South Carolina. Data were collected through questionnaires and interviews. Results showed nontraditional students in entry-level mathematics courses were autonomously motivated to succeed, and teachers and outside academic assistance were experiences impacting nontraditional student success. Community colleges should provide nontraditional students with teacher-led academic assistance in entry-level mathematics courses to support nontraditional student success. This study can benefit community college educators and leaders by providing insight into practices leading to successful completion of entry-level mathematics for nontraditional students.

Dedication

I would like to dedicate this dissertation to my parents, Carl and Karen Grant, for instilling in me the value of education and encouraging me throughout this process. I love you, Mommy and Daddy. I would also like to dedicate this dissertation to my grandmother, Lauretta Winfrey, for always telling me how proud she is of me and always being there to listen. I love you, Grandma. This dissertation is also dedicated to my late grandparents, Reginald Winfrey Sr. and Lorine Grant, who believed in high education achievement against all odds. This one is for you, Grandma and Papa. Finally, the dissertation is dedicated to my best friend, love of my life, and husband, Jay. You are my rock.

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Table of Contents

List of Tables

Table

List of Figures

Figure

Chapter 1: Introduction

The ability to learn and use mathematics is necessary for the success of high school graduates in the technology-driven United States society (Kus, 2018). Nearly one-third of American adults have insufficient numeracy or quantitative literacy skills (Outon, 2018). Insufficient numeracy skills in adults are associated with unemployment, reliance on social assistance, and a negative impact on the American economy. Specifically, only two-thirds of American adults with low numeracy skills are employed, and most of those employed are in semiskilled jobs with low incomes (Outon, 2018). When parents have weak numeracy skills, children are likely to have weak numeracy skills (Outon, 2018), perpetuating a cycle of innumeracy and economic hardship.

The Obama administration implemented initiatives to increase postsecondary education in science, technology, engineering, and mathematics (STEM). Forty-three percent of students in postsecondary education are nontraditional students, or students age 25 or older (Simi & Matusitz, 2016). Community colleges have more nontraditional students than four-year colleges. At two-year community colleges, 87.9% of students have one or more nontraditional student risk factors, while only 58.1% of students at four-year colleges have one or more nontraditional student risk factors (Wladis, Conway, & Hachey, 2015). Because community colleges have higher numbers of nontraditional students, there has been pressure to build a STEM pipeline starting at the community college level for nontraditional students (Wladis et al., 2015). This chapter includes the background of the problem, statement of the problem, purpose of the study, significance of the study, research questions, self-determination theory as the conceptual framework, definitions of terms, limitations, scope and delimitations, and assumptions.

Background of the Study

Nontraditional students, or adult learners, are 25 years or older (Bowers & Bergman, 2016; Chen, 2014; Johnson, Taasoobshirazi, Clark, Howell, & Breen, 2016; Kennan, Stockdale, Howe, & Bigatel, 2018; Luke & Justice, 2016; Osam, Bergman, & Cumberland, 2017; Panacci, 2015; Simi & Matusitz, 2016; Zeit, 2014). In addition to age, nontraditional students may have characteristics which set them apart from traditional students. Nontraditional students may have responsibilities outside of being a student, such as working, spousal responsibilities, and taking care of dependents (Levy, 2017). These external responsibilities can present barriers to nontraditional students' academic success (Osam et al., 2017).

Many nontraditional students attend community college. Sixty percent of community college students are referred to entry-level or developmental mathematics courses upon entering college (Park, Woods, Hu, Jones, & Tandberg, 2018). Nontraditional students are more likely to be placed in entry-level or developmental courses than traditional students (Fong, Melgüizo, & Prather, 2015). More than half of incoming students need at least one developmental mathematics course (Acosta, North, & Avella, 2016). Only 20% of students who are referred to developmental mathematics courses continue to complete the first college-level mathematics course in the sequence (Xu & Dadgar, 2018).

Research exists on best practices for educating nontraditional students. Andragogy theory, a theory of learning developed by Malcolm Knowles, is the science of teaching adult learners based on the characteristics of adult learners (Caruth, 2014). The theory suggests classroom environments should make adult learners feel supported, accepted, and respected. Andragogy theory asserts adults need to know why adults are learning what they are learning, adults are capable of self-directed learning, adults bring life experiences to learning, adults use learning to inform real-life situations, and adults are usually intrinsically motivated (Kennan et al., 2018).

Statement of the Problem

Some nontraditional students do not complete entry-level mathematics courses, and the reasons are unknown. *Autonomous motivation* occurs when an individual acts on the individual's own volition (Garaus, Furtmüller, & Güttel, 2016). *Controlled motivation* occurs when an individual acts under a feeling of pressure (Garaus et al., 2016). A gap existed in the literature on autonomous and controlled motivational profiles of nontraditional students (Rothes, Lemos, & Gonçalves, 2017). Quantitative research has been conducted on the motivation of nontraditional students, but Rothes et al. (2017) suggested qualitative research should be conducted on the motivations of nontraditional students. A gap remains in the literature on how autonomous motivation and controlled motivation affect nontraditional students' success in entry-level mathematics courses. This research addresses the gap in the literature and provides information on how autonomous motivation and controlled motivation may be linked to the academic success of nontraditional students in entry-level mathematics courses.

Purpose of the Study

The purpose of this qualitative explanatory case study was to describe factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. A qualitative methodology may help fill the gap in the literature on the motivational profiles of nontraditional students (Rothes et al., 2017). The explanatory case study research design utilized web-based, open-ended questionnaires and semistructured interviews. Questionnaires were given to nontraditional students who had enrolled in entry-level mathematics courses at the community college in South Carolina. Semistructured interviews were held with nontraditional students who had enrolled in entry-level mathematics courses at the community college.

Significance of the Study

Rothes et al. (2017) asserted qualitative studies should be conducted on the motivation of nontraditional students and include interviews or case studies, suggesting this study was appropriate to advance knowledge on the motivation of nontraditional students. This study was conducted to further understand factors which impact the success of nontraditional students in entry-level mathematics. The knowledge gained from this research may benefit instructors of entry-level mathematics on the postsecondary level and postsecondary academic leaders such as department chairs or college deans. Results of this study may help these educators to implement best practices to support nontraditional students to succeed in entry-level mathematics courses.

Research Questions

An objective of the study was to add to the body of knowledge on factors impacting the success of nontraditional students in entry-level mathematics courses. Research questions were based on descriptions and experiences of nontraditional students to support the qualitative explanatory case study methodology. The following research questions guided the study:

> Research Question One: How do nontraditional students describe the impact of autonomous motivation and controlled motivation on nontraditional students' success in entry-level postsecondary mathematics courses?

Research Question Two: What experiences do nontraditional students identify as important to the nontraditional students' success in entry-level postsecondary mathematics courses?

Conceptual Framework

Self-determination theory, developed by Deci and Ryan in 1985 (Kennan et al., 2018), provided the conceptual framework for this study. In self-determination theory, learning occurs on a continuum from amotivation to intrinsic motivation. Specifically, after amotivation, there are four phases of extrinsic motivation, including external regulation, introjected regulation, identified regulation, and integrated regulation (Rothes et al., 2017). External regulation and introjection are types of controlled motivation, and identified regulation, integrated regulation, and intrinsic motivation are types of autonomous motivation (Rothes et al., 2017). Controlled motivation occurs when the student perceives pressure by others and learns because of reward or force by others. Autonomous motivation occurs when a student has agency, acts with a sense of volition, and chooses to learn because of interest in the content or belief the content is important for future career success (Garaus et al., 2016). Autonomous motivation is reinforced by autonomy, meaning the student has control over the learning; competency, meaning the student perceives personal effectiveness at learning; and relatedness, meaning the student perceives a sense of respect and care in class (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018).

Self-determination theory was directly linked to the first research question which explored nontraditional students' autonomous and controlled motivation. The theory provided a solid conceptual framework for the second and third research questions because it could connect nontraditional students' motivation to succeed to student experiences and instructors' teaching strategies. A more thorough explanation of self-determination theory can be found in the literature review.

Definitions of Terms

Several terms are used throughout the study. Defining these terms is necessary for clarity. Definitions of key terms used throughout the study are provided as follows.

Andragogy theory: The science of teaching adult learners based on the characteristics of adult learners (Caruth, 2014).

Autonomous motivation: The individual has autonomy and acts on the individual's own volition (Garaus et al., 2016); includes identified regulation, integrated regulation, and intrinsic motivation (Can & Satici, 2017; Rothes et al., 2017).

Controlled motivation: The individual acts under a feeling of pressure (Garaus et al., 2016); includes external regulation and introjected regulation (Can & Satici, 2017; Rothes et al., 2017).

Nontraditional student: An adult student or mature learner; a postsecondary student who is 25 years or older (Bowers & Bergman, 2016; Chen, 2014; Johnson et al., 2016; Kennan et al., 2018; Luke & Justice, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; Zeit, 2014).

Numeracy: The ability to learn mathematics in the context of practical application (Kus, 2018).

Limitations

Transferability can be established in qualitative research by identifying pertinent information about the context of the study (Abdalla, Oliveira, Azevedo, & Gonzalez, 2018). This study was conducted at a large American community college. Therefore, the results of this study may be transferrable to other community colleges in the United States. This study is not transferrable to four-year colleges or universities with different entry requirements and programs than community colleges. Because the focus of the study was nontraditional students in entry-level mathematics, the study may not be transferrable to traditional students and may not be transferrable to courses outside of entry-level mathematics.

The community college for this study is not a research university and has no dormitory. Students commute to campus, which means participants for this study were on campus less frequently. Web-based questionnaires were given. While web-based questionnaires could provide potential participants with easier access, potential participants could have felt less inclined to participate in the study. The time constraint of the questionnaire was a limitation of the study because participants may not have felt able to complete the questionnaire in addition to other responsibilities participants had during the time frame.

Scope and Delimitations

The study focused on students who had enrolled in entry-level postsecondary mathematics courses at a community college in South Carolina. Entry-level mathematics courses included MAT 032 Developmental Mathematics, MAT 100 Introductory College Math, MAT 101 Beginning Algebra, and MAT 102 Intermediate Algebra (Appendix A). The time frame for data collection was two months. A delimitation of the study was previously taught students were excluded as participants (Simon & Goes, 2013) to avoid feelings of coercion among the participants and to avoid participants feeling uncomfortable providing truthful responses related to instructional practices which impact the participants' success. This delimitation may not affect the transferability of the results.

Assumptions

Several assumptions apply to this study. One assumption was student participants would truthfully and correctly identify as nontraditional students based on the age category of 25 years or older on the web-based questionnaire. Another assumption was student participants would be honest in responding to the student questionnaire. A third assumption was participants provided all of the information desired in thorough questionnaire responses. Truthfulness in responses in open-ended interviews was assumed for this study. Assuming honesty in participation and in responses was necessary because one could not ascertain whether participants were presenting misleading or incomplete responses to subjective questionnaire and interview questions (Simon & Goes, 2013).

Chapter Summary

Lack of knowledge of mathematics can lead to economic hardships (Outon, 2018). Reasons some nontraditional students age 25 and older do not complete entry-level postsecondary mathematics courses related to autonomous and controlled motivation are unknown. The purpose of this qualitative explanatory case study was to describe factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. Autonomous and controlled motivation are aspects of self-determination theory, which was the conceptual framework for this study. Two research questions guided the study, and the results of the study could fill a gap in the literature on profiles of the autonomous motivation and controlled motivation of nontraditional students related to success in entry-level mathematics courses. This research was important because the findings could help educators understand best practices for helping nontraditional students be successful in entry-level mathematics. Chapter 2 contains a detailed review of the literature, including the literature search strategy and self-determination theory.

Chapter 2: Literature Review

The percentage of nontraditional students in the United States is increasing. According to Caruth (2014), the percentage of nontraditional students increased from 29% in 1970 to 43% in 2009. Per Bowers and Bergman (2016), nontraditional students make up more than 50% of part-time postsecondary students and about 33% of all postsecondary students. Lin (2016) suggested about one-third to one-half of all postsecondary students are nontraditional students. The U.S. Department of Education (as cited in Lin, 2016) stated there were 17.5 million undergraduate students and 2.9 million graduate students in degree-granting postsecondary institutions in the United States, and 31.2% of these students were nontraditional students age 25 and older. The number of nontraditional students in the United States is expected to increase by 8.2% by 2026 (Hussar & Bailey, 2018). Not only is the number of nontraditional students in postsecondary education rising, but also the number of nontraditional students is rising at a faster rate than for traditional students (Chen, 2014).

In 2020, approximately 65% of jobs in the United States will require some level of postsecondary education (Bowers & Bergman, 2016). Additionally, people with an associate's degree will earn $325,000 more in a lifetime than people with just a high school diploma, and people with a bachelor's degree will earn $1 million more in a lifetime than people with just a high school diploma (Bowers & Bergman, 2016). Thus, ensuring students have a proper return on students' educational investment is important (Bowers & Bergman, 2016). Mathematics is essential for student success and success in many jobs. Xu and Dadgar (2018) stated numeracy and cognitive skills are necessary for success in the labor market. Per Kus (2018), numeracy is the ability to use mathematics to solve problems in the context of real-life situations, and numeracy is as important as literacy for high school graduates, particularly to function in a society driven by technology.

Some nontraditional students do not complete entry-level mathematics courses, and the reasons are unknown. The background of the problem emerged through teaching mathematics courses to many nontraditional students at a small career college, part of a larger system of for-profit colleges in the southeastern United States, for nearly four years, and some of these nontraditional students did not complete the mathematics courses with passing grades. According to Outon (2018), nearly one-third of American adults have weak numeracy skills and weak quantitative literacy skills. Low numeracy among adults is associated with unemployment, the need for social assistance, and a negative effect on the U.S. economy (Outon, 2018). Of the adults with low numeracy skills, only two-thirds are employed, and those employed work in semiskilled jobs with low incomes (Outon, 2018). Additionally, children of adults with low numeracy skills are more likely to have low numeracy skills (Outon, 2018). In the United States, there has been a nationwide emphasis on producing students who are strong in STEM (Wladis et al., 2015), but the United States continues to have low mathematics achievement compared to other developed countries, such as the Netherlands and England, and the special administrative region of Hong Kong (Kalaycıoğlu, 2015). The purpose of this qualitative explanatory case study was to describe factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina.

Before a study is conducted, reviewing existing literature is imperative for gaining an understanding of the concepts being studied and identifying any gaps in the literature. Chapter 2 provides a synthesized review of the literature related to factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses. First, the literature search strategy is presented with keywords and parameters which were used to find the literature for review. Next is a description of self-determination theory, which served as the conceptual framework of the study. The chapter also includes characteristics of nontraditional students, concepts related to motivation and self-efficacy, and the role of mathematics in relation to the success of nontraditional students. After reviewing the literature, a gap in the literature was apparent. The literature review did not yield any qualitative studies on how autonomous and controlled motivation and other factors affect the success of nontraditional students in entry-level mathematics. Therefore, this study was necessary.

Literature Search Strategy

The basis for this review was focused on finding literature which could provide background information on factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses. The two research questions led to the identification of six major concepts: autonomous and controlled motivation, nontraditional students, instructors, student success, mathematics, and community college. A scholarly literature search was conducted using the American College of Education library, ERIC, and Google Scholar. Keywords included *motivation*, *autonomous motivation*, *controlled motivation, nontraditional student*, *adult learner*, *mature student*, *student success*, *student achievement*, *nontraditional student success*, *adult student success*, *nontraditional student achievement*, *adult student achievement*, *college instructors*, *college faculty*, *college instructor*, *higher education*, *postsecondary education*, *tertiary education*, *mathematics*, *math*, *mathematics education*, *postsecondary mathematics education*, *higher mathematics education*, *community college*, *two-*

year college, and *junior college*. The relevant articles from these databases were collected, printed, read, analyzed, and organized. After reading and analyzing the articles, more themes emerged related to factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses. These themes included self-determination theory, andragogy theory, developmental mathematics, mathematics anxiety, and self-efficacy. To gather more information, the American College of Education library, ERIC, and Google Scholar were used to find literature on these themes. Keywords included *self-determination theory*, *andragogy*, *adult learning theory*, *developmental mathematics*, *developmental math*, *remedial mathematics*, *remedial math*, *mathematics anxiety*, *math anxiety*, and *self-efficacy*. Relevant articles were collected, printed, read, analyzed, and organized. To ensure the relevancy of articles, the range of articles to be recovered by the databases was set from 2015 to 2019. Additionally, the option to require peer-reviewed articles was selected, and only articles with full text available were used. A few articles from 2014 were included in the literature review based on the articles' relevance, quality, and contribution to the literature.

Conceptual Framework

A conceptual framework guides the study to answer the research questions. Understanding motivation was integral to the study, and self-determination theory provided the conceptual framework. This section includes an overview of motivation theories and self-determination theory.

Theories of Motivation

Before addressing different theories of motivation, describing the components of intrinsic and extrinsic motivation is necessary. Intrinsic motivation is demonstrated when an individual does something out of enjoyment or interest, while extrinsic motivation is demonstrated when an individual does something for an external outcome (Irvine, 2018; Rothes et al., 2017). Additionally, intrinsic motivationhas been found necessary to create lifelong learners. Specifically, intrinsic motivation leads to increased creativity, more time on task, and persistence despite failure, qualities necessary for lifelong learning, while extrinsic motivation is negatively correlated with lifelong learning (Irvine, 2018).

Achievement goal theory involves mastery goals, intrinsic goals an individual does for the self, and performance goals, extrinsic goals the individual does to look favorable compared to others (Irvine, 2018; Isik, 2018). Students tend to adopt the goal orientation of the students' instructor. Mastery goals are positively correlated to intrinsic motivation, while performance (and avoidance) goals are positively correlated with extrinsic motivation. Students with mastery goal orientations tend to outperform students with performance goal orientations (Irvine, 2018).

Possible selves theory states an individual has an idea of the selves the individual might become, wants to become, and does not want to become (Harrison, 2018; van Rhijn, Lero, & Burke, 2016). The possible selves – fears, motives, and goals – provide motivation for the individual to work to become the desired self (van Rhijn et al., 2016). Van Rhijn et al. (2016), featuring 398 nontraditional student-participant parents, found there were primary and secondary motivators for attending post-secondary education related to possible selves theory. The primary motivators the nontraditional student-parents had for attending post-secondary education were occupation, including personal fulfillment through the career, current employment difficulties, and future career opportunities; abilities and education, including personal fulfillment, future personal opportunities, and current requirements; and family, including support, inspiration, and a future-oriented focus on family. Secondary motivators for nontraditional student-parents attending postsecondary education included material motivators such as future income and access to financial resources, lifestyle motivators, personal motivators, relationships, social responsibility, leisure, and physical motivators. Accessibility to school was found to be a motivator that did not fit possible selves theory. Findings suggested a connection for student-parents between motivation to partake in postsecondary education and wanting to be the ideal future possible self (van Rhijn et al., 2016).

Irvine (2018) described theories of intelligence as motivational theories. Some theories of intelligence suggest intelligence is fixed at birth and cannot change, while other theories of intelligence suggest intelligence can grow and is malleable (De Castella & Byrne, 2015; Irvine, 2018). Students with a fixed intelligence mindset are less motivated to learn, and students with a growth mindset of intelligence are more motivated to learn, be engaged, and put effort into learning. Fixed mindsets are often seen in mathematics, and fixed mindsets can lead to students having learned helplessness (Irvine, 2018). According to Irvine, there is a reciprocal relationship between motivation and achievement, which is especially important in mathematics.

