THE PERCEIVED INFLUENCE OF MATHEMATICS ANXIETY ON SELF-EFFICACY AMONG ADULT LEARNERS AT A TECHNICAL COLLEGE IN GEORGIA: A PHENOMENOLOGICAL STUDY

by

George A. Ofosu-Anim

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

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2024

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Abstract

The purpose of this transcendental phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The theory of self-efficacy introduced by Albert Bandura which explains how learners develop their self-efficacy beliefs by executing a series of actions while dealing with diverse situations, guided this research study. The central question, “What is the perceived influence of math anxiety on adult learners at a technical college in Georgia?” was answered through this study. Data collection followed a systematic criterion with 10 interviews conducted from a purposeful consideration of the diverse backgrounds of adult learners and their respective motivational levels. Other data collection methods considered for this transcendental phenomenological study included participant observations and document analysis. The data analysis followed a methodical plan including epoché, bracketing, and phenomenological reduction. The three themes that emerged from the study were vicarious, mastery, physiological and emotional, and verbal persuasion experiences. The findings revealed that the influence of mathematics anxiety on the self-efficacy of adult learners stemmed from the absence of factors such as prior knowledge of course content, lack of positive feedback from teachers and peers, deficiency in emotional management skills, and inability to observe and replicate how others solve mathematics problems. Future research should concentrate on utilizing (a) participants enrolled in a university setting, (b) a quantitative approach, (c) a case study to describe adult learners' interaction with teachers, peers, and technology in a mathematics class over some time.

Keywords: adult learner, mathematics anxiety, motivation, phenomenology, self-efficacy

Copyright Page

Dedication

This dissertation is dedicated to my wife Jennifer Renea Kelley for her support and encouragement throughout this journey.

This researcher would also like to dedicate the research effort to the blessed memories of his mother Ms. Margaret Eva Amankwah Ohene-Darko, his grandmother Mrs. Florence Ohene-Darko, and father Reverend George A. Ofosu-Anim.

This research effort is also dedicated to my brothers Augustine, and Duke, my sister Eunice, and my entire family for their encouragement and immense contributions in completing this dissertation research.

Acknowledgments

This writer wishes to extend sincere appreciation to Dr. Jonathan Matthew Bracewell, Dissertation Committee Chair for his guidance throughout the dissertation process.

The writer also wishes to express gratitude to Dr. George Johnson for his help and assistance throughout the dissertation process.

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Centers for Disease Control and Prevention (CDC)

Individualized Student Plans (ISPs)

Response to Intervention (RtI)

CHAPTER ONE: INTRODUCTION

Overview

Mathematics anxiety is prevalent and hurts students, including adult learners (Hiller et al., 2022; Hössjer et al., 2022; Lau et al., 2022). Mathematics anxiety has influenced the choices of college courses as well as future career paths of students experiencing the challenge (İlhan et al., 2022; Gabriel et al., 2020; Guzmán et al., 2023). Students who experience such a phenomenon tend to have low self-esteem and self-efficacy (Gürefe & Bakalım, 2018; Huang et al., 2019; Lau et al., 2022). Students encounter learning difficulties during the acquisition of knowledge irrespective of the efforts put in by educators during the classroom experience (Hössjer et al., 2022; Fooks et al., 2021). Educational practitioners are mandated to teach the next generation the knowledge needed to thrive in their chosen careers.

Learners from diverse backgrounds approach the classroom experience with different reasons and motivation levels (Lim et al., 2022; Pongračić et al., 2022). Adult learners from varied backgrounds struggling with mathematics anxiety have developed a certain type of mindset that impedes their ability to acquire new knowledge, especially mathematics knowledge acquisition (Geist, 2015; Petty, 2019). Research has been conducted to indicate that there is a direct relationship between mathematics anxiety and self-efficacy among students from diverse backgrounds including adult learners (İlhan, 2022; Lau et al., 2022; Hendral & Hidayati, 2023). When students are introduced to numerical literacy earlier in their formative years, it enhances their mathematical self-efficacy (Guzmán et al., 2023; Petty, 2019; Pongračić et al., 2023). Students who struggle with mathematics anxiety tend to steer clear of mathematics-based professions (Everingham et al., 2017; Fooks et al., 2021; Huang et al., 2019). The circumvention of mathematics-based professions can influence their career choices and their subsequent earning

potential (Aldrup et al., 2020; Cribbs et al., 2021). There is a relationship between perceived self-efficacy, mathematics anxiety, and helplessness behavior (Gürefe & Bakalım, 2018; John et al., 2020; Wang et al., 2018). Individuals experience mathematics education at different stages in life. (Campbell et al., 2020). Interventions exist to help individual students who struggle with mathematics anxiety, including adult learners (Gabriel et al., 2020; Klee, 2022).

The first chapter of this research will provide a background to the problem under study, the problem statement, the purpose statement, the significance of the problem under study, and research questions comprising a central research question followed by three sub-research questions. The summary of the chapter will be provided after the key terms used throughout the chapter are defined.

Background

The background of the phenomenon must be further investigated to fully understand the influence of mathematics anxiety on self-efficacy among adult learners. Stress, tension, and anxiety are some of the emotions exhibited by adult learners who struggle with mathematics anxiety during the learning experience (Schunk, 2020). Mathematics anxiety has been studied since the 1950s (Aldrup et al., 2020; Lau et al., 2022; Passolunghi et al., 2020). The 50 years of research on mathematics anxiety and the historical context of the anomaly will be covered in the background information. Mathematics anxiety will be looked at from the social context as well while shedding light on the theoretical concepts underpinning the study of mathematics anxiety and its influence on self-efficacy among adult learners.

Historical Context

Mathematics anxiety is defined as the emotional state of anxiety that interrupts an individual's ability to perform basic mathematical calculations in various settings (Ashcraft,

2002). These emotions can have adverse effects on respective students during the learning experience. The influence of mathematics anxiety on adult learners has been documented over the years (Everingham et al., 2017; Geist, 2015; Huang, 2019). The higher the stakes of a mathematics test, the higher the anticipatory anxiety exhibited by the adult learner (Richardson et al., 2012; Throndsen et al., 2022). Considering this, the term *mathemaphobia* was coined by Mary Fides Gough (1954) to describe the phenomenon surrounding mathematics anxiety and its influence on students' learning. It is important to find remedies for disorders after the main causes of those disorders are discovered (Gough, 1954). Most of the research on mathematics anxiety conducted during the early days centered around finding the rationale behind students' failure in mathematics classes (Gough, 1954).

The same scenario is prevalent in modern-day classroom settings (Pizzie et al, 2020; Pongračić et al, 2022; Wang, 2018). Mathemaphobia is the reason behind the failure rate of mathematics courses among learners (Gough, 1954). The pervasiveness and influence of mathemaphobia call for an intense need for education among educational professionals (Gough, 1954). Since most of these anxious feelings stem from the classroom experience, constant support from educators through investment in time and effort can help alleviate the anomaly among adult learners (Gabriel et al., 2020; Gürefe & Bakalım, 2018; İlhan, 2022; Lau et al., 2022). When educators spend time to ascertain the behaviors exhibited by the various students in their classroom, the more they can help students rise above mathematics anxiety to enjoy mathematics during the learning process.

Mathemaphobia is difficult to detect during its early stages (Gough, 1954). Most educational practitioners are not well trained to detect the initial signs of the phenomenon (Hendral et al., 2023; Lau et al 2022) which makes students struggle throughout the classroom

experience. This phenomenon tends to make students perform poorly in mathematics courses and the subsequent tests that accompany those courses. When students lag in their mathematics courses due to either mathematics anxiety or turning in assignments late, it triggers a life cycle where students get into a loop that they cannot escape (John et al., 2020; Klee et al., 2022; Lau et al., 2022). Mathematics anxiety must be categorized in the same group as heart and cancer diseases (Gough, 1954) which needs its foundation with professionals who conduct extensive research into the issue. The mental well-being of students is as important as their physical well-being (Gough, 1954). Students who are nurtured to use their everyday activities to learn mathematics concepts tend to build on their cognitive abilities (Lyons & Beilock, 2012; Hössjer et al., 2022). There are instruments designed over the years to measure the rate of mathematics anxiety among students, including adult learners. The Mathematics Anxiety Rating Scale (MARS) was formulated by Richardson and Suinn (1972) to measure students' levels of mathematics anxiety for research and remediation purposes. The scale comprises 26 modules that test the extent to which students experience mathematics anxiety during the learning process (Richardson & Suinn, 1972; Suinn, et al., 1988). The reliability and validity particulars will aid in pinpointing the anomaly so intervention procedures can be devised.