This study utilized self-determination theory (Rothes et al., 2017) as the conceptual framework. Self-determination theory was the preferred motivational theory for this study because it is infrequently used to examine the motivation of nontraditional students (Johnson et al., 2016; Rothes et al., 2017) but has been used to study the motivation of students in postsecondary education settings (Davidson & Beck, 2019). Self-determination theory is further described in the next section.

Self-Determination Theory

According to Rothes et al. (2017), understanding students' motivation is essential for understanding student engagement, student satisfaction, and student achievement. Research has been conducted on motivation of traditional students under 25 years of age (Rothes et al., 2017). However, there has been scarce research on the motivation of nontraditional students under self-determination theory (Rothes et al., 2017). Rothes et al. found no research on autonomous or controlled motivation in nontraditional students 25 years and older. Additionally, Rothes et al. suggested studying the motivation of nontraditional students is worthwhile as nontraditional students have special characteristics distinguishing nontraditional students from traditional students. Self-determination theory provided a new way to frame the study of motivational factors impacting nontraditional students.

Self-determination theory, a theory of motivation originally proposed by Ryan and Deci in 1985 (Kennan et al., 2018), is a way of defining self-directed learning to predict students' academic achievement and well-being (Kennan et al., 2018). The theory states individuals are active agents who determine what to do with external stimuli, and individuals are not passive agents who are involuntarily controlled by external stimuli (Wisniewski et al., 2018).

Autonomy, relatedness, and competence. Self-determination theory states all human beings have three basic needs: autonomy, relatedness, and competence (Durmaz & Akkus, 2016; Garaus et al., 2016; Irvine, 2018; Jacobi, 2018; Johnson et al., 2016; Kennan et al., 2018; Komiyama & McMorris, 2017; Rothes et al., 2017; Wisniewski et al., 2018). The term, *autonomy*, refers to an individual's feelings of volition, control, and self-determination (Wisniewski et al., 2018). Autonomy means the individual can make decisions without influence from others (Jacobi, 2018) and can provide a choice or meaningful rationale when a choice is limited (Garaus et al., 2016). In addition, autonomy is a prominent factor in motivating students through instructional strategies, such as choice in instructional language, the rationale behind tasks to be completed, flexibility in options for learning, and validation of any negative feelings associated with difficult or tedious tasks (Jacobi, 2018).

Relatedness is when an individual cares for and feels cared for by others (Garaus et al., 2016; Wisniewski et al., 2018). Students experience relatedness in class when students feel a sense of belonging. Instructional strategies to help students experience this sense of relatedness include collaborative activities through group work and discussion and immediate and effective feedback (Jacobi, 2018).

Competence is when an individual feels effective (Wisniewski et al., 2018), which occurs when the desired amount of feedback is received at the individual's current mastery level (Garaus et al., 2016). A student feels competent when the student knows classroom expectations, when the student has the skills to succeed, and when instructional strategies are implemented which promote discussions, class routines, and effective feedback, particularly in an online environment (Jacobi, 2018). When a student's needs of autonomy, relatedness, and competence are satisfied, the student can become a self-determined learner (Jacobi, 2018).

Autonomous and controlled motivation. Part of the foundation of self-determination theory is not only are there different amounts of motivation, but also there are different types of motivation, and some types of motivation are better than others (Rothes et al., 2017). Self-determination theory asserts motivation exists on a continuum. At one end of the continuum is amotivation, where the individual is not motivated and will not act (Jacobi, 2018). An example of amotivation would be a nontraditional student who is not motivated to study mathematics and chooses not to study mathematics. After amotivation, four types of extrinsic motivation exist on the continuum. Extrinsic motivation to learn is learning to obtain an outcome separable and external to the individual (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018). According to Rothes et al. (2017), extrinsic motivation involves engaging in an activity to avoid negative outcomes like criticism or punishment or engaging in an activity to obtain positive outcomes like high grades, honors, or money. The four types of extrinsic motivation are external regulation, introjected regulation, identified regulation, and integrated regulation (Durmaz & Akkus, 2016; Jacobi, 2018; Johnson et al., 2016; Komiyama & McMorris, 2017; Rothes et al., 2017). Can and Satici (2017) replaced integrated regulation with internalized regulation, while Kennan et al. (2018) omitted integrated regulation.

External regulation follows amotivation. External regulation is motivation based on seeking external rewards and avoiding external punishments (Can & Satici, 2017; Durmaz & Akkus, 2016; Jacobi, 2018; Johnson et al., 2016; Rothes et al., 2017). An example of external regulation is a nontraditional student studying mathematics to earn more money. Following external regulation is introjected regulation. Introjected regulation is characterized by engaging in activities to avoid guilt, shame, or anxiety (Can & Satici, 2017; Jacobi, 2018) and to meet the needs and goals of others (Kennan et al., 2018). An example of introjected regulation is a nontraditional student studying mathematics to be socially accepted.

Next on the continuum is identified regulation. Qualities of identified regulation include the individual identifying with the importance of an activity (Jacobi, 2018; Johnson et al., 2016), although the activity may not be enjoyable (Kennan et al., 2018). A nontraditional student who studies mathematics because mathematics is a necessary part of the student's future career even though the student does not enjoy mathematics illustrates identified regulation. Integrated regulation is characterized by the activity being consistent with the individual's values (Komiyama & McMorris, 2017). In integrated regulation, the individual assimilates the reasons for engaging in the activity in the individual's sense of self (Can & Satici, 2017; Jacobi, 2018; Johnson et al., 2016). An example of integrated regulation is a nontraditional student studying mathematics because the student values increasing the student's mathematical knowledge.

At the other end of the continuum is intrinsic motivation. Intrinsic motivation is distinct from extrinsic motivation. Intrinsic motivation is characterized by engaging in an activity simply for the enjoyment or interest (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018; Kennan et al., 2018; Komiyama & McMorris, 2017; Rothes et al., 2017). According to Can and Satici (2017), there are three types of intrinsic motivation: intrinsic motivation to know, intrinsic motivation to accomplish, and intrinsic motivation to stimulate. Intrinsic motivation to know involves participating in an activity for pleasure (Can & Satici, 2017). Intrinsic motivation to accomplish involves engaging in an activity to gain satisfaction from the process or performance of the activity (Can & Satici, 2017). Intrinsic motivation to stimulate involves engaging in an activity to experience the accompanying positive sensations resulting from the activity (Can & Satici, 2017). Per Can and Satici, students' intrinsic motivation is the most important factor influencing positive academic performance. Additionally, intrinsic motivation is a good predictor of students' course grades, learning, and persistence in academic programs (Can & Satici, 2017).

Autonomous motivation. In self-determination theory, the motivational continuum can be further divided into autonomous motivation and controlled motivation. During autonomous motivation, the individual has autonomy and can act on the individual's own volition (Garaus et al., 2016; Rothes et al., 2017). According to Durmaz and Akkus (2016), people who are autonomously regulated feel agentic in behavior. According to Durmaz and Akkus, integrated regulation and intrinsic motivation are autonomous motivation. Alternatively, Can and Satici (2017) and Rothes et al. (2017) suggested identified regulation, integrated regulation, and intrinsic motivation are autonomous motivation. Autonomous motivation is defined in congruence with the definitions provided by Can and Satici and Rothes et al.

Controlled motivation. People who are controllingly regulated feel compelled by external forces (Durmaz & Akkus, 2016). Controlled motivation occurs when an individual acts under a feeling of pressure (Garaus et al., 2016). According to Durmaz and Akkus (2016), external regulation, introjected regulation, and identified regulation are controlled motivation. Alternatively, Can and Satici (2017) and Rothes et al. (2017) suggested external regulation and introjected regulation are controlled motivation. Controlled motivation is defined in congruence with the definitions provided by Can and Satici (2017) and Rothes et al (2017).

Comparing autonomous motivation and controlled motivation. Autonomous motivation is considered better than controlled motivation, with autonomous motivation leading to positive learning outcomes and controlled motivation leading to negative learning outcomes (Can & Satici, 2017). Autonomous motivation positively impacts students' academic achievement (Can & Satici, 2017). Controlled motivation is better for repetitive tasks such as rote memorization and for tasks uninteresting to the learner. Additionally, students with controlled motivation are likely to stop learning once the external reason for learning ends (Garaus et al., 2016). Having autonomous motivation alone is better than having both autonomous and controlled motivation (Rothes et al., 2017). Figure 1 provides a visual representation of the conceptual framework.

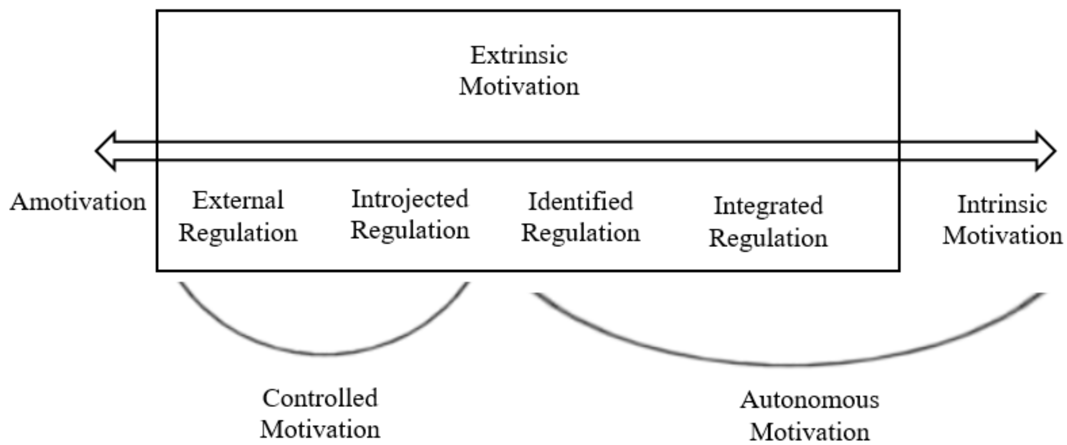

Figure 1: Self-determination theory.

According to self-determination theory, there are four combinations of autonomous and controlled motivation: high autonomous and high controlled motivation (high-quantity motivation), high autonomous and low controlled motivation (good-quality motivation), low autonomous and high controlled motivation (poor-quality motivation), and low autonomous and low controlled motivation (low-quantity motivation; Rothes et al., 2017). In a study by Rothes et al. (2017), the high autonomous and low controlled motivation group scored significantly higher levels of self-efficacy, learning strategies, and self-reported behavioral engagement than the low autonomous and high controlled motivation group and low autonomous and low controlled motivation group. Additionally, the high autonomous and high controlled motivation group scored significantly higher than the low autonomous and high controlled motivation group and the low autonomous and low controlled motivation group on learning strategies and behavior management but not on self-efficacy. However, the study showed no significant difference between the high autonomous motivation groups and the low autonomous motivation groups. Furthermore, nontraditional students scored higher on autonomous motivation than controlled motivation (Rothes et al., 2017). Self-determination theory provided the conceptual framework for this study, the foundation of literature collected for the review, and the methodology described in Chapter 3.

Research Literature Review

The research literature review includes detailed information from research related to factors impacting the success of nontraditional students in entry-level mathematics courses. Self-determination theory is the lens for the research literature review, and motivation is discussed. This section includes a review of research on nontraditional students, motivation, learning and instructional methods for nontraditional students, and mathematics.

Nontraditional Students

Nontraditional students are different from traditional students (Kennan et al., 2018; Rothes et al., 2017). The nontraditional student group has diverse characteristics and needs educators should strive to meet (Caruth, 2014). This section presents information on nontraditional students, including the definition of nontraditional students, descriptions of characteristics of nontraditional students, explanations of andragogy theory, and proposed instructional methods beneficial for nontraditional students.

Defining nontraditional students. There is a distinction between traditional students and nontraditional students in postsecondary education. Chen (2014) and van Rhijn et al. (2016) described traditional students as 18 to 24 years of age, while Panacci (2015) described traditional students as 18 to 22 years of age. Traditional students attend postsecondary education directly out of high school (Panacci, 2015; van Rhijn et al., 2016). Additionally, traditional students usually do not have major responsibilities outside of postsecondary education competing with education (Panacci, 2015). Traditional students may attend postsecondary education during the day, night, or day and night; are less likely to have a job while in school; and may be financially supported by someone else (Simi & Matusitz, 2016).

Nontraditional students are additionally referred to as adult learners, mature students (Simi & Matusitz, 2016), reentry students, and returning students (Lin, 2016). Nontraditional students are age 25 and older (Bowers & Bergman, 2016; Chen, 2014; Johnson et al., 2016; Kennan et al., 2018; Luke & Justice, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; Zeit, 2014). The number of nontraditional students in the United States is rising (Caruth, 2014; Phillips, Baltzer, Filoon, & Whitley, 2017). The fastest growing postsecondary student population (Simi & Matusitz, 2016), nontraditional student populations are rising at a faster rate than traditional student populations (Chen, 2014).

In the United States from 2008 to 2019, undergraduate student enrollment was expected to increase by 12% for students age 18 to 24 (traditional students), 28% for students age 25 to 34, and 22% for students age 35 and older (Phillips et al., 2017). The mean age of postsecondary education students in the United States has increased from 18 years to 24 years (Osam et al., 2017). From 1970 to 2009, there was a 48% increase in the number of nontraditional students in postsecondary education (Caruth, 2014). The nontraditional student population is expected to increase by 8.2% by 2026 (Hussar & Bailey, 2018). According to Cox and Sallee (2018), most students in postsecondary education are nontraditional students, which contrasts with the information provided by other researchers. Per Bowers and Bergman (2016), nontraditional students comprise 50% of part-time postsecondary enrollment and 33% of total postsecondary enrollment in the United States. Lin (2016) suggested one third to one half of all postsecondary education students are nontraditional students.

Osam et al. (2017) attributed the increase in the number of nontraditional students to the changing needs of the U.S. economy. Specifically, postsecondary education has become a necessity for most entry-level and mid-level occupations, and more nontraditional students are starting or returning to school. Leaders of postsecondary institutions view nontraditional students to increase student enrollment, and nontraditional student enrollment is expected to continue to increase (Osam et al., 2017). Thus, the increase in nontraditional student postsecondary enrollment warrants the study of nontraditional students (Caruth, 2014).

Characteristics of nontraditional students. In addition to age, nontraditional students may have certain roles and responsibilities which distinguish nontraditional students from traditional students. Many nontraditional students are financially independent and work in addition to being students (Levy, 2017; Lin, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; van Rhijn et al., 2016). Nontraditional students have self-perceptions of employees first and students second (Chen, 2014). Nontraditional students may be parents and have childcare and family responsibilities (Levy, 2017; Lin, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; van Rhijn et al., 2016). Other characteristics of nontraditional students include having a year or more between high school and enrolling in postsecondary education (Lin, 2016; Simi & Matusitz, 2016), being a spouse (Lin, 2016), lacking a high school diploma (Simi & Matusitz, 2016; Zeit, 2014), involvement in the community (Panacci, 2015), and commuting to campus (van Rhijn et al., 2016). Nontraditional students often face barriers to postsecondary educational goals. Osam et al. (2017) described three barriers to nontraditional student education: situational barriers, dispositional barriers, and institutional barriers.

Situational barriers. Situational barriers for nontraditional students to postsecondary education include transportation, work conflicts, family responsibilities (Osam et al., 2017), health, and finances (Merrill, 2015; Osam et al., 2017). Many nontraditional students live a long distance from campus (Levy, 2017) and have to commute to campus (van Rhijn et al., 2016). Transportation to campus may be unreliable for nontraditional students. When nontraditional students do not have reliable transportation, nontraditional students may arrive to class late, leave class early, or not attend class at all. Irregular class attendance negatively impacts many student attendance requirements, and students with irregular class attendance miss important information covered in class. To remedy this problem, nontraditional students can use hybrid courses or online courses which provide greater flexibility and ease of access to postsecondary education (Wladis et al., 2015). However, many nontraditional students lack the technological skills to be comfortable or successful in an online learning environment (Kennan et al., 2018). Below-average technological competency and part-time enrollment are risk factors for attrition among nontraditional students (Kennan et al., 2018; Wladis et al., 2015).

Work conflicts are another situational barrier for nontraditional students in postsecondary education (Bowers & Bergman, 2016; Osam et al., 2017). Because of job demands, many nontraditional students do not have sufficient time to devote to studies, leading to withdrawal from courses or academic programs (Bowers & Bergman, 2016; Rothes et al., 2017). Many nontraditional community college students work in addition to being students. Additionally, students are less likely to complete coursework if students work more than 20 hours per week (Zeit, 2014).

Family responsibilities present barriers to academic success for nontraditional students (Osam et al., 2017; Rothes et al., 2017). Zeit (2014) cited supporting dependents as a potential barrier to nontraditional student retention at the community college level. Student-parents are particularly affected by family responsibilities. When student-parents perceive hostility or lack of support by campus staff and inflexible programs, student-parents are less likely to succeed in postsecondary education (van Rhijn et al., 2016). Furthermore, because student-parents juggle the roles of being a student and parent and other nonacademic responsibilities, student-parents can doubt student-parents' self-efficacy as students and as parents, leading student-parents to take a leave of absence or withdraw from academic programs (van Rhijn et al., 2016).

Female nontraditional students, compared to male nontraditional students, tend to have more pressure from childcare, financial, and school responsibilities which can create barriers to success in postsecondary education (Lin, 2016). Results of a literature review conducted by Lin (2016) showed student-mothers with young children have the highest pressure in student roles, and family situations are typically the reason student-mothers do not complete postsecondary education. Lack of support from student-mothers' spouses, significant others, or other family members interferes with student-mothers' progress in postsecondary education (Lin, 2016). Additionally, childcare responsibilities limit student-mothers' abilities to participate in group activities or attend tutoring services. The success of student-mothers has an impact on the success of the children of student-mothers. According to van Rhijn et al. (2016), when student-mothers complete postsecondary education, the children of student-mothers are more likely to do well in school and value and complete postsecondary education. Alternatively, when student-mothers do not complete postsecondary education, children of student-mothers are less likely to do well in school, value postsecondary education, or complete postsecondary education.

Lack of childcare is a barrier to student-parent success in postsecondary education (Bowers & Bergman, 2016). A qualitative comparative case study of a Canadian college and an American community college by Cox and Sallee (2018) found the Canadian college used a state-centered neoliberal agenda and viewed being a student-parent as a private affair, providing an inadequate on-campus childcare center as the only resource to meet the needs of student-parents. Alternatively, the American community college used a market-based system to meet the needs of its nontraditional student population, providing low-cost on-campus childcare reserved for student-parents and a Pregnancy and Parenting Assistance Fund through a grant from New York. The on-campus childcare and the Pregnancy and Parenting Assistance Fund more than met the needs of nontraditional student-parents.

Dispositional barriers. Dispositional barriers for nontraditional students include fear of failure, attitude toward intellectual activity, and perceptions about self-efficacy. Thus, dispositional barriers should be resolved by the individual (Osam et al., 2017). One type of dispositional barrier to postsecondary education completion is nontraditional students' biases and preformed ideas which have risen from life experiences (Caruth, 2014). Nontraditional students who have the responsibility of taking care of children may have low self-efficacy about nontraditional students' roles as students (Lin, 2016) and parents, leading to taking a leave of absence from the program of study or withdrawing from the program (van Rhijn et al., 2016).

Institutional barriers. Osam et al. (2017) stated institutional barriers for nontraditional students are lack of night, weekend, and online courses; limited availability of faculty members; and difficulty working with admission and advising staff. Because nontraditional students may work full-time or part-time, have family responsibilities, and have other roles and responsibilities outside of being a student, nontraditional students benefit from flexible course schedules. Contrary to the idea of nontraditional students needing online courses for flexibility, nontraditional students are less likely to do well in online courses (Zeit, 2014). Additionally, community colleges often focus on the needs of traditional students enrolled directly out of high school (Simi & Matusitz, 2016; Zeit, 2014), which means nontraditional students at community colleges often have to be successful without the support of the college, leading many nontraditional students to struggle to achieve academic goals (Zeit, 2014).