Technical colleges and two-year colleges are the perfect avenues for nurturing and teaching adult students who may have mathematics anxiety (Lim et al., 2022; Snyder & Cudney, 2017; Wang et al., 2018). The information existing on mathematics anxiety, both present and past, suggests that mathematics anxiety can be a learned behavior (Cribbs, 2021; Geist, 2015; Lau et al., 2022). Since mathematics anxiety can be a learned behavior, well-trained educators who are equipped with the right intervention tools can help adult learners overcome mathematics anxiety without a negative influence on their self-efficacy (Everingham, 2017; Hendral &

Hidayati, 2023).

Social Context

Students exhibit mathematics anxiety during the learning experience (Aldrup et al., 2020; Everingham et al., 2017). During the learning process, adult learners who are typically 18 years and older, interact with other students by working in groups or on a project (Gürefe & Bakalım, 2018). These social interactions can help students assimilate into their various institutions (Tinto, 1975). Adult learners also interact with their educators which helps in enriching their overall educational experience. The richer these experiences, the higher the tendency for adult learners to stick around and work toward graduation (Ilhan et al., 2022). Educators must be conversant with the different students in their classrooms and their unique backgrounds and motivations (Lau et al., 2020; Hendral & Hidayati, 2023). When adult learners struggling with mathematics anxiety are identified earlier, the necessary intervention plans can be implemented to help alleviate the anomaly (Lyons & Beilock, 2012; Petty, 2019). The intervention plans lead to educators being given the necessary training before and during their professional careers (Gough, 1954). According to Pizzie et al. (2020), adult students learn better when they work in groups on projects together. The authors asserted that when adult learners teach others, they tend to reinforce their prior knowledge while applying the currently acquired knowledge. Curriculum designers must work in collaboration with all stakeholders including administrators, teachers, parents, and other pertinent stakeholders when planning the contents of the lessons (Schunk, 2020).

Theoretical Context

Several studies have been conducted on the influence of mathematics anxiety among students (Gabriel et al., 2020; Hiller et al., 2022; Huang et al., 2019). These researchers

mentioned how mathematics anxiety is a learned behavior and can be modified just like any other behavior. With the right intervention plan, students facing mathematics anxiety can self-regulate and make amends to cope during the learning experience (Ilhan et al., 2022). The prevailing effect of mathematics anxiety is students' attrition in various institutions (Pongračić et al., 2022; Snyder & Cudney, 2017; Wang et al., 2018). Student retention must be the priority for such institutions facing a high volume of student attrition (Wang et al., 2018).

Since adult learners approach the learning experience with an idea of what they need from their studies, they tend to be more motivated than younger students (Gürefe & Bakalım, 2018). When educators are familiar with what their students need, they will be compelled to make changes to their lessons to accommodate these students. The situation also applies to adult learners so they will not feel that their time is being wasted during the classroom experience. Adult learners approach the learning experience with an idea of what they need from their studies, so they tend to be more motivated than younger students (Gürefe & Bakalım, 2018). Educators who prepare lesson plans based on the educational information obtained from the assessments of adult learners cater to their immediate needs which enhances their motivation levels during the classroom experience (Gabriel et al., 2020, Gürefe & Bakalım, 2018). Previous scholars have postulated the motivation levels of learners based on their unique backgrounds (Everingham et al., 2017; Gabriel et al., 2020). Their propositions would help provide awareness of the perceived influence of mathematics anxiety on self-efficacy among adult learners.

Adult Learning Theory

Students learn new knowledge and modify their prior knowledge differently based on their varied learning stages (Schunk, 2020). The term *andragogy* which focuses on adult learners and how they acquire knowledge during the learning experience was coined by Malcolm

Knowles (2005). Andragogy differentiates adult learners from pedagogy which concentrates on grade-level students. Adult learners possess both intrinsic and extrinsic motivation which makes them approach the classroom experience from a different perspective (Knowles, 2005). The distinction between the two terminologies lies in the level of motivation, cognitive learning processes, and behavior of the respective students (Ansari et al., 2011).