According to Simi and Matusitz (2016), nontraditional students in postsecondary education are treated as afterthoughts with a focus on traditional students. College mission statements and advertising illustrate the lack of inclusion and consideration for nontraditional students (Simi & Matusitz, 2016). Fewer financial aid opportunities are available to nontraditional students. Nontraditional students may acquire debt other than student loans. This other debt makes getting financial aid difficult for nontraditional students and limits the amount of financial aid private institutions offer nontraditional students (Simi & Matusitz, 2016). Because many nontraditional students are not able to pay for postsecondary education with personal funds, difficulty getting financial aid, and limited financial aid cause other institutional barriers for nontraditional students. Bowers and Bergman (2016) found the three key focus areas for nontraditional students are increased flexibility in academic programs, simpler and increased financial aid options, and more campus support for nontraditional students in need of additional attention.

Andragogy theory. Caruth (2014) found postsecondary education institutions are not teaching nontraditional students andragogically but need to teach nontraditional students andragogically. Andragogy theory was developed by Malcolm Knowles and is the science of teaching adult learners based on characteristics of adult learners (Caruth, 2014). Andragogy theory has five assumptions: (a) adult students need to know why adult students are learning the content adult students are learning; (b) adult students need to be treated as capable of self-directed learning; (c) adult students bring life experiences to learning; (d) adult students perceive learning as a means of informing adult students' real-life situations; and (e) adult students are intrinsic, although there are some important extrinsic motivators for adult students (Kennan et al., 2018).

Andragogy theory asserts adult students possess a wealth of experience, are a valued resource for learning, are problem centered, and are concerned with immediate application of the knowledge learned (Rothes et al., 2017). The theory can add to high engagement levels among nontraditional students (Rothes et al., 2017). Andragogy theory is compatible with blended or online learning (Caruth, 2014) because students in these classes utilize self-direction for learning in these formats. Caruth (2014) asserted pedagogs keep the student dependent on the instructor while andragogs encourage the student to be autonomous in learning.

Motivation

Motivation was an important concept to review for this study. Irvine (2018) argued motivation contains related concepts of interest, engagement, persistence, self-concept, and self-efficacy. According to Rothes et al. (2017), motivation is necessary to understand student satisfaction, engagement, and academic achievement. This section includes a review of literature on nontraditional student motivation and self-efficacy.

Nontraditional student motivation. Although postsecondary education systems are based on extrinsic rewards like grades and teacher confirmation, intrinsic motivation, not extrinsic motivation, molds lifelong learners (Irvine, 2018). Intrinsic motivation in learning leads to a deeper understanding (Luke & Justice, 2016). A quantitative study by Rothes et al. (2017) featuring 188 participants revealed autonomous motivation should be encouraged in education and controlled motivation should be discouraged in education. Academic motivation in postsecondary education is positively associated with students' academic success, retention, persistence, and out-of-class communication with faculty members (Trolian, Jach, Hanson, & Pascarella, 2016). Trolian et al. (2016) found quality and frequency of faculty contact, personal discussions with faculty, and out-of-class interactions with faculty had a positive effect on students' academic motivation. Specifically, the quality of student–faculty interactions influenced students' academic motivation the most. The study revealed students' academic motivation during postsecondary education decreases, and the researchers suggested interventions should be put in place to support students' academic motivation throughout postsecondary education.

Nontraditional students are motivated (Simi & Matusitz, 2016), tend to be more intrinsically motivated than traditional students (Rothes et al., 2017; van Rhijn et al., 2016), and have the same level of extrinsic motivation as traditional students (van Rhijn et al., 2016). When nontraditional students are given options for how and what nontraditional students learn, nontraditional students are intrinsically motivated to learn and perceive the learning experience as relevant (Muñoz, Welsch, & Chaseley, 2018). Nontraditional students with higher levels of education usually have more intrinsic and knowledge-based motivation, with job-related motivation following closely behind. Alternatively, nontraditional students with lower levels of education have more extrinsic motivation, particularly job-related motivation, and are more motivated for social reasons such as improving self-esteem and meeting new people (Rothes et al., 2017). Nontraditional students are more likely to value learning or mastery goals over performance goals (van Rhijn et al., 2016).

Various factors impact nontraditional students' motivation to attend postsecondary education. Such factors include starting a new life after undesirable circumstances like divorce, job loss, or a rejected job opportunity, or finding purpose in life and achieving goals through postsecondary education (Simi & Matusitz, 2016). Some nontraditional students are motivated to attend postsecondary education to become more professionally marketable (Luke & Justice, 2016). Nontraditional female students are usually more intrinsically motivated and self-determined than nontraditional male students (Rothes et al., 2017), and student-mothers are often motivated by gaining an independent life (van Rhijn et al., 2016).

Luke and Justice (2016) found the most important factors motivating nontraditional students to pursue postsecondary education were to advance professionally, and to increase income, job security, and personal fulfillment. These factors did not significantly differ from each other save when comparing income groups. Additionally, nontraditional students face motivational challenges when deciding whether to return to school, such as family responsibilities, work responsibilities, and school hours. Furthermore, the study revealed educational achievement had little effect on nontraditional students' motivation to pursue a degree, and there were no significant differences between genders and age groups on any motivational factor researched. Brower et al. (2017) suggested advisors create intentional course schedules for nontraditional students which provide a clear course pathway in alignment with students' motivational goals.

Self-efficacy. Self-efficacy is an individual's belief about the individual's abilities (Luke & Justice, 2016). Self-efficacy is one of the most studied parts of motivation (Wang, Shakeshaft, Schofield, & Malanchini, 2018) and one of the strongest motivational predictors of academic achievement (Johnson et al., 2016). Bandura's social cognitive theory states self-efficacy influences every aspect of goal achievement because efficacy beliefs control cognitive, motivational, selective, and affective processes (Elliott, 2016). Self-efficacy influences the choices people make, how much effort is exerted, the way people realize choices, and task persistence through internal and external attributions of success and failure. Additionally, self-efficacy arises from mastery experiences because success authentically measures capability and builds a sense of competence (Elliott, 2016). A quantitative study by Elliott (2016) featuring 2,358 participants revealed an increase in academic self-efficacy decreased the odds of persistence in postsecondary education by 26%.

Nontraditional students typically have high levels of self-efficacy and engagement (Rothes et al., 2017). While nontraditional students tend to have higher levels of self-efficacy than traditional students, nontraditional students usually have lower levels of self-efficacy in mathematics than traditional students (Johnson et al., 2016). Nontraditional students are more likely to attempt tasks on which nontraditional students have greater self-efficacy. However, nontraditional students with low self-efficacy may have low motivation to pursue distance education (Luke & Justice, 2016).

Nontraditional students have a locus of control, and self-efficacy can exist on a continuum from internal to external locus of control. An individual with an internal locus of control feels responsible for events in the individual's life, while an individual with an external locus of control feels external forces control events in the individual's life. The location of a student's self-efficacy on the continuum of locus of control impacts the student's perception of learning and achievement (Luke & Justice, 2016). A quantitative study by Johnson et al. (2016) with 139 participants revealed self-efficacy and the belief one's peers cared about one's learning significantly predicted the academic achievement of nontraditional students. Johnson et al. found nontraditional students had higher levels of self-efficacy, academic support from teachers, identified and intrinsic regulation, and attributions of interest, teacher influence, and strategy. These results suggested nontraditional students have different motives for pursuing academic work regardless of the students' grade point averages (GPAs; Johnson et al., 2016).

Learning and Instruction Methods for Nontraditional Students

Nontraditional students have preferred methods of learning. Instructors can use various methods to support the learning needs of nontraditional students. This section includes a review of literature on learning methods and instructional methods for nontraditional students. The section ends with a review of ideas combining learning and teaching methods for nontraditional students.

Learning methods for nontraditional students. According to Muñoz et al. (2018), four key ideas apply to learning for nontraditional students: nontraditional students are self-directed in learning, nontraditional students need acknowledgment of nontraditional students' real-life experiences, social and career roles guide nontraditional students' readiness to learn, and nontraditional students value immediate application of the skill or knowledge learned. Chen (2014) described three tenets of adult learning. First, adult learners are self-directed in learning, and adults' learning is enhanced when learners' prior knowledge and experience are used. Adult learners are intrinsically motivated to learn, actively plan learning, and value relevant and immediate learning based on problem solving. Second, learning for adults is transformative and creates personal development. Third, adult learners value critical reflection (Chen, 2014). Johnson et al. (2016) found self-efficacy and believing peers care about one's learning significantly predicted academic achievement in nontraditional students. Contrary to andragogy theory, Luke and Justice (2016) found nontraditional students may decrease in self-efficacy to make decisions when nontraditional students are given full control of nontraditional students' learning.

Mastery goals are more important for nontraditional students than performance goals as mastery goals are associated with well-being, effective learning strategies, intrinsic motivation, long-term retention of learned information, and positive perceptions of learning (Johnson et al., 2016). Nontraditional students do well in learning environments which meet nontraditional students' needs for safety, security, and belonging (Muñoz et al., 2018). According to Merrill (2015), nontraditional students value acceptance in the academic community. Because of possible roles and responsibilities outside of being a student, many nontraditional students participate in limited or no activities outside of the classroom, making the classroom the focal point of nontraditional students' on-campus experience. However, the lack of activities outside of the classroom does not negatively impact nontraditional students' academics (Panacci, 2015; Simi & Matusitz, 2016).

Simi and Matusitz (2016) noted nontraditional students come to class more prepared, ask more questions, and participate more in discussions compared to traditional students. Nontraditional students study more and value postsecondary education more than traditional students (Simi & Matusitz, 2016). Furthermore, nontraditional students tend to have higher GPAs than traditional students, and nontraditional students use task-oriented coping such as enduring stress and persistence in solving problems more than traditional students (Johnson et al., 2016). In addition, nontraditional students are a positive addition to class because nontraditional students can share prior knowledge and experiences with other students, including traditional students (Simi & Matusitz, 2016).

Instructional methods for nontraditional students. Self-determination theory and self-efficacy provide frameworks for best practices in instructional methods for nontraditional students. A narrative inquiry study by Wisniewski et al. (2018) with five participants revealed when instructors gave nontraditional students autonomy in learning and focused instruction on meeting their needs, the locus of causality among the students changed from external to internal. This change suggests nontraditional students participate in learning because of an intrinsic desire to participate rather than participating in learning to please other people (Wisniewski et al., 2018).

Additionally, instructors can meet nontraditional students' basic needs of autonomy, relatedness, and competence, as described by self-determination theory, by providing nontraditional students with autonomy support by moving the instructor's role away from a controller to a facilitator or guide (Wisniewski et al., 2018). Rothes et al. (2017) found instructors should provide autonomy support for nontraditional students by giving effective feedback, the rationale behind learning content, and opportunities to share experiences and participate in class. Furthermore, Jacobi (2018) suggested instructors providing a meaningful rationale for instruction motivated students to take online courses and satisfied students' basic need for autonomy. Additionally, instructors satisfied students' basic need for competence in online courses by providing effective feedback, balancing requirements and freedom in discussions, and providing easily understandable class routines. Instructors satisfied students' basic need for relatedness in online courses by providing effective feedback, allowing activities which fostered collaboration, and ensuring immediacy in learning (Jacobi, 2018). Can and Satici (2017) argued postsecondary students need help improving levels of autonomous motivation and academic success by enrolling in programs which hone the students' talents and interests.

Various and specific instructional methods are beneficial for nontraditional students. Luke and Justice (2016) found instructors need to understand nontraditional students are diverse and have varying backgrounds, perspectives, and levels of preparedness. As Kennan et al. (2018) suggested, context is important when making assumptions about the behavior of nontraditional students. Thus, instructors should use a variety of teaching strategies and attend workshops to help instructors understand teaching strategies beneficial for nontraditional students (Luke & Justice, 2016). Similarly, a mixed-methods study with 132 participants by Phillips et al. (2017) revealed instructors should read literature on how to effectively teach nontraditional students. Qualitative results of the study revealed nontraditional students preferred instructors who demonstrated respect for nontraditional students as adults, had applied knowledge in the field, were understanding, were flexible, and were enthusiastic. However, nontraditional students found instructors problematic who disrespected nontraditional students, were condescending, arrogant, rigid, or disorganized. Quantitative results of the study revealed nontraditional students value communication, fairness, respect for adult learners, preparedness, connections with adult students, and demonstrating positive attitudes as extremely important characteristics of instructors. As reported in the study, nontraditional students considered having published papers and presenting at conferences the least important characteristics of instructors (Phillips et al., 2017).

Instructors building relationships with nontraditional students is important for the success of nontraditional students. Muñoz et al. (2018) argued instructors should get to know as much as possible about nontraditional students. Trolian et al. (2016) found the quality of student–faculty interactions was the most significant factor influencing students' academic motivation. Qualitative case studies by Merrill (2015) with two participants revealed when instructors supported nontraditional students, nontraditional students' confidence in learning increased and helped students to stay in postsecondary education and succeed in postsecondary education in several cases. Additionally, Merrill found instructors should create a welcoming environment for nontraditional students.

Online courses provide nontraditional students with needed course flexibility (Acosta et al., 2016). Nontraditional students enroll in more online programs than traditional students (Johnson et al., 2016). Contrary to other research findings, a quantitative study by Kennan et al. (2018) with 724 participants revealed only seven teaching behaviors were consistently related to differences in age and class standings among online students, and these teaching behaviors did not mesh with the assumptions made about teaching nontraditional students. The seven teaching behaviors included leaving of evidence of course participation, giving clear and detailed feedback on assignments, creating a respectful learning environment, presenting content understandably, reminding of assignment due dates, providing supplemental resources, and presenting frequent, graded activities related to content (Kennan et al., 2018). This finding suggested researchers should investigate whether principles of adult learning apply in online learning environments (Kennan et al., 2018).

Combining learning and instructional methods for nontraditional students. Panacci (2015) stated there is academic knowledge and real-world knowledge. Academic knowledge is knowledge based on concepts, theory, memorization, and book learning, while real-world knowledge is based on students' daily activities, has immediate application and relevance, and involves learning by doing. In 2003, Kasworm described five knowledge voices on the value of the association between real-world knowledge and academic knowledge: entry voice, outside voice, cynical voice, straddling voice, and inclusion voice (Panacci, 2015). Nontraditional students with an entry voice focus on academic knowledge and academic achievement through earning high marks, and these nontraditional students prefer instructors who organize and present content, utilize memorization, and use tests and essays for evaluations (Panacci, 2015). Nontraditional students with an outside voice are concerned with learning real-world knowledge and denounce learning content in class irrelevant to the nontraditional students' everyday lives. Additionally, nontraditional students with an outside voice like instructors who use discussions, projects, case studies, and other activities connecting nontraditional students' lives to knowledge learned in the classroom (Panacci, 2015).

Nontraditional students with a cynical voice have negative reactions to classroom learning because these students think classroom learning is disassociated from the real world, but these nontraditional students attend school to reach motivational goals such as getting a job, gaining expertise, or pleasing peers (Panacci, 2015). Those nontraditional students with a straddling voice believe both academic and real-world knowledge are important and prefer instructors who use collaborative, active, and applied instructional methods to present real-world and academic knowledge (Panacci, 2015). Nontraditional students with an inclusion voice value depth of immersion in academia and layers of meaning and understanding in the nontraditional students' lives and educational goals. These students like instructors who are mentors and work together with the students to create and share knowledge (Panacci, 2015).

In a similar context, Kennan et al. (2018) matched different types of nontraditional students with different qualities of instructors. According to Kennan et al., not all nontraditional students are ready for complete autonomy in learning, and instructors should match the instructional methods to the students' stages of learning autonomy. Stage 1 is when the nontraditional student is a dependent learner, and the instructor acts as authority or coach. Stage 2 occurs when the nontraditional student is interested in learning, and the instructor acts as a motivator or guide. Stage 3 takes place when the nontraditional student is involved in learning, and the instructor acts as a facilitator. Lastly, in Stage 4, the learner is self-directed, and the instructor acts as a consultant or delegator (Kennan et al., 2018). Per Panacci (2015), the development of many nontraditional students is bolstered when classroom learning is related to nontraditional students' career goals and when instructors use active and collaborative teaching methods. Based on findings by Panacci and Kennan et al., instructional methods for nontraditional students should align with students' personalities, goals, and levels of autonomy.

Mathematics

In the United States, there was a push from the Obama administration to increase the number of students pursuing and entering STEM fields. Females and racial minorities are underrepresented in STEM fields (Belser, Shillingford, Daire, Prescod, & Dagley, 2018). Because community colleges have high numbers of female students, racial minority students, and nontraditional students, community colleges have made efforts to create a STEM pipeline for these students starting at the community college level (Wladis et al., 2015).

Numeracy is the ability to learn mathematics in the context of practical applications and building on interconnections of different types of knowledge in students' everyday lives (Kus, 2018). Additionally, numeracy is as important as literacy for high school graduates to function in a technology-driven society (Kus, 2018). Research shows nontraditional students perform better in real-life numeracy situations rather than on word problems with unreal contexts (Outon, 2018). Research suggests attempting to make classroom teaching or mathematics more relevant for students by transferring mathematics learned in class to real-life situations is troublesome because students who do not view mathematics learned in classroom as real mathematics may become disengaged (Outon, 2018). This finding is contrary to research by Rothes et al. (2017) which showed instructors used content and examples related to students' everyday lives in mathematics courses to boost students' self-efficacy. Mathematics well-being theory suggests five stages for improving mathematics engagement among students: awareness and acceptance of the mathematical activity, a positive response to the mathematical activity, valuing the mathematical activity, having a conscious and integrated value structure for mathematics, and being independently competent and confident in doing the mathematical activity (Irvine, 2018).

Mathematics motivation is measured by how much an individual finds mathematics important, is interested in mathematics, and is driven to perform well in mathematics (Wang et al., 2018). A quantitative study by Wang et al. (2018) with 927 participants showed mathematics achievement was modestly positively correlated with mathematics motivation, and time spent on mathematics was modestly negatively correlated with mathematics achievement. Additionally, mathematics self-efficacy is an individual's perception of the individual's competence in different mathematics tasks (Wang et al., 2018). Nontraditional students have lower levels of mathematics self-efficacy than traditional students (Johnson et al., 2016).

Many nontraditional students enroll in online courses because of the flexibility afforded by these courses (Levy, 2017), but online or hybrid mathematics courses have higher withdrawal rates than face-to-face mathematics courses (O'Connell, Wostl, Crosslin, Berry, & Grover, 2018). Wladis et al. (2015) found interactions between the online medium and age were significant, with older students completing STEM courses at around the same rate in both online and face-to-face formats and with younger students having a significant decrease in successful STEM course completion rates when using an online course format. Additionally, a quantitative study by O'Connell et al. (2018) with 20,776 participants revealed a student's academic load was the best predictor of the student passing a college algebra course, with full-time students more likely to pass than part-time students, possibly because full-time students work less at a job. Furthermore, the study revealed online students performed worse in college algebra than face-to-face students, and Black and Hispanic students performed worse in college algebra than White and Asian students (O'Connell et al., 2018). According to O'Connell et al., there are high failure rates in entry-level mathematics courses globally, and failing entry-level mathematics can negatively impact student retention and persistence. Thus, understanding factors leading to success in entry-level mathematics courses can help postsecondary education institutions improve student retention and graduation rates (O'Connell et al., 2018).

Mathematics anxiety. Mathematics anxiety is related to mathematics content, shows as negative emotions on the autonomous nervous system (Durmaz & Akkus, 2016), and can negatively impact short-term memory, long-term memory, and learning (Durmaz & Akkus, 2016). Furthermore, chronic mathematics anxiety can lead to desperation and hopelessness, and individuals with mathematics anxiety may quickly abandon mathematics, limiting the individuals' education options and leaving the individuals to view mathematics as an obstacle to goal achievement. Additionally, mathematics anxiety is positively correlated with controlled motivation (Durmaz & Akkus, 2016). Mathematics anxiety usually forms after negative experiences with mathematics content or mathematics instructors (Schommer-Aikins, Unruh, & Morphew, 2015). Other factors which can contribute to mathematics anxiety include limited experience with mathematics, poor mathematics textbooks, lack of exposure to everyday applications of mathematics, other people showing discomfort with mathematics, and general test anxiety. Formation of mathematics anxiety can occur in kindergarten through 12th grade (Schommer-Aikins et al., 2015).

A quantitative correlational study with 8,806 participants by Kalaycıoğlu (2015) revealed mathematics anxiety has a -.187 correlation with socioeconomic status, a -.318 correlation with math self-efficacy, and a -.340 correlation with mathematics achievement. A quantitative study with 927 participants by Wang et al. (2018) revealed mathematics anxiety for learning mathematics was lower than mathematics anxiety for taking mathematics exams, female students had higher mathematics anxiety and lower mathematics motivation than male students, mathematics achievement was modestly negatively correlated with mathematics anxiety, and a combination of higher mathematics motivation and lower mathematics anxiety is associated with higher mathematics achievement. Additionally, students with higher mathematics anxiety worked longer hours, possibly to avoid the negative consequence of poor mathematics performance, but these students still performed worse in mathematics than students with lower mathematics anxiety (Wang et al., 2018).

A quantitative study using Bayesian networks with 468 participants by Smail (2017) revealed students with the introvert, sensing, feeling, judgment Myers–Briggs personality type had the highest probability of mathematics anxiety, while students with the introvert, sensing, thinking, perceiving personality type were least likely to have mathematics anxiety. This finding suggested students learn differently, and instructors should learn students' personality types and adapt teaching methods to students' learning styles to reduce mathematics anxiety among students (Smail, 2017). A quantitative study by Schommer-Aikins et al. (2015) with 234 participants enrolled in postsecondary courses from prealgebra to college algebra revealed the more a student believed the student could complete time-consuming mathematics problems and the more classes the student had, the less anxiety the student had. Additionally, the more the student believed mathematics required understanding, the more anxiety the student had. Furthermore, the study showed the greater the difference between epistemological beliefs of the student and the instructor, the less the student believed in time-consuming mathematics problem solving and the worse the student performed in the course (Schommer-Aikins et al., 2015).

Durmaz and Akkus (2016) asserted students' basic psychological needs should be supported to encourage students and give students autonomy, which will increase students' mathematics motivation and reduce mathematics anxiety. Basic psychological needs refer to the needs described in self-determination theory of autonomy, relatedness, and competence (Durmaz & Akkus, 2016). Qualitative results of a mixed-methods study by Thompson, Wylie, and Hanna (2016) with 22 participants revealed students suggested small groups, increasing the amount of numeracy-based classes, explaining the application of numeracy-based knowledge in more detail, and using more sympathetic teaching methods could reduce students' mathematics anxiety.

More specifically, some nontraditional students, despite experiencing mathematics anxiety, often demonstrate persistence and resilience in mathematics engagement (Ryan & Fitzmaurice, 2017). As students get older, mathematics anxiety increases and math self-efficacy decreases (Simi & Matusitz, 2016) because nontraditional students may be uncomfortable in a formal learning setting and using mathematics. Additionally, nontraditional students may not think mathematics is a skill which needs further mastery (Simi & Matusitz, 2016). Ryan and Fitzmaurice (2017), in a mixed-methods study, found nontraditional students had the most mathematics anxiety for tasks in the following order from highest anxiety to lowest anxiety: taking a mathematics exam, being given a surprise mathematics test in class, being asked a mathematics question by the instructor in front of the class, and being asked to write an answer on the board at the front of the class. Alternatively, nontraditional students had the least mathematics anxiety for tasks in the following order from lowest anxiety to highest anxiety: adding a pile of change, determining how much time one has left before going to work or school, determining how much change a cashier should give in a shop after making a purchase of several items, determining how much a shopping bill will be, and “being asked to add up the number of people in a room” (Ryan & Fitzmaurice, 2017, p. 53).

Developmental mathematics. The level of mathematical preparedness in the United States has decreased (Cafarella, 2016). Approximately 60% of students entering community college are required to enroll in remedial or developmental mathematics courses (Kosiewicz, Ngo, & Fong, 2016; Park et al., 2018). Therefore, entry-level mathematics courses for most community college students are developmental mathematics courses, and the sequence of developmental mathematics usually resembles progression in high school mathematics with an emphasis on algebraic content (Kosiewicz et al., 2016). Developmental mathematics courses have some of the highest rates of unsuccessful completion with 14.2% of students failing and 20.8% of students withdrawing (Acee et al., 2017). Furthermore, only 20% of developmental mathematics students in community colleges reach the college-level mathematics courses needed to earn an associate’s or bachelor’s degree (Kosiewicz et al., 2016; Xu & Dadgar, 2018).

Developmental mathematics courses are meant to prepare underprepared students for college-level mathematics courses, but enrollment in developmental mathematics courses comes with negative consequences. Developmental mathematics courses cost students time, money, and financial aid, yet the courses do not count as college credit applicable to a degree (Fong et al., 2015). Because developmental mathematics courses increase the amount of time students spend in school, students enrolled in developmental mathematics are more likely to drop out of postsecondary education in between semesters and fail to complete a degree or program (Kosiewicz et al., 2016). Additionally, enrollment in developmental mathematics courses can lead students to fail due to the increase in time and money spent to obtain a degree and traditional lecture-style teaching methods using pedagogy focused on drills unrelated to other courses and real-life application (Kosiewicz et al., 2016). Placement in developmental mathematics courses can have a negative psychological effect on students as students enrolled in developmental mathematics courses may feel stigmatized because the students are not ready for college-level mathematics coursework (Xu & Dadgar, 2018).

Because developmental mathematics courses are costly for governments, institutions, and students, there has been rising political pressure to quicken students' progression through developmental mathematics courses (Cafarella, 2016; Park et al., 2018). Methods for hastening students' progression through developmental mathematics courses include accelerating the courses (completing the course in less than one term), compressing the courses (completing more than one course in one term; Cafarella, 2016), allowing student corequisite education (enrolling in the developmental course concurrently with the college-level course; Park et al., 2018), or eliminating developmental mathematics courses (Cafarella, 2016). However, acceleration, compression, and elimination of developmental mathematics courses would be detrimental to students (Cafarella, 2016). Acceleration, compression, and elimination are methods which would benefit students who need little help, but most developmental mathematics students need help to succeed (Cafarella, 2016).

Instructors can help developmental mathematics students achieve by using the algorithm instruction technique (Cafarella, 2016). The algorithm instruction technique involves the instructor modeling effective step-by-step procedures to solve mathematics problems on a specific topic, allowing students to practice new material with the instructor and with peers, if desired, with frequent and early feedback from the instructor, and then students solving mathematics problems independently. The algorithm instruction technique is similar to the developmental mathematics scaffolding technique suggested by Brower et al. (2017) in which instructors can help students by breaking mathematics problems into parts and providing students with hints as necessary to solve the problem. Scaffolding helps instructors build students' mathematical autonomy (Brower et al., 2017). Instructors can help developmental education students solve word problems by helping students understand the problem, implementing a plan to solve the problem, and reflecting on the students' answers to the problem. Instructors should encourage students to take organized, deliberate notes and to review the notes frequently to improve students' short-term and long-term memory of mathematics lectures (Cafarella, 2016).

Nontraditional students enroll in developmental mathematics courses. In fact, nontraditional students are more likely to be placed in developmental mathematics courses than traditional students (Fong et al., 2015). Fong et al. (2015) found each additional year of age decreased the odds a student would attempt a developmental mathematics course but increased the odds a student would pass the developmental mathematics course with small effect sizes. Acee et al. (2017) found 65% of students listed academic interferences to success in developmental mathematics, while 31% of students listed nonacademic interferences to success in developmental mathematics. Acee et al. concluded age was a significant predictor of nonacademic interference, with nontraditional students listing significantly more nonacademic interferences to success in developmental mathematics than traditional students. Thus, postsecondary education institutions should focus on nonacademic factors interfering with success in developmental mathematics because nontraditional students with nonacademic factors interfering with success in developmental mathematics are less likely to pass the developmental mathematics course, have lower GPAs, and are less likely to continue to the next semester (Acee et al., 2017).

Chapter Summary

Chapter 2 included a review of the literature related to factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses. Relevant, recent peer-reviewed literature was gathered using keywords based on the research questions. Self-determination theory provided the conceptual framework for the study. Key elements of self-determination theory include a continuum from amotivation to intrinsic motivation, autonomous and controlled motivation, and basic human needs of autonomy, competence, and relatedness (Rothes et al., 2017). Nontraditional students were defined as age 25 or older, and characteristics of nontraditional students were described, including the need to be taught using an andragogical approach (Kennan et al., 2018). Motivation and self-efficacy were described, including how nontraditional students' motivation affects appropriate teaching and learning strategies. Specifically, nontraditional students tend to be intrinsically motivated (van Rhijn et al., 2016) and have high levels of self-efficacy (Rothes et al., 2017) and need autonomy-support in learning (Rothes et al., 2017), instruction relevant to students' goals, and instruction utilizing collaborative learning approaches (Panacci, 2015).

Chapter 2 contained a review of mathematics with an emphasis on mathematics anxiety and developmental mathematics. Mathematics anxiety increases as students get older (Simi &

Matusitz, 2016). Additionally, many nontraditional students enroll in developmental mathematics courses in community colleges, but characteristics of nontraditional students create nonacademic interferences to the successful completion of the courses (Acee et al., 2017). The literature review revealed a gap in qualitative studies on factors impacting the success of nontraditional students in entry-level mathematics courses using self-determination theory as a conceptual framework. Therefore, this study filled the gap in the literature.

Chapter 3 includes the research methodology and design of a qualitative explanatory case study using questionnaires and semistructured interviews. Participants were nontraditional students age 25 or older at a community college in South Carolina. The participants had enrolled in or taught entry-level mathematics courses. Data were collected and analyzed using content analysis.

Chapter 3: Methodology

The purpose of this qualitative explanatory case study was to identify factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. The study addressed nontraditional students' success in completing entry-level postsecondary mathematics courses related to students' experiences, instructional strategies, and levels of autonomous or controlled motivation. Per Rothes et al. (2017), studying the motivation of nontraditional students is worthwhile because nontraditional students have specific characteristics which set nontraditional students apart from traditional students.

This study was important for several reasons. This basic research study contributed to the knowledge base by informing leaders in postsecondary education on how student experiences and autonomous or controlled motivation relate to nontraditional students' success or failure in entry-level postsecondary mathematics courses, and instructors and leaders in higher education can take action to improve retention and successful completion of entry-level postsecondary mathematics courses among nontraditional students. Upon completion of this study, many nontraditional students may use factors associated with success in entry-level postsecondary mathematics courses to succeed in these courses in the future. Nontraditional students' success may lead to higher rates of entry-level postsecondary mathematics course completion, higher rates of nontraditional student retention, and greater mathematics knowledge retention. The research report was shared with the mathematics department at the community college, where participants for the study were selected, and with American College of Education. The following research questions guided the study:

Research Question One: How do nontraditional students describe the impact of autonomous motivation and controlled motivation on nontraditional students' success in entry-level postsecondary mathematics courses?

Research Question Two: What experiences do nontraditional students identify as important to the nontraditional students' success in entry-level postsecondary mathematics courses?

Major sections of the methodology chapter include the rationale for a qualitative explanatory case study design, the role of the researcher as an instructor, and the research procedures. In addition, the chapter explains the sampling of nontraditional students, developing the student questionnaire and interview instruments, collecting data from participants' questionnaires and interviews, and preparing the data for analysis. The chapter also covers data analysis procedures using coding and MAXQDA Analytics Pro software, reliability and validity of the study, and ethical procedures to protect the participants and maintain the confidentiality of the data.

Research Design and Rationale

The research design for this study was a qualitative explanatory case study. According to Gog (2015), an explanatory case study is a qualitative research strategy which seeks to explain a phenomenon in depth through the examination of multiple cases, and case studies are often used in the field of education. A case study was appropriate for this research design because this qualitative approach allows the investigation of real-life phenomena using nonrandom sampling of an individual or group (Ridder, 2017) and detailed descriptions of factors which impact the phenomenon. In this case, the phenomenon under study was the success of nontraditional students in entry-level postsecondary mathematics courses for which purposeful, nonrandom sampling was used to collect and analyze data to address the research questions. This research sought to explain in depth the factors which impact the success of nontraditional students enrolled in entry-level mathematics at a community college by analyzing data gathered through web-based questionnaires and semistructured interviews.

Role of the Researcher

As a previous adjunct instructor at a career college and as an adjunct instructor at a community college, the researcher has experience teaching entry-level mathematics to nontraditional students. The college where the researcher teaches is part of the South Carolina Technical College System. The research was conducted at a different college in the South Carolina Technical College System. Reflexivity was used to bracket for assumptions because the population was previously taught at a community college which is part of the South Carolina Technical College System. Reflexivity in qualitative research helps to maintain ethics by monitoring the effects of the perceptions of researchers on findings (Berger, 2015). Specifically, emotional response was limited during interviews by remaining objective and neutral. Bias was eliminated by refraining from using affect when asking interview questions and thanking each participant for any responses provided. Assumptions were bracketed by checking regularly to determine if meaning was imposed on the data and to identify what other meanings might appear from the data (Fischer, 2009).

Research Procedures

The research procedures for this study included population and sample selection, instrumentation, data collection, and data preparation. The population was nontraditional students at the community college, and the sample was a purposive sample of nontraditional students age 25 and older at the community college who have enrolled in entry-level postsecondary mathematics courses. From this sample, a random selection of 11 students was asked to participate in interviews. Data instruments included a researcher-created web-based questionnaire and researcher-created interview questions. The web-based questionnaire provided immediate data collection because the SurveyMonkey website sent responses directly to the researcher, and data were collected from the face-to-face interviews by audio recording the interviews and taking interview notes. Data were prepared through transcription of the interview audio recordings, member checking, and entry into the MAXQDA Analytics Pro data analysis software.

Population and Sample Selection

The study included participants who are nontraditional students at a community college. Nearly half of American college students are nontraditional students age 25 or older (Caruth, 2014). The community college had a student population of 4,534, and 1,224, or approximately 27% of the student population, were nontraditional students age 25 or older. Because the study sought to explain factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses, a purposive nonrandom sample of students age 25 years or older was selected among students who have enrolled in entry-level postsecondary mathematics courses at the community college. These entry-level courses included MAT 031 Developmental Mathematics Basics, MAT 032 Developmental Mathematics, MAT 101 Beginning Algebra, and MAT 102 Intermediate Algebra (Appendix A).

A link to the web-based questionnaire was sent to the Institutional Review Board (IRB) of the community college, and the IRB then disseminated the link to 560 current students who enrolled in the entry-level courses during the 2017–2018 or 2018–2019 school year. The questionnaire asked students to select either 24 years or younger or 25 years or older. Students who selected 24 years or younger were eliminated from the study, and students who selected 25 years or older were kept as potential participants in the study. The last question of the student questionnaire allowed students who were interested in participating in a face-to-face interview to provide contact information by selecting a link which directed students to a separate Google form. From the respondents of the questionnaire who indicated willingness to participate in a face-to-face interview and provided contact information, a sample of 11 students was randomly selected for participation in interviews.

According to Baker and Edwards (2012), there is no consensus on the number of qualitative interviews necessary as the number of interviews depends on time, resources, and methodology. Per Fusch and Ness (2015), data saturation occurs when no more new information can be collected from the participants, and data saturation can occur with as few as six interviews. Thus, a sample size of 11 participants was chosen for interviews. Potential student participants were contacted electronically by the community college’s IRB. Participants were required to read and sign an informed consent form (Appendix B). Participants could ask any questions about the study and were allowed to opt out of the study at any time. Finding and selecting the participants took one month.

Instrumentation

A student questionnaire (Appendix C) and semistructured interview questions (Appendix D) for students were the research instruments. Field testing these instruments was done by e-mailing (Appendix E) five community college mathematics instructors who are subject matter experts (Zamanzadeh et al., 2015). No changes were identified based on field testing.

An original web-based student questionnaire was created using SurveyMonkey. Benefits of web-based questionnaires over paper questionnaires include reaching larger samples, higher response rates, low or no cost, and no data input errors (Bakla, Çekiç, & Köksal, 2013). Questionnaire questions were original because self-designed web-based questionnaires allowed more control and the ability to meet the specific needs of the research. Participants using web-based questionnaires were protected by being required to read and virtually sign an informed consent form before completing the questionnaire. Completion of the questionnaire was voluntary, and participants were not required to answer any questions the participants did not want to answer. At the end of the questionnaire, participants who were interested in taking part in an interview clicked on a link sending participants to a Google form where participants could include name, phone number, and e-mail address. The Google form did not connect contact information with questionnaire responses, preserving participants' anonymity.

Original interview questions were developed to gain insight into factors impacting the success of nontraditional students enrolled in postsecondary mathematics courses. Original interview questions were necessary because of the specificity of the problem and the purpose of the study. Semistructured interviews allowed participants to provide flexible answers and more in-depth responses (Sonmez & Koc, 2018). Because of the nature of a semistructured interview, impromptu interview questions at times followed participant responses to gain deeper insight into the experience of the participant.

Data Collection

Students who had enrolled in one of the entry-level postsecondary mathematics courses received a link to a web-based questionnaire disseminated by the community college's IRB. All students meeting the criterion and who were 25 or older were asked to participate. At the beginning of the student web-based questionnaire was an informed consent form for the participant to sign electronically before proceeding to the questionnaire questions. Data from the web-based questionnaire were collected electronically upon completion of the questionnaire. Student questionnaires were anonymous. At the end of the web-based questionnaire, students who were interested in participating in an interview selected a link leading to a Google form where students could provide contact information for an interview. Contact information included name, phone number, and e-mail address. Student respondents who selected the age of 24 years or younger were excluded because the research aimed to study nontraditional students. Student respondents who selected no enrollment in any of the entry-level mathematics courses were excluded.

Completed Google forms were assigned a number. The participants for interviews included 11 individuals randomly selected from the questionnaires using a random number generator because random sampling is the best method to generalize results to a population (Wilson, 2016). Participants for interviews were contacted by the phone number or e-mail address provided in the Google form. Before each interview, the participant was provided with the informed consent form; a signed informed consent form was collected from each participant.

Any questions the participant had about the research were answered. Interviews took place by phone. Each participant was assigned a number to maintain participant confidentiality when reporting findings.

Interviews were recorded on a password-protected and fingerprint-protected voice recorder to maintain safe data storage. Handwritten notes on participants' responses to interview questions were taken during the interview to support the voice recording and to support remembering participant responses. At the end of the interview, the participant was debriefed. Debriefing including information about member checking to ensure accuracy of the data the participant provided, an opportunity to ask any questions or state any concerns about the study, and a reminder of the confidentiality of the study.

Participants would have been exited from the study after providing oral or verbal confirmation the participant no longer wished to participate in the study, and the exited participants' data and information would have been shredded or deleted. No participants were exited from the study. After the interview, the handwritten notes were immediately typed into a password-protected computer and then shredded to maintain safe data storage. To protect participants' names, signed inform consent forms were scanned and uploaded into a password-protected computer, and original signed consent forms were shredded. As required by American College of Education, dissertation documentation will be retained for a minimum of three years. After minimum three years, uploaded signed consent forms will be permanently deleted from the computer. Names, phone numbers, and e-mail addresses of students participating in interviews were temporarily entered into a password-protected electronic device. These names, phone numbers, and e-mail addresses were assigned a numbers and will be permanently deleted after a minimum three years. Collecting the data took two months.

Data Preparation

Data collected from the web-based questionnaires were transferred into MAXQDA Analytics Pro qualitative software with accuracy as web-based questionnaires eliminate errors in inputting data (Bakla et al., 2013). After audio recording each interview, the data were transcribed and typed into a document. The handwritten notes from each interview were typed into a document. Member checking was used allowing each participant to review the interview transcript. The typed, transcribed data were entered into the MAXQDA Analytics Pro qualitative software and prepared for analysis. Preparing the data took two weeks.

Data Analysis

Qualitative data analysis commonly involves coding. Coding is an inductive process in which the data are categorized by common themes (Srivastava & Hopwood, 2009). According to Srivastava and Hopwood (2009), reflexive iteration is the key to analyzing qualitative data. Three questions provided in a qualitative data analysis framework developed by Srivastava and Hopwood were used to help guide the data analysis process: "Q1: What are the data telling me? Q2: What [do] I want to know? Q3: What is the dialectical relationship between what the data are telling me and what I want to know?" (p. 78). The coding philosophy described by Stuckey (2015) was used to code the data. First, the transcripts of the data were read at least once leading to the creation of a storyline. Then, the data were categorized into predetermined and emergent codes (Stuckey, 2015). Predetermined codes included nontraditional students, motivation, success, and entry-level mathematics courses. Memos about how codes were developed were kept for auditing (Stuckey, 2015).

Per Salmona and Kaczynski (2016), using data analysis software to code shortens the time for qualitative data analysis compared to coding by hand. MAXQDA Analytics Pro data analysis software was used to code the data. MAXQDA software was beneficial because, as Salmona and Kaczynski suggested, learning to use data analysis software will be beneficial for future projects. Several weeks were devoted to learning how to use the MAXQDA software proficiently before analyzing the data.

Data from the web-based questionnaires were read at least once, and data from interview transcripts were read at least once. Data from the questionnaires and interview transcripts were entered into MAXQDA Analytics Pro. MAXQDA Analytics Pro allows users to compile, code, organize, and display qualitative data. The data from the questionnaires and interviews were analyzed in MAXQDA Analytics Pro for patterns such as commonalities and differences, frequency, sequence, correspondence, or causation (Ganapathy, 2016). These patterns led to a storyline related to factors impacting the success of nontraditional students in entry-level mathematics courses. The storyline and patterns were then used to code the data by determining what the data represent, express, or exemplify (Ganapathy, 2016). Data from the questionnaires and interview transcripts were analyzed to identify predetermined codes of nontraditional students, motivation, success, and entry-level mathematics courses. New codes emerged during the data analysis process. Axial coding was conducted to group codes into refined themes, which are outcomes of coding (Ganapathy, 2016). After identification of themes, participants’ experiences and explanations of participants' experiences were described, identifying the reality of the cases studied in the research.

Connections between information provided in the questionnaires and the interviews were examined to build the foundation of the storyline participants told about personal experiences. Data from the questionnaires provided the basis of the analyzed content, while data from the interviews provided deeper meaning of the analyzed content through deeper reflections and anecdotes. Combining the analysis of the questionnaires with the interview questions determined if answers were consistent between instruments. As the data from questionnaires and interviews were analyzed, emergent codes and new themes were noted to gain a more complete picture of factors impacting nontraditional students' success in entry-level mathematics courses. The questionnaires and interviews yielded narrative data which could be grouped by code or theme to answer the research questions. All data collected from the instruments were grouped by code or theme to answer the research questions.

Reliability and Validity

Per Hays, Wood, Dahl, and Kirk-Jenkins (2016), researchers use different terminology more befitting to qualitative research in the areas of reliability and validity. *Credibility* replaces *internal validity*, *transferability* replaces *external validity*, *dependability* replaces *reliability*, and *confirmability* replaces *objectivity*. According to Hays et al. (2016), credibility means ensuring the results of a qualitative study are believable based on the research process. Member checking was used to establish credibility by allowing participants who took part in interviews to review the respective transcript to ensure the data accurately reflected the participants' perspectives. Reflexivity and triangulation were used to establish credibility. According to Carter, Bryant-

Lukosius, DiCenso, Blythe, and Neville (2014), one type of triangulation includes method triangulation in which more than one method is used to collect data. Questionnaires and interviews were used for method triangulation.

Hays et al. (2016) described transferability as the extent to which results from a qualitative study can be generalized to settings and participants. Research was conducted on nontraditional students age 25 years or older who were enrolled in entry-level mathematics courses at a community college in South Carolina. Research is dependable when research findings are consistent across time and researchers (Hays et al., 2016). To establish dependability, member checking and triangulation were used. Any changes occurring in the context of the research and how these changes were accounted for were described. Confirmability is the extent to which research results can be corroborated without the researcher's views affecting findings (Hays et al., 2016). Confirmability was established by documenting the research procedures throughout the study, noting any data outliers, and thoroughly auditing the data minimize researcher bias in the data collection or data interpretation.

Ethical Procedures

Data were not collected until the study proposal was approved by both the IRBs at American College of Education and the community college at which the research study was conducted. Because this study included research on human participants, the rights of human subjects were protected as described by *The Belmont Report* (U.S. Department of Health & Human Services, 1979) and the National Institutes of Health. Respect for persons, beneficence, and justice were exercised during the study. Regarding respect for persons, participants in the study were required to read and sign the informed consent document (Appendix B). Participants were allowed to opt out of the study at any time. Regarding beneficence, the study maximized the benefit to the participants while minimizing any harm, although no harm was foreseen to come to participants during this study or as a result of this study. Regarding justice, each participant equally shared the benefits and burdens of the research.

Foreseeable benefits of the research to the participants included a better understanding of how autonomous or controlled motivation, personal experiences, and teaching strategies impacted the success of nontraditional students enrolled in entry-level mathematics courses. A foreseeable burden of the research was participants had to take time to complete the questionnaires and interviews. Assigning numbers to participants protected participants' data. Data collected from the study were password protected in an electronic format with paper documents shredded as soon as possible. No students were chosen who were previously taught or who would be taught in the future to avoid conflicts of interest or power differentials. Permission to conduct the research was granted by the community college IRB (Appendix F).

Chapter Summary

This qualitative explanatory case study sought to answer two research questions regarding the factors which impact the success of nontraditional students in entry-level mathematics courses. Data were conducted on a purposive sample of student participants from a community college in South Carolina. Research methods included web-based questionnaires and semistructured interviews. Data were analyzed and coded using MAXQDA Analytics Pro software. Reliability and validity were established by triangulation and member checking. Participants were treated ethically, and the IRBs of both American College of Education and the community college research site approved the study before data were collected. Chapter 4 includes research findings and results of the data analysis.

Chapter 4: Research Findings and Data Analysis Results

The background of the study involves factors impacting the success of nontraditional postsecondary students, or students age 25 years or older in entry-level postsecondary mathematics courses at the community college level. In addition to age, nontraditional students may have characteristics distinguishing nontraditional students from traditional students such as learning habits supported by andragogy theory and external factors such as work and childcare, which may be barriers to academic success. The purpose of this qualitative explanatory case study was to describe factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. Students participated in the research conducted online and by phone, and data collection methods included a questionnaire and semistructured interview. Included in this chapter are the research findings, including emerging themes throughout the analysis related to the research questions guiding the study:

> Research Question One: How do nontraditional students describe the impact of autonomous motivation and controlled motivation on nontraditional students' success in entry-level postsecondary mathematics courses?
>
> Research Question Two: What experiences do nontraditional students identify as important to the nontraditional students' success in entry-level postsecondary mathematics courses?

Data Collection

Online questionnaires were e-mailed to 500 students at a community college in South Carolina by the chair of the IRB of the community college. Questionnaires were open from

October 24 to December 2, 2019. The questionnaire began with allowing the participant to read the linked informed consent and indicate consent to participate in the study voluntarily by selecting *yes* or *no*. All participants selected yes and indicated informed consent to participate in the study. Participants received three e-mail reminders from the chair of the IRB of the community college to complete the questionnaire. Of the 25 questionnaires submitted, six were not completed, and one completed questionnaire contained a response indicating the participant had not enrolled in any of the listed entry-level mathematics courses. Three incomplete questionnaires were from respondents willing to participate in interviews. Therefore, four questionnaires were not counted, leaving 21 participants and questionnaires for data analysis, a 4.2% response rate.

Participants who indicated willingness to participate in an interview were contacted through the e-mail address, phone number, or e-mail address and phone number provided on the questionnaire. Participants were able to choose whether to participate in the interview over the phone or in person. All participants opted to take part in phone interviews at a time convenient for the participant. At the start of each interview, the participant was reminded the information disclosed would remain confidential. The participants' ages were collected in alignment with the definition of nontraditional students as students 25 years or older (Bowers & Bergman, 2016; Chen, 2014; Johnson et al., 2016; Kennan et al., 2018; Luke & Justice, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; Zeit, 2014).

Fifteen participants indicated willingness to participate in an interview. Because of the low number of participants, all participants were contacted for interviews instead of selecting participants for interviews using a random number generator. Of the 15 participants contacted for interviews, 11 participated in interviews, a deviation from the data collection plan. Interviews were conducted by phone and audio recorded. The recordings were transcribed by the researcher. On December 31, 2019, each participant received an e-mailed transcript of the interview and was given until January 3, 2020, to respond with any corrections; a lack of response would indicate no corrections were needed. Two participants responded indicating the transcripts were accurate. There were no deviations or unusual events in the data collection process.

The data gathered were secured in several ways. Participants completed online questionnaires through the SurveyMonkey platform. The password to the SurveyMonkey account was not shared. Within the SurveyMonkey questionnaire was a link to a Google form where participants were able to provide contact information including name, e-mail address, and phone number to complete the optional interview. The password to the Google account housing the Google form and the Google sheet with the participants’ Google form responses were not shared.

Audio recordings of interviews were stored in a passcode- and fingerprint-protected voice recorder. Interviews were transcribed into the same Google account. The password to the Google account was not shared. A number was assigned to each interview participant to protect privacy and anonymity. Questionnaire responses were copied into a Microsoft Excel spreadsheet on a passcode-protected computer. This spreadsheet and the interview transcripts were uploaded into MAXQDA Analytics Pro software located on the passcode-protected computer. When the computer was not in use, the computer was locked to ensure the security of participant data.

Data Analysis and Results

This section describes how the data were analyzed and the results of the data analysis. Data were prepared, sorted, organized, categorized, coded, and searched for themes. Results include how the data supported predetermined and emerging themes..

Data Analysis

Once the questionnaires were compiled, the data from the questionnaires were analyzed for similarities in responses by question. The Microsoft Excel spreadsheet allowed for easy comparison of responses across questionnaire questions. Data from the questionnaires were coded using predetermined codes of motivation and experiences. Motivation was chosen as a predetermined code to answer Research Question One. Experiences was selected as a predetermined code to answer Research Question Two. Analysis of the questionnaire data revealed four themes related to motivation: learning, complete a program requirement, academic achievement, and children.

Interview data were coded using MAXQDA Analytics Pro software. Data were first coded using predetermined codes of nontraditional students, entry-level mathematics, success, and motivation. These codes were chosen to align with the purpose of the study. As data were analyzed, other codes emerged. Emergent codes from the interviews included online learning platform, math background, program or degree requirement, personal motivation to succeed, comfortable classroom environment, detail-oriented teaching, outside academic support, teacher impact, and children as motivation. Emergent codes were then categorized under predetermined codes, as shown in Table 1.

Table 1

Interview Code Categorization

Predetermined code	Emerging code
Entry-level mathematics	Online learning platform Math background
Motivation	Program or degree requirement Personal motivation to succeed
Success	Comfortable classroom environment Detail-oriented teaching Outside academic support Teacher impact
Nontraditional students	Children as motivation

Questionnaire Results

Eighteen participants completed the online questionnaire through the SurveyMonkey platform. Figure 2 shows the number and percentage of questionnaire respondents who took different combinations of entry-level mathematics courses. Respondents included a mixture of students who passed, failed, passed but did not score high enough to progress, withdrew from, or were enrolled in entry-level mathematics courses.

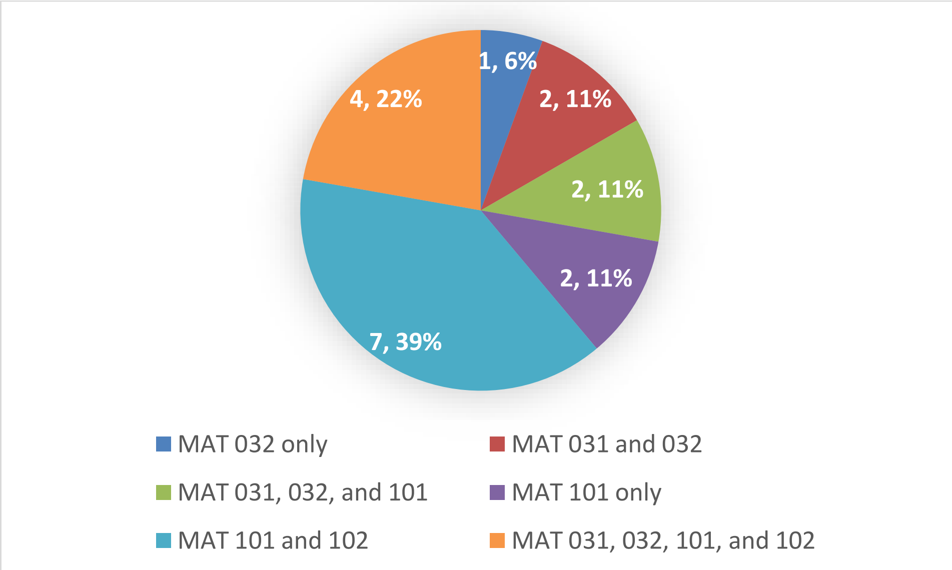

Figure 2: Combinations of entry-level mathematics courses taken by questionnaire respondents.

Questionnaire analysis include predetermined codes of motivation and experiences. Results related to motivation helped answer Research Question One: How do nontraditional students describe the impact of autonomous motivation and controlled motivation on nontraditional students' success in entry-level postsecondary mathematics courses? Participants responded to the question, What was your motivation to be successful? Based on participants' responses, emerging themes related to motivation included learning, complete a program requirement, academic achievement, and children (Table 2).

Table 2

Emerging Themes From Code Motivation

Emerging theme	Participant	Participant response to, What was your motivation to be successful?
Learning	1	"Being able to recall things I had not dealt with in 13 years it challenged my mind."
	4	"The work."

	14	"Math runs in the family, I guess."
Complete a program requirement	2	"My degree."
	6	"I had to pass them to take the math 110 class needed for my degree."
	7	"To about math to see can I finished and pass it for the next step in life."
	8	"To be able to continue with my education."
	9	"To pass and get closer to graduating."
	10	"Completing my degree."
	12	"The fact that I have a son and I've always had the dream of becoming an RN [registered nurse]."
	15	"To get my associate's degree to obtain my math requirement."
	17	"Needed to move forward in getting my degree."
	18	"To pass this class so I can move on forward to school."
Academic achievement	11	"Wanted to understand the information and have an A or B average."
	5	"I wanted to do the best I could do in all my classes, especially math since I have never been good at it."
Children	3	"The same thing that motivates me every single day of my life, my children. I needed to show them that it is never too late to try to better yourself."
	12	"The fact that I have a son and I've always had the dream of becoming an RN."
	13	"I wanted to be someone my children can be proud of."

Experiences was a predetermined code based on the purpose of the study. Results from experiences helped answer Research Question Two: What experiences do nontraditional students identify as important to the nontraditional students' success in entry-level postsecondary mathematics courses? Analysis of commonalities among participants' responses revealed seven experiences impacting the success of nontraditional students in entry-level mathematics courses: the teacher or instructor, the textbook, the learning center or tutoring, real-world experience, an online learning platform, a positive outlook, and positive prior experience (Figure 3).

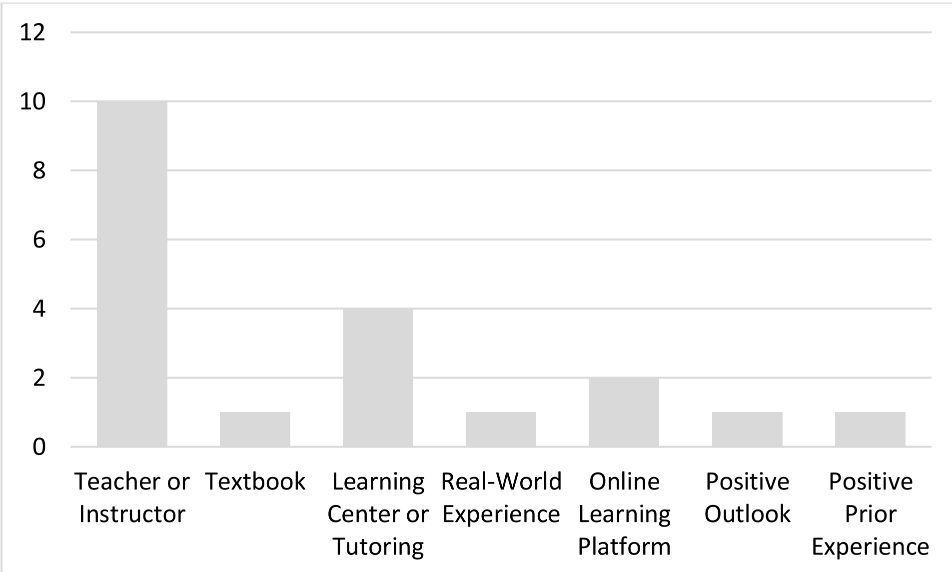

Figure 3: Experiences impacting success in entry-level mathematics courses, based on questionnaire responses.

Several responses were related to the theme of teacher or instructor experiences. Participant 1 indicated an "awesome teacher as well as textbooks." Participant 4 said the teacher impacted success in the mathematics course. Participant 3 stated:

> I had two fantastic teachers in these courses! They broke things down step by step, took the time to answer any questions the students might have, and made learning math as fun as it can be in a way. I'm not sure that I would have made it through with a matter-of-fact or monotone type of teacher.

Participants 8, 11, and 18 were impacted by teachers being available for help. According to Participant 8, " "Both instructors were available even though the classes were online. They were both amazing." Participant 11 said, "Had an awesome teacher who had an open door if I needed any help." As stated by Participant 5, "In Math 101, I can honestly say the teacher had the biggest impact on my success; in Math 102 the teacher had the biggest impact on why I withdrew." A learning center or tutoring availability impacted Participants 10, 12, and 13. Participant 13 said, "The TLC [The Learning Center] is a huge part of me being able to succeed." The online learning platform was important to Participants 6 and 16. Participant 2 was impacted by real-world experience and stated, "[I] had worked as a respiratory therapist for 30 years, and math is a very important subject in real life." Participant 7 had a positive outlook on the mathematics course and stated, "Studies just a little better than before when I was in high school about 40 years ago and knowing, understanding, and learning that I will finish this time." Participant 17 indicated a prior positive experience. Textbooks impacted the success of Participant 1.

Interview Results

Eleven interviews were conducted with nontraditional students of mathematics. Interviews lasted between 10 and 30 minutes. A number was assigned to each interview participant to maintain participant confidentiality. The age of each participant was gathered at the start of each interview. Interview participants' ages are shown in Table 3. Predetermined codes of entry-level mathematics, motivation, success, and nontraditional students were used to address the purpose of the study and help answer the research questions.

Table 3

Interview Participants' Ages

Participant	Age
19	27
3	37

Table 4

Interview Participants' Ages (continued)

Participant	Age
6	35
4	27
11	46
9	40
8	27
20	31
13	31
12	29
21	42

Entry-level mathematics. Entry-level mathematics was a predetermined code from the interviews. Upon analysis of the interviews, two codes emerged: online learning platform and math background. Table 4 shows interview participant responses related to the codes.

Table 5

Interview Participant Responses Related to Entry-Level Mathematics

Emerging code	Participant	Participant response
Online learning platform	6	It was the learning tools, like the practice, they gave you a learning section, a practice section, and then a quiz section, um, with the website they used which was really helpful. . . . The learning tools that we used, the Hawks Learning is what we used, and it was extremely easy to use.

(*continued*)

Table 6

Interview Participant Responses Related to Entry-Level Mathematics (*continued*)

Emerging code	Participant	Participant response
Online learning platform (*cont'd.*)	9	With math, they gave us homework every night. So, I try to do it every night to keep it fresh in my head. I kind of like that because—and then if you didn't pass, you had like these, I guess you had lives, you had like five lives, and if you get the fifth one wrong, they make you do the whole review over. So that took a lot of time because you're on your last life and you have two problems left and if you miss that you'll have go all the way over and do it again. So that was very frustrating.
	20	I thought it was fabulous. It really works really well. The online program has guided practice so they would walk you through problems. It will solve problems for you. No like problems for score, but if you need help, they will solve it for you and then you get a different question. Uh, if you're wrong, it will tell you right away that you're wrong, and show you why you're wrong, and it really helps you figure it out.
	21	I appreciated the learning platform as well because it gave you a lot of practice because it would work it out for you and show you the steps that went along with that, and I think that made a difference for me because all those little steps are extremely important on down the road. . . . It was the online stuff that was really challenging my brain. But I got the hang of it after about a week or two, and of course my teachers were there to help me, and then I really loved it.
Math background	19	"I was always horrible at math."
	3	I elected to because they told me that I could have skipped the 101 if I wanted to because I did test a bit higher. I guess they thought I would. But I decided that I would start from there. That way I wouldn't get into something that I didn't understand. . . . I've always been fairly strong in math, so it wasn't anything I struggled with.
	6	I was really good in high school but it's been a very long time, so it was not something that I was comfortable doing. . . . It was difficult. . . . I guess trying to process all of the equations, the terminology. Things have changed now from when I was in high school. So, it was just, I had to relearn a lot of it all over again.
	11	I always thought I was good at math, but going to school 20-something years later, I'm not that good anymore. . . . I thought I was good. Because even in high school I took advanced classes like trigonometry and all that, so, I thought I was pretty good in math. But, I guess, pretty much if you don't use it, you lose it.

(*continued*)

Table 7

Interview Participant Responses Related to Entry-Level Mathematics (*continued*)

Emerging code	Participant	Participant response
Math background (*cont'd.*)	9	"I'm not really good in math, but they told me I had to take math."
	8	I have a really strong background in math. I was always pretty good at math, even in high school. So, I figured might as well take the easier math classes, take them online, so that way I didn't have to worry about going in to class, because I do work full time, and that kind of works with my schedule.
	20	I did have some math anxiety coming back to school. . . . Just that I'm not good at math. Like oh gosh, I'm not good at math. There was anxiety before I started school about it, that I'm not good at math, and the nursing program has math requirements, and you know my wife was like, "It's not that bad," you know, when you're an adult you're a lot more motivated to learn at this time, which is true. And so, once I got in the classroom and we actually started doing it, it wasn't that bad.
	13	"It was really easy. . . . But technically I'm already like an optician. You know optician we like we deal with like math and physics all the time."
	12	I struggled. I struggled very bad. I mean, um, I did not like some of the things I struggled with was like fractions. Even with simple division and stuff until I reached college, that when I actually was able to do it correctly. But through high school, even in my high school I can remember um in elementary school I struggled. . . . I will say um, especially since it was needed for the nursing program, I was discouraged and because of that, it took me years to go back to nursing. That was one of the main things that kept me from going to nursing school was math. I felt like I wasn't good at it, so I wouldn't be a good nurse.
	21	I had already taken 031 and made and A, but I decided to retake the class because I had forgotten everything really. I was afraid I had forgotten everything. That was an option that I did and was glad that I could do. . . . [I was a strong math student] when I applied myself. I was in all honors classes and AP [Advanced Placement] classes.

Motivation. Motivation was a predetermined code for the interview data. During analysis, two codes related to motivation emerged: program or degree requirement and personal motivation to succeed. Table 5 outlines participant interview responses related to the codes.

Table 8

Interview Participant Responses Related to Motivation

Emerging code	Participant	Participant response
Program or degree requirement	19	Realistically, the only reason that I took an entry-level math class is because I had to. Now, once I got into my first 100-level class, it was a little bit different. That one was also a degree requirement, but by that point I had a couple semesters under my belt—successful semesters—um, and I was actually just—there was a little bit of personal motivation and dedication to that that wasn't there initially. So, but they were both degree requirements.
	6	"I had to. I failed the entrance tests that they give you to place you into the college level."
	4	"I was placed into that."
	11	"Pretty much everything was what I was supposed to take. I went to advisors and this is what I was supposed to take so I enrolled in it."
	9	"To pursue my associate's degree . . . they told me I had to take math."
	8	Sure. So, when I came to this school, instead of making—they didn't except my math credits from my previous schooling. So instead of letting me start out at like the college Math 110, they made me take the prerequisite for it. Which was fine because I hadn't taken math in a few years and I forgot all this because I'm not using it. So, it definitely did help me in the long run to be able to succeed and get A's in math and stuff like that.
	20	"I really needed it for the program of study that I wanted."
	13	Um, I had to do it because I had to start all over again. I already had a previously I had a bachelor's degree, but my credits did not transfer over, so I had to do it all over again. . . . I didn't want to, but it's required.
	12	"That's one of the classes that I had to have to get to the next class that I need to count toward the actual program that I was applying for."
Personal motivation to succeed	19	When I hit the 100-level class my confidence was higher, and it wasn't just that I enjoyed learning new things, it had more to do with the fact that my confidence in math was higher because I learned that, hey, it you acquire diligence in a subject, you can master what they're asking you to master. So that was more the personal—the personal drive just came from essentially beating the game so to speak. I've always looked at it like a game. You don't have to be there, but if you chose to go there then you're competing with what the instructor is asking you to do. And it's up to you whether or not you're going to succeed in that.

(*continued*)

Table 9

Interview Participant Responses Related to Motivation (*continued*)

Emerging code	Participant	Participant response
Personal motivation to succeed	4	"I took it on my own."
	11	"I knew I could do, I wanted to prove to myself that I could do it, and even you know, in struggling with it, I just refused to give up."
	9	I was motivated on my own. But it is discouraging when you practice and you get right on the homework, and then you take the test and you fail. It kind of puts a damper on things. Um, and I couldn't understand why I wasn't getting it. I don't know if my brain ain't wired right, but I'm motivated because I want to graduate. I may be walking across the stage with a cane, but I want to graduate. I do.
	20	"I'd say [my motivation was] autonomous. Because I could have just given up right there, but I said, 'No, this is what I want to do, this is what the requirements are, and I can do it.'"
	13	I don't think it was anything with pressure, I think it was my own motivations to get it done. . . . I mean I think for me it was more of self-motivation if anything because I'm already like, I was already trying to get some other things worked out. I mean I wanted to become a nurse because I wanted more job security that what I already had, and I also wanted to gain more income as well. That's why I'm deciding to go back to school for that reason. . . . It was more self-motivation for me, if anything. I wouldn't say it—like my parents are encouraging, my family's encouraging, but more for me it's like self-motivation to get it done and over with and not giving up.
	12	"It was like a self-motivation type thing, like I had to get this done, even though it was hard."
	21	So, when I decided to go back to school, and I had not been in school in a very long time, and math was an area that I know, like you have to have a strong foundation. So for one thing I, um, did the entrance test and I think I scored like almost close enough or close enough that I could have skipped one of the entry levels, but I chose to just start from scratch because I knew that I would have to go all the way through college algebra, and I wanted to make A's. So, that was the biggest thing for me . . . the way I see it, I mean, on the down the road, classes are going to get harder and harder, and an A now is going to be really important then when I make a B or a C. I want to do the very best that I can because I don't know what the future holds for one thing. . . . But I've always been that way. When I'm in school, that's real important to me that I have A's.

Success. Success was a predetermined code from the interview data. Emerging codes during interview data analysis related to success included comfortable classroom environment, detail-oriented teaching, outside academic support, and teacher impact. Interview participant responses related to the codes are shown in Table 6.

Table 10

Interview Participant Responses Related to Success

Emerging code	Participant	Participant response
Comfortable classroom environment	19	I think overall because it's a place for fresh high school graduates all the way to working people and people with families, um, I always did. Yeah. I never felt like it—like, everything was so rigid that there was no way to kind of have the little nuances in life where you show up five minutes late and you're going to be thrown to the curb. I've always felt comfortable in class there.
	6	You can do chats, like instant chats, direct messages, you can do e-mails. They give you all of the students that are in your class are available on your class list so you can message them privately. You can set up tutoring sessions with them. They were all pleasant interactions.
	4	I mean with [Teacher A], we were able to work in groups or something. We were able to help each other, but with [Teacher B], it wasn't like that. She would just like, I felt like she rushed through everything, and [Teacher A] didn't. For [Teacher B], it was a lot of kids. But in [Teacher A], I mean, I'm used to like, small classes. I'm not used to big classes with a lot of kids. I mean, downtown was much quieter, and not a lot of noise.
	11	And I also think that, I mean it's good to have a mixture in the classrooms because I've met a lot of young girls. You know, I was like, "I'm not getting this." So, they were like, "Just try it this way," or "Or just do this," and I was like ok thanks, cool.
	9	I felt really comfortable. I felt like [the instructor] cared. I felt like she really wanted us to do well. Now the one in the summer, it was kind of like you got your big boy pants on, here you go, learn the material.
	8	"So, for, definitely for Math 101 which was the first one I took, I definitely would have continued to take that one online because the material was kind of easy to grasp, the learning environment was great."

(*continued*)

Table 11

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Comfortable classroom environment	20	"Yeah. It was a really good learning environment. Like I said, nonjudgmental. Just calm and easy. . . . The other students were very calm, too. So, everybody's just there to learn. So, it was a pretty focused group."
	13	My 101 class it was my first time doing the math class, and I was just looking at all these kids. It was like I was in the classroom with kids that were like my sibling's age, and it was kind of weird. But other than that, it was pretty cool.
	12	The classroom was very comfortable. . . . [The instructor] made you feel like, uh, she's just not just an instructor. You know she talked about her family and you know some issues she would kind of joke around and make you feel kind of comfortable in your classes.
Detail-oriented teaching	19	"I have to practice it with my hands, like actually work through a problem from start to finish. Like for example I don't do well with short cuts. I am very particular when it comes to those things."
	3	"[The instructors] broke things down step by step."
	6	"[The program] also added videos that showed you how to work it."
	9	"If I don't understand something, you have to really, really take your time and explain it."
	13	"[The instructors] were very cool. They were very detailed. Very—they explained a lot."
	12	"[The instructor] was very good also. She took the time to make sure she explained everything."
	21	The way that [the instructor] taught it was extremely detail oriented, and I appreciated the learning platform as well because it gave you a lot of practice because it would work it out for you and show you the steps that went along with that, and I think that made a difference for me because all those little steps are extremely important on down the road.

(*continued*)

Table 12

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Outside academic support	19	That 0-level math class, it came a bit more naturally, it was a little bit easier than to go to the learning center, but actually retaining the material and looking forward to attaining the material was a big factor. The 100-level class, what affected my performance there was getting a tutor outside of school. I paid; I think it was twice a week. Twice a week for a tutor. . . . I have more of a data-driven mindset. So, when it came down to that 100-level math class, it was like, ok, I'm going to get my tutor. And then, when I worked with a tutor and I would get the material, I retained it pretty well. And so, I was like a personal confidence booster. . . . I got the tutor, and, a lot of that was driven because it was a bit more advanced. It was material that I hadn't seen since high school, prior to me dropping out. So, having that additional help was necessary in order for me to master the material. It wasn't enough for me to go into Hawke's Learning and you know what and do it. Like that's not really personal, but going to see the tutor and she could, like, give me her time and break it down for me face-to-face. So generally speaking, once she did that, I was able to understand what something was because if I didn't, she could explain to me principally, and kind of bring the abstract into a practical, uh, practical terminology to help me understand it. So, at first, the tutor was a trial run. She just happened to work out, more than just showing me how to do the steps. That's self-explanatory. But I really wanted to understand the principles of it. So, as far as continuing to see her, that's why I did that, because she helped me understand things in a very practical way, the abstract principles of it.
	3	"I went [to the learning center] a couple times just to get some clarification on how to do a couple things."
	4	I felt like [the tutors] don't help me because they'll try to teach me something that they know and something that I don't know that's really new to me, and I don't do that . . . like the formulas or something, or teach me how they were taught. And that was throwing me off a lot. . . . If I were to go to tutoring, I would prefer how the teacher would show me how to do it.
	11	I also went to the study lab and got additional help as well. . . . You can go down there and get tutoring for any of the subjects. Sometimes they have a tutor for just about all the subjects. They have a tutor down there. But a lot of times I didn't go until late. And a lot of the tutors—maybe one or two may be there, depending on what subject I'm working on, may be there until 9:00 that night. Because I was staying until 9:00 at night, Monday through Thursday, due to the fact that I did not have Internet.

(*continued*)

Table 13

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Outside academic support (*cont'd.*)	9	I went to tutoring. I made time. I usually did the tutoring right after class while my kids were in school, and I would squeeze in like a 30-minute tutoring. . . . It's hard for me to get a tutor because like I have to work. Sometimes I have to go to work right after school. So sometimes I'll try to squeeze in tutoring right after I get out of class and then I have time to go to work. . . . I kind of like question myself when I do stuff, and I wanted to make sure I was doing it right.
	8	Sometimes I would go on like Google because sometimes I would forget how some things were supposed to be set up even from looking in the notes and stuff. So, I would Google math problems and use some math websites.
	12	I also got to the point that whatever he was teaching, and if I didn't understand it of course we have the tutoring center so I used that to my advantage. And we have the YouTube videos that shows us how to properly do some math. So, I just kept pushing myself. . . . The YouTube videos are helpful, but I'm more of a, I like to have the teacher right there beside me.
Teacher impact	19	[My instructor] was a very, very personal teacher. She—it's in her nature. She's like a servant. So, it's nothing when she has the time to give you the extra time that she has to help you. So, she was always willing. She always had a other classes to go do, and of course the school has support systems in place so, probably if I had to quantify it in any way, I can say that, as far as she went, it was the giving of her time outside of simply teaching it to you. And the class too, because she would like spend a few extra minutes if somebody needed help on something. She's not a really "check the box" kind of teacher. . . . She had office hours. I don't remember how frequently she was available. But I will tell you this, if I ever heard that she ever turned a student away, I probably wouldn't believe it. She was always willing to give you her time to help you. She makes you feel comfortable. She makes you feel comfortable. Not like if you don't understand math, you're an idiot. To the best of her ability with the time she had to work with, she'll break it down and do what she can for you. And that's a big benefit. And the other thing to, uh, rambling on here with her, I think her mindset is a little more driven more towards people who work, who have families. She's not a big disciplinarian. She's more of a flexible person. She understands that if you need to devote a little more time away from class, she's not going to come down on your hard if your time gets tied up elsewhere, so. She's a relatable person. Very relatable. So that helps.

(*continued*)

Table 14

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Teacher impact (*cont'd.*)	3	The biggest factor was my teachers I'm sure. The two teachers I had for the 101 and 102 courses were absolutely phenomenal. They engaged the students. They broke things down step by step. They didn't make you feel like you were stupid for asking a question. They never did the whole, "You should have been paying attention" or anything like that. They were really, really fantastic teachers. Actually, both of them would—anytime they would see me or my classmates in the hallway, they would talk to me. "Hey. How you doing? You getting the homework done?" You know. "If you have any questions give me a call." You know. So, they were really, really good about that.
	6	If students had questions about certain problems we were trying to work, she would post them through the message board and other students could put their input in on how to solve it or how they figured it out themselves. It would help from a student's perspective along with the teacher's perspective . . . the instructor online was very helpful. Like she was there if we needed her. She helped us work problems through.
	4	Well basically she would like, I guess [Teacher B] would come up with her own methods of the math, and they were all new methods that I didn't know about. So, and then basically she would talk a lot about her family. And like the work was getting harder and harder and harder so I'm like, I have to drop out because she was going too fast. . . . We could have like, tried to work on problems together. Or like at least done some of the work together that was due because if [Teacher B] would have done that, I think I would have been able to understand it a little more.
	11	I had a good teacher, that was the good part, and she tried to work with me because I wasn't really familiar with the technology. Basically, I've only had a cell phone for a year and a half, and I have pretty much no Internet experience. The teacher worked with me. I also did not have Internet at home and everything needed to be done online. So, I got a lot of help from the teacher. . . . She did try to explain it. She did a pretty good job at explaining. Maybe, just here taking time, being able to come to her office, being able to send her e-mails and she'd answer them, that helped a lot. That played a big factor. And she didn't want me or others to fail. She would extend our homework sometimes so we could make sure we could get it in. Dropping some of our lowest grades because some of them were just awful. Giving us extra credit, that was good. Four or five points makes a difference. Let's see, what could she have done better? I'm not really sure. I do think she's awesome. I want to say maybe, I don't know, I'm trying to look at it from the teacher's standpoint.

(*continued*)

Table 15

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Teacher impact (*cont'd.*)	11 (*cont'd.*)	When you have like, you know, so many people coming at you, you know, some positive and some not, you get a little exasperated sometimes. She's not easily exasperated, but I think that she was like, "Why aren't y'all getting it," sometimes. I think maybe, uh, I guess as a teacher she doesn't want us to fail, and I'm sure she doesn't want to think that she failed us by us not getting the material. I guess that where some of her exasperation comes in at. So, she's kind of think of ways and sometimes she'll come in the next time we meet and she's like, "Ok. I thought about this. And we tried this. Let's try this," to see if that would help some of us get it. There's nothing bad I can say about her, really. You know? She really is a good teacher. She's fun, she's energetic, she's funny, really funny. She really, really tries.
	9	[The instructor] would review and if we need help, she'll go over it. She wouldn't rush us. Like, she would give us time to answer questions before she went on to the next section. And she gave us quizzes and she gave us chapter tests, but it would be, you know, not a major test. You know. I think more quizzes would help us retain the information longer. I mean me personally. . . . The Algebra 2 class I took it in the summer, and the teacher, she was rushing us. And she would go over the material so fast, because I know it's like a short semester, but she acted like she just didn't care. She just was very, she wasn't very, like, I don't know the word I'm looking for, but it was just like, "Ok here's your stuff. Do it. Have a good day," so I made a D in her class. And then I was like no I got to really take it. And then I got a good teacher in the Fall and I did really well because she was caring, we did these fun exams—like, fun experiments to relate to velocity you know. We went outside and we shot this thing in the air so she could give us a visual. It was great. She was a good teacher, the second time, this other teacher I had.
	8	My first two classes were online, and they were both readily available to answer questions at any time because it was online. It wasn't like a set time for like class. Um, so I could e-mail them with questions from like our math homework and stuff, and they'd usually get back to me pretty quickly. Um, which was awesome. And they would give me like examples and show me how it was done. Or help me work through that same problem, just depended. So, it was nice to be able to have that. And so, those ones were both online, and I definitely did have great teachers for both of them. . . . They never treated me like I should already just know everything. They kind of helped me. They understood that maybe like I just forgot how to do this. And they didn't have any attitude. They were more than willing to assist you with whatever, even if it was a stupid question or if you were just making stupid mistakes, they never made you feel like you were a failure.

(*continued*)

Table 16

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Teacher impact (*cont'd.*)	8 (*cont'd.*)	They just were like, "Oh, well maybe we should try it this way." . . . A lot of times with like my first math I took online, what they would was so the problems work, like step by step on like paper or something and then they'd screenshot it and send it back. Um, sometimes they would be like, "Oh, that's just like the other problem we did." And they'd be like, "Refer back to that one," and I'd be like, "Oh ok. That makes sense." So sometimes it was just like that. Sometimes it was just saying, "Oh review this rule so that way you understand what you're reading."
	20	[The instructor] had a really positive way of talking about math, which has not always been a positive thing for me. I had a lot—I did have some math anxiety coming back to school. But she was really positive and real calm about it. Really good at explaining if you had questions and, um, there just like wasn't a lot of pressure. Wasn't a lot of homework. Wasn't a lot of, like, I didn't feel like, there wasn't a lot of extra studying to do. It was just kind of a real casual way to ease into it.
	13	You just ask the professor the questions, and she knows what question it is that you're talking about, and she can go back, look over your work and see it from there where you went wrong, and it's no problem. . . . [The instructors] were very cool. They were very detailed. Very—they explained a lot. They were very cool. All you basically had to do was show up, do your homework, ask questions.
	12	You run into very good instructors at the college that actually took the time to teach you the things you needed to know. There was two professors I ran into that actually, you know, kind of help me look at things on a different perspective when it came to math and, I kind of overcame my fears, and here I am. . . . I kind of feel like I did not have a very good experience in one of my math classes because of the instructor that I had, which you know at the end of the semester they always ask for the evaluations and I did leave it, a good bit of us left evaluations, but this particular teacher, I don't know I kind of was discouraged when I finished his class because I felt like I did not gain a whole lot from him but then when I moved on to this next, the higher level, it was a higher level math that I had to take, this instructor, I mean she, she was very well organized. And I was going through things you know personal life issues. I was her attitude, her teaching, and she would tell us a little bit of her personal life which kept me going and it kept me coming to her class and it kept me wanting to learn and stuff because I felt like I could kind of relate to some of the things she would talk about as far as her personal life.

(*continued*)

Table 17

Interview Participant Responses Related to Success (*continued*)

Emerging code	Participant	Participant response
Teacher impact (*cont'd.*)	12 (*cont'd.*)	For instance, she had a child, she was a single parent and stuff like that, so I could definitely relate, and it helped me going to her class. And not only that she was very organized and she did take the time out to teach. . . . [An instructor] would make comments as if Americans, like we were needy. If we had questions, he kind of skipped over us. Like you could raise your hand and ask for him to slow down. He would keep going, he would speed up. I mean, at that point it was only a couple of students left in the class. I lot of us felt like we weren't going to pass him. . . . I ended up with a B, and it was because of that same teacher that I ended up taking in the higher class. She actually came in and substituted for him one time, and it was when we had a major test, and she really, uh, I mean she made a difference. And I was like so thankful, and lot of us was you know, we felt relief, because she came in and took over . . . she joked a lot. Sometimes, which is a good thing, because there was days, where, you know, I know I would be going through issues in my own life, and then you come to class and you have this teacher that kind of joke around with the class and make you smile and you know brightens your day. I'm thankful for days like that.
	21	I really appreciated the teacher making herself available. . . . She was detail oriented, and she really made it memorable. I can remember her doing like, you know, like just weird stuff to make us remember stuff. Like, uh, do like a little dance or something with it so that we wouldn't forget that you have to flip this or slide that because those were key components where a lot of people make mistakes, so I just remember that being, I really appreciated that because she didn't just throw the information out there. She really wanted us to grab and digest it.

Nontraditional students. A predetermined code was nontraditional students. An emerging code related to nontraditional students was children as motivation. Table 7 outlines interview participant responses related to the code.

Table 18

Interview Participant Responses Related to Nontraditional Students

Emerging code	Participant	Participant response
Children as motivation	3	My oldest daughter and I actually started college the same year. So that was a big motivation. Because I remember I didn't graduate from high school. I quit and then I went back and got my GED. So, my oldest daughter graduated high school and then started college and we started together. So that was kind of the thing, just to show her, I know it's hard, but if I can do it you can do it.
	9	I was determined because I wanted to pass, and plus to show my kids that anything's possible, and the harder you get, the older you get, the harder it gets to do that kind of stuff, like math and reading and English. It's like my brain is older and it's harder to retain it. And you got a lot going on with work and kids and school. You can't just be a full-time college student. So, it's harder. So, I want to show them go to college early, get it done, don't wait until you have kids and you have a job and all that stuff, because it's harder.
	12	"I have a son that I really want to make sure I'm providing for, so I kept just pushing myself."

Reliability and Validity

Member checking was used to establish credibility of the study. Members were allowed to read the interview transcripts, which were e-mailed to the respective participants. Members could make any necessary changes to the content by responding to the e-mail with changes, and members were informed a lack of response would indicate no need for changes. Two members responded the information in the transcripts was correct, and the other members did not respond. Triangulation was used to ensure credibility of the research by collecting data through different means: questionnaires and interviews and by member checking. All interview participants were questionnaire participants. Using two different instruments allowed for comparison of responses and ensured the believability of participants' responses.

Strategies were used to support the dependability and transferability of the data. Member checking and method triangulation allowed for dependability in the study. Because the research used both questionnaires and interviews and interview participants were able to check and correct responses to interviews, time or location did not impact the data. The research was conducted on nontraditional students at an American community college. The data collected are transferrable to nontraditional student populations at U.S. community or technical colleges or U.S. two-year colleges with nontraditional student populations.

Confirmability was established in the study by documenting the research procedures and data findings, including data findings contrary to the researcher's assumptions. This study is confirmable because reflection was used to control for biases influencing results of the study or presentation of the results of the study. During analysis of the questionnaires and interviews, results were noted, including those contrary to assumptions. Care was taken to ensure all data results, including those results which were unexpected, were included and displayed in the study.

Chapter Summary

Data were collected in online questionnaires and semistructured interviews with nontraditional students of entry-level mathematics at a community college. All participants provided informed consent to participate in the study, and participants' data and confidentiality were maintained throughout the study through various security measures. The data from questionnaires and interviews were compiled and analyzed using predetermined and emerging codes. MAXQDA Analytics Pro data analysis software was used in the data analysis process.

Analysis of the questionnaire data led to predetermined codes of motivation and experiences. Emerging codes related to motivation included learning, complete a program requirement, academic achievement, and children. Themes which arose during analysis of questionnaires related to experiences included teacher or instructor, textbook, learning center or tutoring, real-world experience, online learning platform, positive outlook, and positive prior experience. Analysis of interviews included predetermined codes of entry-level mathematics, motivation, success, and nontraditional students. Each predetermined code was associated with an emerging code. Entry-level mathematics was associated with an online learning platform and math background. Motivation was associated with program or degree requirements and personal motivation to succeed. Success was associated with a comfortable classroom environment, detail-oriented teaching, outside academic support, and teacher impact. Nontraditional students were associated with children as motivation.

In response to Research Question One, nontraditional students described autonomous motivations impacting students’ success in entry-level mathematics courses. Nontraditional students stated learning, personal motivation to succeed, completing a degree or program requirement, academic achievement, and children impacted students’ success in entry-level mathematics courses, all of which are examples of autonomous motivation. In response to Research Question Two, nontraditional students described the following experiences as important to success in entry-level mathematics courses: teacher impact, outside academic support, and an online learning platform. Chapter 5 includes a discussion of the results of the study and the conclusion of the study.

Chapter 5: Discussion and Conclusion

The purpose of the qualitative explanatory case study was to describe factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses at a community college in South Carolina. The problem was some nontraditional students do not complete entry-level mathematics courses, and the reasons are unknown. Study findings may help teachers and educational leaders identify and understand factors impacting the success of nontraditional students in entry-level mathematics courses at community colleges. Included are interpretations of the results with connections to literature reviewed and self-determination theory as a conceptual framework to answer the following research questions guiding the study:

Research Question One: How do nontraditional students describe the impact of autonomous motivation and controlled motivation on nontraditional students' success in entry-level postsecondary mathematics courses?

Research Question Two: What experiences do nontraditional students identify as important to the nontraditional students' success in entry-level postsecondary mathematics courses?

Key findings related to the research questions arose from the data. Regarding Research Question One, nontraditional students described autonomous motivation, not controlled motivation, as impactful on success in entry-level postsecondary mathematics courses. Findings suggested teachers' actions and tutoring as primary experiences impacting nontraditional students' success, answering Research Question Two.

Findings, Interpretations, and Conclusions

Findings were based on data analysis from questionnaires and interviews of nontraditional entry-level postsecondary mathematics students at a community college in South Carolina. Participants took different combinations of courses with various outcomes. Some participants took one entry-level mathematics course, while others took four entry-level mathematics courses. Participants passed, failed, withdrew from, and were enrolled in entry-level mathematics courses. The different courses and outcomes of the participants in entry-level mathematics courses indicated participants had diverse experiences in entry-level mathematics courses. Diversity of the sample population was conducive to answering the research questions.

Nontraditional entry-level mathematics students expressed being comfortable in face-to-face or online classroom platforms. Teachers supported nontraditional students through flexibility and respect for the student as an adult. This finding is in line with the work of Phillips et al. (2017), which revealed nontraditional students prefer teachers who respect nontraditional students as adults and do not prefer teachers who are disrespectful, condescending, and rigid. Nontraditional students felt comfortable in classrooms even when most of the classmates were traditional students, and nontraditional students did not find the age gap to be an educational detraction. Simi and Matusitz (2016) stated nontraditional students can be positive additions to classes by sharing prior knowledge with traditional students.

Online learning platforms may help nontraditional students be successful in entry-level mathematics courses. Participants indicated positive experiences with online mathematics platforms by providing immediate feedback on formative assessments and thorough explanations on how to solve practice problems. Online learning platforms may be an alternative for enrichment and remediation, including when teachers are unable to use scaffolding, as described by Brower et al. (2017), or the algorithm teacher technique described by Cafarella (2016). Online learning platforms may be helpful for nontraditional entry-level mathematics students who need academic assistance but are not able to attend teacher office hours or tutoring.

Three participants identified children as a motivation to succeed in entry-level mathematics courses. The literature indicated nontraditional students may have children (Levy, 2017; Lin, 2016; Osam et al., 2017; Panacci, 2015; Simi & Matusitz, 2016; van Rhijn et al., 2016), and childcare responsibilities can be barriers to student success (Osam et al., 2017; Rothes et al., 2017). Contrary to the literature, nontraditional students described children as motivators, not impediments to success. Nontraditional students balanced childcare and school responsibilities, and students were motivated to show children academic and career success was possible.

A student's mathematics background may impact student performance in entry-level mathematics. A positive outlook and positive prior experiences were indicated as factors impacting the success of nontraditional students in entry-level mathematics. Whether participants described strong or weak mathematics backgrounds, most participants expressed anxiety or apprehension in beginning the entry-level mathematics course. These findings are consistent with literature suggesting students have increased mathematics anxiety and decreased mathematics self-efficacy with age (Simi & Matusitz, 2016). Even if students had strong mathematics backgrounds with positive experiences in previous mathematics courses, participants still experienced anxiety entering entry-level mathematics courses. Ryan and Fitzmaurice (2017) found nontraditional students are persistent in courses despite having mathematics anxiety.

While nontraditional students were apprehensive of returning to mathematics class, the apprehension did not impact nontraditional students' overall success in entry-level mathematics classes. Nontraditional students did not enroll in entry-level mathematics courses for the sake of learning but out of necessity of course progression and program completion.

Results suggested teachers of entry-level mathematics play an important part in the success of nontraditional students of mathematics. When teachers taught in a detail-oriented, step-by-step fashion, nontraditional students were able to follow and understand lesson content. Nontraditional students described the teacher as having a large impact on students' success in entry-level mathematics, as supported by Trolian et al. (2016). When teachers were supportive of students, made learning intentional, and sought to help students achieve, nontraditional students had more positive experiences in entry-level mathematics, in alignment with Phillips et al. (2017).

Nontraditional students took advantage of outside academic support provided by teachers during office hours. When nontraditional students could not work with teachers, the students used tutoring to gain a better understanding of the material and supplement the learning. Learning support and extension through academic support outside of class time is worth further investigation.

Findings Related to Self-Determination Theory

Self-determination theory provided the conceptual framework for the study. This theory suggests motivation lies on a continuum from amotivation to intrinsic motivation (Rothes et al., 2017). Autonomy, relatedness, and competence are three main components of self-determination theory (Durmaz & Akkus, 2016; Garaus et al., 2016; Irvine, 2018; Jacobi, 2018; Johnson et al., 2016; Kennan et al., 2018; Komiyama & McMorris, 2017; Rothes et al., 2017; Wisniewski et al., 2018). This section describes findings related to the motivation, autonomy, relatedness, and competence in self-determination theory.

Findings on motivation. Parts of the motivation continuum described in self-determination theory include amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation (Rothes et al., 2017). Intrinsic motivation is demonstrated when a person acts because of enjoyment or interest (Irvine, 2018; Rothes et al., 2017). Nontraditional students generally have high levels of intrinsic motivation (Rothes et al., 2017; van Rhijn et al., 2016).

Contrary to the literature, research participants did not describe intrinsic motivation. None of the participants stated being motivated to succeed in entry-level mathematics courses because of enjoyment or interest in the course; instead, the participants were motivated to succeed in entry-level mathematics courses because the course was necessary to complete a degree or program requirement. Participant 12 explained needing an entry-level mathematics class to get into a program. Participants 13 and 8 expressed being required by the college to enroll in an entry-level mathematics course because previous mathematics credits would not transfer. Participant 13 stated, “I didn’t want, but it’s required.”

Nontraditional students expressed personal motivation to succeed once enrolled in the entry-level mathematics course. A common sentiment among interviewees was self-motivation and refusing to give up. Participant 11 stated, “I wanted to prove to myself that I could do it, and even . . . in struggling with it, I refused to give up.” Participant 12 asserted, “It was like a self-motivation type thing like I had to get this done even though it was hard.” These nontraditional students experienced integrated regulation, a type of autonomous motivation where the individual assimilates reasons for participating in an activity in the individual's sense of self (Can & Satici, 2017; Jacobi, 2018; Johnson et al., 2016).

Findings on autonomy, relatedness, and competence. Autonomy is one of three basic needs described in self-determination theory (Durmaz & Akkus, 2016; Garaus et al., 2016; Irvine, 2018; Jacobi, 2018; Johnson et al., 2016; Kennan et al., 2018; Komiyama & McMorris, 2017; Rothes et al., 2017; Wisniewski et al., 2018). Autonomy is an individual's ability to make decisions without influence from others (Jacobi, 2018) and with feelings of volition (Wisniewski et al., 2018). Data analysis revealed nontraditional students' needs for autonomy were partially met. While some participants were able to choose whether to take a math course face-to-face or online, many participants described being placed into an entry-level mathematics course after taking a placement test. These students would not have enrolled in an entry-level mathematics course otherwise. Allowing nontraditional students to elect whether to take a mathematics course or which mathematics course to take may help students meet the need for autonomy and increase academic success.

Relatedness, a basic need found in self-determination theory, occurs when an individual feels cared for by others (Garaus et al., 2016; Wisniewski et al., 2018). Nontraditional students felt relatedness when describing a positive classroom environment. Despite the age difference, nontraditional students were comfortable around traditional classmates and enjoyed working in groups. Participant 11 described how traditional students helped explain confusing concepts. Course teachers met nontraditional students' need for relatedness by creating a comfortable classroom environment and interacting positively with students. Participant 9 said, "I felt like [the teacher] really wanted us to do well." Participant 12 stated, "[The teacher] talked about her family and, you know, some issues. She would kind of joke around and make you feel kind of comfortable in your classes." Participant 20 said, "It was a really good learning environment. Like I said, nonjudgment. Just calm and easy." Many nontraditional students learned in comfortable classroom environments created by the teacher which supported students' need for relatedness and academic success.

Competence, the third basic human need according to self-determination theory, occurs when the individual feels effective (Wisniewski et al., 2018) and gets effective feedback (Jacobi, 2018). Participants indicated low levels of self-efficacy entering entry-level mathematics courses. Nontraditional students may have lower levels of mathematics self-efficacy than traditional students (Rothes et al., 2017), and additional measures may be necessary to increase nontraditional students' levels of self-efficacy allowing students to meet the need of competency. Several participants used outside academic assistance as a tool to increase understanding, improve academic success, and meet the need for competence. Participant 9 stated, "I kind of like question myself when I do stuff, and I wanted to make sure I was doing it right." Participant 12 described using a learning center and online videos to supplement mathematics instruction. Supplemental instruction may help nontraditional students meet the need for competency.

Nontraditional Students Are Autonomously Motivated

Relating to Research Question One, nontraditional entry-level mathematics students are autonomously motivated to succeed. Autonomous motivation and controlled motivation are aspects of self-determination theory (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018). Nontraditional students have autonomous motivation to succeed in entry-level postsecondary mathematics courses and do not experience controlled motivation to succeed in entry-level postsecondary mathematics courses.

Themes from questionnaire responses about participants' motivation to succeed included learning, complete a program requirement, academic achievement, and children. Codes related to motivation from the interviews were personal motivation to succeed and program or degree requirements. Each theme or code is an example of autonomous motivation (Garaus et al., 2016). Learning and personal motivation to succeed are types of integrated regulation and are consistent with the students' values (Komiyama & McMorris, 2017). Completing a program requirement, academic achievement, and children are types of identified regulations where the students named successful completion of entry-level mathematics courses as necessary to academic or career goals although the students did not necessarily enjoy studying mathematics (Kennan et al., 2018). The finding is contrary to the work of Kennan et al. (2018), Rothes et al. (2017), and van Rhijn et al. (2016) which suggested adult learners are intrinsically motivated to learn.

Teachers and Academic Support Impact Nontraditional Student Success in Mathematics

Research Question Two posited the course teacher and academic support outside of class time as experiences impacting the success of nontraditional students in entry-level mathematics courses. Teachers have a positive or negative effect on nontraditional students' success. Students' success was positively impacted when teachers were available to the students. Positive teacher interactions where teachers used engaging methods of teaching, flexibility, and personable attitudes contributed to the students' success, as Phillips et al. (2017) noted. Alternatively, teachers could negatively impact nontraditional student success in entry-level mathematics courses through incoherent teaching and lack of empathy. Kennan et al. (2018)

recommended teachers use instructional methods based on students' personalities and autonomy levels. Additionally, engaging teaching methods and teachers' personable attitudes meet students' basic needs for relatedness in self-determination theory (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018).

Detail-oriented teaching positively impacted student success. Detail-oriented teaching is important to student success as results showed some nontraditional students had low levels of mathematics self-efficacy in entry-level courses, consistent with findings of Johnson et al. (2016). Positive effects of detail-oriented teaching on success in entry-level mathematics align with the work of Brower et al. (2017) and Cafarella (2016) which suggested teachers can use step-by-step teaching and scaffolding to help students learn mathematics.

Academic support outside of class time impacted nontraditional students' success in entry-level mathematics courses. Academic support through a learning center or tutoring, either regularly or as needed, improved success in entry-level mathematics. Outside academic support helped the respondents to be more comfortable and confident in what was learned. Academic support allowed the students to be competent in the students' mathematical abilities. Competence is a basic need in self-determination theory (Durmaz & Akkus, 2016; Garaus et al., 2016; Jacobi, 2018).

Limitations

This study has several limitations. Time constraints impacted the scope of the research. Data were collected between October 24 and December 12, 2019. If data had been collected over two or more semesters, more participants may have been reached. Participants did not receive incentives to participate in the research. Providing participants with monetary or academic incentives may have increased participation in the research. Data were collected at a single community college. Responses from participants through questionnaires and interviews were based solely on the experiences of students who attended the community college, resulting in a smaller sample size and decreased transferability of results (Hays et al., 2016). More participants may have been reached if the research had been conducted at multiple community colleges. Transferability may have been increased if the research had been conducted at community colleges across the United States.

Data were collected strictly from nontraditional students' perspectives. Teachers, community college leaders, academic assistants, advisors, and students' families were not included in the data collection process. Including teachers in the research may have provided insight into how teachers perceive nontraditional mathematics students' motivations and factors impacting nontraditional student success. Leaders may have offered data on measures and systems implemented to support nontraditional students as a special population. Academic assistants such as tutors and learning center teachers may provide feedback on how supplemental instruction impacts nontraditional students' success in entry-level mathematics. Advisors may have shared insight into the information and support nontraditional students receive before and during enrollment in entry-level mathematics courses. Nontraditional students' families may have noted barriers and other factors impacting student success.

Recommendations

Understanding recommendations may help educators better meet the needs of nontraditional entry-level mathematics students. The recommendations stemmed from predetermined and emerging themes from results and findings from the study. This section presents recommendations for practice followed by recommendations for future research.

Recommendations for Practice

Entry-level mathematics teachers need to identify which students are nontraditional. Teachers should get to know nontraditional students' personalities and include teaching strategies and methods aligned with students' learning preferences (Luke & Justice, 2016; Muñoz et al., 2018). Nontraditional students enrolling in entry-level mathematics courses through intrinsic motivation is unlikely, yet nontraditional students are still autonomously motivated. Teachers may learn nontraditional students' motivations to enroll and succeed in the course and encourage these students to persevere and be successful based on the students' definitions of success. Detail-oriented teaching, encouraging questions, and scaffolding help nontraditional students learn the content (Brower et al., 2017).

Community colleges can provide free, on-campus learning centers with qualified tutors who provide instruction in entry-level mathematics. Because nontraditional students require flexibility (Osam et al., 2017), these learning centers need to be open during late evening and weekend hours. Online tutoring with more flexible times and remote access should be available for nontraditional students.

Availability and flexibility are important for nontraditional students of mathematics (Osam et al., 2017). Many community colleges and two-year colleges do not require all mathematics teachers to provide academic assistance to students through office hours. Teachers need regular office hours at convenient times for students to receive academic feedback. Because nontraditional students may have external factors which may impede access to academic support

(Osam et al., 2017), teachers need to find time to provide academic assistance when most students can access the teachers. Because many of the interview participants indicated positive experiences with an online learning platform, teachers may be able to hold synchronous online office hours for greater flexibility and accessibility for nontraditional students.

Combined, teachers and tutors impact the success of nontraditional students in entry-level mathematics courses. Teachers should provide outside academic support to nontraditional students. As an institutional support, teachers should be given an office or a designated place to meet one-on-one with students, and teacher pay should reflect any increase in time commitment for students. Teachers know course content and learners best, making teachers better equipped to provide nontraditional mathematics students with academic support.

Recommendations for Future Research

Factors impacting the success of nontraditional students in entry-level postsecondary mathematics courses through the lens of self-determination theory was the study focus. Identifying how nontraditional students in entry-level mathematics courses describe levels of autonomous or controlled motivation to be successful was a research goal. Results led to recommendations for future research, including increasing the number of participants and locations; including teachers, leaders, advisors, and families; conducting a quantitative or mixed-methods study; and investigating how teacher-delivered academic assistance impacts nontraditional student success in entry-level mathematics.

Data were collected from 21 participants at one community college. Data should be gathered on more participants at community colleges and two-year colleges across the United States. Increasing the sample size and expanding the number of data collection sites may help improve transferability of results to nontraditional communities and two-year college students throughout the United States. Including two-year career colleges in addition to community colleges may further increase transferability to nontraditional student populations. If the number of participants and research locations are increased, study results may lead to improved practices to help nontraditional students at community colleges and two-year colleges across the United States complete entry-level mathematics courses.

A second recommendation is to include teachers, leaders, advisors, and families in a qualitative case study. Data from this qualitative explanatory case study were gathered solely from nontraditional students. Perspectives on factors impacting nontraditional student success in entry-level mathematics may be expanded by including entry-level mathematics teachers, college leaders, and advisors as sources of data. Teachers may share classroom practices and course content impacting nontraditional student success. School leaders may provide data on systems and strategies implemented to impact nontraditional student success. Information on advice before and during enrollment may be given by students' academic advisors. Nontraditional students' families may be sources of data on barriers or other factors impacting nontraditional students' success. Family members may provide insight into nontraditional students' autonomous or controlled motivations to enroll and succeed. Additional data from teachers, leaders, advisors, and family may enhance a qualitative explanatory case study.

A third recommendation is to conduct a quantitative or mixed-methods study to supplement this qualitative explanatory case study. Conducting a quantitative or mixed-methods study exploring factors impacting the success of nontraditional students in entry-level mathematics using self-determination theory as a theoretical framework may provide a more complete set of data from which to draw conclusions and make recommendations. Quantitative research can explore whether nontraditional students have higher levels of autonomous or controlled motivation. Results from a quantitative or mixed-methods study may be compared to the results of this qualitative research.

The fourth recommendation for future research is to extend the research by exploring the impact of teacher-delivered academic assistance on nontraditional students. Results led to recommendations for teachers to provide outside academic assistance for nontraditional students during office hours. Once teachers implement office hours for nontraditional students, research should be conducted to determine the impact teacher-delivered academic assistance has on nontraditional student success in entry-level mathematics courses. The effects of frequency, duration, time, location, and face-to-face or online format may be explored in this future research.

Implications for Leadership

Community college leaders can actively promote and foster the success of nontraditional students of entry-level mathematics. Feedback received from nontraditional students of entry-level mathematics suggests the importance teachers and outside academic assistance play in student success. Community college leaders such as college presidents and deans are responsible for creating teaching positions which allow teachers to work with students outside of class time. Leaders should create more full-time teaching positions in entry-level mathematics, allowing teachers to have more hours to dedicate to ensuring students get the support and understanding needed to complete the courses.

Community college leaders should modify positions of adjunct mathematics faculty members, allowing adjunct faculty members to commit extra time to work with nontraditional students individually and in small groups. Teachers need financial compensation for additional time educating nontraditional students outside of the classroom. Ensuring all teachers of entry-level mathematics have office hours for students may be an investment in the academic success of nontraditional students and the overall success of the community college. Leaders should ensure teachers have fully stocked, readily available resources necessary to tutor students of each entry-level mathematics subject.

Online office hours are another option community college leaders can implement. Community college leaders can provide entry-level mathematics teachers with the tools and technology necessary to hold online office hours. Online office hours can afford more flexibility than in-person office hours given both the teachers and students have Internet access, as supported by Acosta et al. (2016). Online office hours would be suitable for courses requiring the Internet, such as online or hybrid courses. In-person office hours are recommended for face-to-face courses.

Conclusion

The nontraditional student's mathematics education should be a holistic experience which combines the student's motivation, teacher relationships, and outside academic support into a pathway for academic and career success. Nontraditional students are autonomously motivated to succeed in entry-level mathematics courses. Furthermore, nontraditional mathematics students are not motivated to enroll in entry-level mathematics courses for learning and enjoyment; instead, nontraditional students enroll in entry-level mathematics courses to complete a program or degree requirement. Most nontraditional student participants did not describe enjoyment or inherent interest in mathematics as a motivation to enroll or succeed in the entry-level mathematics course, nor did nontraditional student participants describe a desire to learn mathematics beyond the scope of the enrolled course. Many participants were placed into entry-level mathematics courses. Nontraditional students enrolled in entry-level mathematics courses not because the students wanted to know mathematics but because students were required to know mathematics. Because nontraditional students have integrated regulation to succeed, community college leaders should examine curricula to determine if mathematics placement is necessary for students' academic and career success. Academic assistance through teacher office hours may help students complete these entry-level courses and meet students' needs for competence. Further research on the effect of teacher-led academic assistance is encouraged to learn more about the factors impacting the success of the dynamic and growing population of nontraditional students of entry-level mathematics.

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Appendix A: Course Descriptions

Developmental Mathematics Basics
ID: MAT-031
This course includes the study of whole numbers, fractions, decimals, ratios, and proportions. Concepts are applied to real-world problem solving.

Developmental Mathematics
ID: MAT-032
This course includes the study of integers, rational numbers, percents, basic statistics, measurement, geometry, and basic algebra concepts. Application skills are emphasized.

Beginning Algebra
ID: MAT-101
This course includes the study of rational numbers and their applications, operations with algebraic expressions, linear equations and applications, linear inequalities, graphs of linear equations, operations with exponents and polynomials, and factoring.

Intermediate Algebra
ID: MAT-102
This course includes the study of linear systems and applications; quadratic expressions, equations, functions and graphs; and rational and radical expressions and functions.

Appendix B: Informed Consent

Prospective Research Participant: Read this consent form carefully and ask as many questions as you like before you decide whether you want to participate in this research study. You are free to ask questions at any time before, during, or after your participation in this research.

Project Information

Project Title: Factors Impacting the Success of Nontraditional Students in Entry-Level Mathematics Courses: An Explanatory Case Study

Researcher: Lauretta Grant
Organization: American College of Education
Email: dlauretta1@gmail.com **Telephone:** 803-719-1464

Researcher's Dissertation Chair: Dr. Marsha Moore
Organization and Position: American College of Education, Dissertation Chair
Email: marsha.moore@ace.edu

Introduction
I am Lauretta Grant, and I am a doctoral candidate student at American College of Education. I am doing research under the guidance and supervision of my Chair, Dr. Marsha Moore. I will give you some information about the project and invite you to be part of this research. Before you decide, you can talk to anyone you feel comfortable with about the research. This consent form may contain words you do not understand. Please ask me to stop as we go through the information, and I will explain. If you have questions later, you can ask them then.

Purpose of the Research
You are being asked to participate in a research study which will assist with understanding factors that impact the success of nontraditional students in entry-level mathematics courses. This qualitative study will examine how viewpoints, behaviors, classroom instructional practices, and other factors from students at a community college impact student success.

Research Design and Procedures
The study will use a qualitative methodology and explanatory case study research design. Web-based questionnaires will be disseminated to specific participants within two (2) weeks. The study will comprise of randomly selected participants from a sample of respondents to the questionnaire who volunteer to participate in an interview. The study will involve face-to-face interviews to be conducted at site most convenient for participants. After the interview a debrief session will occur.

Participant Selection
You are being invited to take part in this research because of your experience as an entry-level mathematics student who can contribute much to the study. Participant selection criteria: Student

age 25 and older who is enrolled in or has enrolled in MAT 031 Developmental Mathematics Basics, MAT 032 Developmental Mathematics, MAT 101 Beginning Algebra, and MAT 102 Intermediate Algebra at a community college.

Voluntary Participation
Your participation in this research is entirely voluntary. It is your choice whether to participate. If you choose not to participate, there will be no punitive repercussions and you do not have to participate. If you select to participate in this study, you may change your mind later and stop participating even if you agreed earlier.

Procedures
We are inviting you to participate in this research study. If you agree, you will be asked to complete an online questionnaire or a face-to-face interview. The type of questions asked will range from a demographical perspective to direct inquiries about the topic of factors impacting the success of nontraditional students in entry-level mathematics.

Duration
The questionnaire portion of the research study will require approximately 10 minutes to complete. If you are chosen to be interviewed, the time allotted for the interview will be 30 minutes at a location and time convenient for the participant. A follow-up debriefing session will take 15 minutes.

Risks
The researcher will ask you to share personal and confidential information, and you may feel uncomfortable talking about some of the topics. You do not have to answer any question or take part in the discussion if you don't wish to do so. You do not have to give any reason for not responding to any question.

Benefits
While there will be no direct financial benefit to you, your participation is likely to help us find out more about how to help nontraditional students succeed in entry-level mathematic courses. The potential benefits of this study will aid the faculty and administrators in promoting best practices for teaching entry-level mathematics to nontraditional students.

Confidentiality
The researcher will not share information about you or anything you say to anyone outside of the researcher. During the defense of the doctoral dissertation, data collected will be presented to the dissertation committee. The data collected will be kept in a locked file cabinet or encrypted computer file. Any information about you will be coded and will not have a direct correlation which directly identifies you as the participant. Only the researcher will know what your number is, and the researcher will secure your information.

Sharing the Results
At the end of the research study, the results will be available for each participant. It is anticipated to publish the results so other interested people may learn from the research.

Right to Refuse or Withdraw
Participation is voluntary. At any time, you wish to end your participation in the research study, you may do so without repercussions.

Questions about the Study
If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact the researcher, Lauretta Grant, at 803-719-1464 or dlauretta1@gmail.com. This research plan has been reviewed and approved by the Institutional Review Board of American College of Education. This is a committee whose role is to make sure research participants are protected from harm. If you wish to ask questions of this group, email IRB@ace.edu.

Certificate of Consent
I have read the information about this study, or it has been read to me. I acknowledge why I have been asked to be a participant in the research study. I have been provided the opportunity to ask questions about the study, and any questions have been answered to my satisfaction. I certify I am at least 18 years of age. I consent voluntarily to be a participant in this study.

Print or Type Name of Participant: ____________________________

Signature of Participant: ____________________________

Date: ________________

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily. A copy of this Consent Form has been provided to the participant.

Print or type name of lead researcher: ____

Signature of lead researcher: ___________________________________

I have accurately read or witnessed the accurate reading of the assent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm the individual has freely given assent.

Print or type name of lead researcher: ______________________________

Signature of lead researcher: ________________________________

Date: _____________________________

Signature of faculty member: ____________________________

Date: ____

PLEASE KEEP THIS INFORMED CONSENT FORM FOR YOUR RECORDS.

Appendix C: Student Questionnaire

1. Select your age.
    - 24 years or younger
    - 25 years or older.
2. In which course(s) have you ever enrolled, whether it be passed, failed, or withdrawn? Do not select courses that you dropped during the add/drop period. Select all that apply.
    - MAT 031 Developmental Mathematics Basics
    - MAT 032 Developmental Mathematics
    - MAT 101 Beginning Algebra
    - MAT 102 Intermediate Algebra
    - I have not enrolled in any of these courses.
3. Why did you enroll in the course(s) you selected in question 3? (If you did not enroll in any of these courses, type “n/a”).
4. What was the outcome of your enrollment in the course(s) you selected in question 3 (e.g. pass, fail, withdraw, repeat, etc.)? (If you did not enroll in any of these courses, type “n/a”).
5. What was your motivation to be successful in the course(s) you selected in question 3? (If you did not enroll in any of these courses, type “n/a”).
6. What experiences impacted your success in the course(s) you selected in question 3? (If you did not enroll in any of these courses, type “n/a”).
7. The next phase of the research is an interview. The purpose of the interview is to gain greater insight into the motivations and experiences that may impact the success of students 25 year or older in entry-level postsecondary mathematics courses. The interview will take place at a

time and location convenient for the participant. If you are willing to participate in the interview, please click the link below to provide your name, phone number, and email address. Your contact information will not be connected to your questionnaire response, and your questionnaire response will remain anonymous.

Google Form

Thank you for your interest in participating in an interview for Lauretta Grant's doctoral research on Factors Impacting the Success of Nontraditional Students in Entry-Level Mathematics Course. Please enter your name, phone number, and email address in the spaces provided. Your contact information will not be shared with anyone other than the researcher, Lauretta Grant, and will be discarded upon completion of the research. You will be assigned a pseudonym for the interview to maintain your anonymity. Interviewees will be selected at random, so you may or may not be selected to participate in an interview.

Name___________________

Phone Number__________________

Email Address ______________________

Appendix D: Student Interview Questions

Understanding students' motivation is essential for understanding student engagement, student satisfaction, and student achievement. There are different types of motivation. This study focuses on autonomous motivation and controlled motivation. Under autonomous motivation, the individual has autonomy and acts on the individual's own volition (Garaus, Furtmüller, & Güttel, 2016). Under controlled motivation, the individual acts under a feeling of pressure (Garaus et al., 2016).

1. What motivated you to enroll in your entry-level mathematics class?
2. What motivated you to succeed in your entry-level mathematics class?
3. What factors impacted your success in your entry-level mathematics class?
4. What strategies did you use to be successful in your entry-level mathematics class?

Appendix E: E-Mail to Subject Matter Experts for Field Testing of Instruments

8/20/2019 Subject Matter Experts Needed for Dissertation on Highe... - Lauretta D. Grant

Subject Matter Experts Needed for Dissertation on Higher Math Education

Lauretta D. Grant

Tue 8/20/2019 7:52 PM

To: Legun L. Emmanwori <emmanworil@midlandstech.edu>; Nevermind E. Chigoba <chigoban@midlandstech.edu>; Rick Bailey <baileyr@midlandstech.edu>; Willie J Frierson <friersonw@midlandstech.edu>; Tracy McCoy <mccoyt@midlandstech.edu>;

Cc: dlauretta1@gmail.com <dlauretta1@gmail.com>;

1 attachments (15 KB)

L Grant Research Questions, Questionnaire, & Interview Questions.docx;

Greetings Fellow Educators!

I am a doctoral candidate at American College of Education writing a dissertation on factors that impact the success of nontraditional students in postsecondary entry-level mathematics courses. Because you are a mathematics educator in higher education and subject matter expert, I humbly request that you review the attached questionnaire and survey questions for content validity. Review of the attached questions should take less than 10 minutes of your time and help further best practices on teaching nontraditional students of entry-level mathematics.

I greatly appreciate your time and any feedback you can provide. You can respond to this email or contact me at 803-719-1464.

With kind regards,

Lauretta Grant, M.T.
Adjunct Instructor
Department of Mathematics

MIDLANDS
TECHNICAL COLLEGE

Appendix F: Permission Letter

[redacted]

[redacted]

Institutional Review Board Approval Form

Date: September 26, 2019

IRB File NUM: [redacted]

Title: Factors Impacting the Success of Nontraditional Students in Entry-Level Mathematics Courses: An Explanatory Case Study

Principal Investigator: Lauretta Grant

Institution/Department: American College of Education

Insurance Coverage: ____ In Place   X Not Necessary

Action Taken:

____ Exempt from Full Review

X Expedited Review

____ Full IRB Review

Disposition of Application:

X Approved

____ Disapproved

Modifications and Comments:
The Principal Investigator does not have permission to use the names of any participant in published reports. [redacted] requests a copy of any published reports related to this request. [redacted] Arts and Sciences department requests that the Principal Investigator share with the department the research findings.

James Jackson
IRB Chair/Designee

Approval Date*: September 26, 2019

Expiration Date*: September 25, 2020

*Approval of Research is for up to ONE year only. If your research extends beyond one year, the project must be reviewed before the expiration date prior to continuation.