The adult learning theory pertains to the phenomenon under research. Adult learners approach the learning experience with an awareness of their strengths, shortcomings, and preferences in learning (Bloom et al., 1956). The intrinsic and extrinsic motivations of adult learners drive them to become autodidacts who take the initiative to pursue knowledge needed for their immediate application (Bloom et al., 1956). As students progress through the different stages of Bloom's (1956) taxonomy their cognitive abilities are honed and developed. These motivational factors allow them to sift through information to glean those that are pertinent for immediate use. Adult educators utilized andragogy and self-directed learning as their first models in the dissemination of knowledge to adult learners (Knowles, 2005).

Adult learners encounter several barriers during the classroom experience with both internal and external factors such as family obligations, students' mental state, and students' attitudes posing challenges to adult students' ability to concentrate and learn in the classroom (Ansari et al. (2011). Students' mental state determines the quality and quantity of information acquired during the learning experience (Schunk, 2020). Matured learners exhibit preconceived notions about themselves struggling with anxiety during the learning process with mathematics anxiety being one of such anomalies (Schunk, 2020).

Adult learners who exhibit mathematics anxiety are open to intervention and will go to lengths to find the intervention applicable to their unique situation (Mammarella, 2015). In most

cases, they seek these interventions very early due to their motivation and experienced backgrounds. Educational practitioners must actively engage adult learners during the learning process to enhance their motivational levels (Mammarella, 2015). Based on the theorist (Knowles, 2005), transformational opportunities presented during the classroom learning process necessitate the support needed by adult learners to thrive. The support will enable them to perceive themselves in a more favorable light and make them start thinking differently. Adult learners being aware of this phenomenon and its effect on their education would be motivated to cope by utilizing their unique backgrounds.

Constructs exist within the adult learning theory to guide educational practitioners in dealing with students with mathematics anxiety (Knowles, 2005). These conceptual elements are andragogy, self-concept, and self-directed learning. Andragogy entails the mode of teaching tailored to suit adult learners. Self-concept deals with self-directed knowledge acquisition based on the independent nature of adult learners. Self-directed learning encompasses adult learners' willingness and ability to study and learn on their own due to their prior experiences.

Theory of Student Departure

The theory of student departure deals with how students interact with their peers in an educational institution (Tinto, 1975). Based on the researcher's assertion, students assimilate and succeed when they connect and interact with their peers and other institutional personnel. The association will inadvertently increase their association and willingness to stay and graduate. The retention rate of every institution hinges on the theory of student departure (Tinto, 1975). Students Integration Model (SIM) and the Students Attrition Model (SAM) were designed by Tinto (1975) to help study the "good fit" between the college of choice of a student and their academic and career goals. Most adult learners are returning to the educational experience after

an absence. The theory of student departure and the SIM will assist educational practitioners to ascertain the level of commitment that the returning adult learners are bringing to the classroom. The SAM model will help educators to test the degree to which the students are willing and ready to stay and progress toward graduation.

There are three main reasons why students drop out of their institutions of learning (Tinto, 1975). These three reasons are the difficulty level of the students' courses, students' inability to attain their academic and career goals, and students' inability to integrate socially into their respective institutions of study (Tinto, 1975). Constructs exist within the theory of student departure. The conceptual elements that keep resurfacing in the article are persistence, retention, and graduation (Tinto, 1975).

Persistence is an individual student's ability to continue in a course of action regardless of the challenges that come their way (Tinto, 1975). Retention is also the ability of an educational institution's ability to retain a student throughout their course of study up until graduation. The retention of students is accomplished through enrichment programs introduced from matriculation through graduation. Students return to school to graduate due to their choosing (Tinto, 1975). Learners resume their studies due to their motivation to graduate so they can better their lives (Campbell et al., 2020). Graduation, according to Proverbio and Carminati (2019), is the point in a student's academic pursuit where degrees are awarded for the completion of all required courses in a specific program of study.

Most academic majors in institutions of study require that students take at least one mathematics course in their discipline (Proverbio & Carminati, 2019). They are with the notion that all individuals irrespective of their background or future endeavor will need mathematics at one point in life. That is why they also proposed that all students, especially those in institutions

of higher learning, get formal instruction in mathematics during their academic pursuits. The mathematics course requirements run parallel to Tinto's (1975) assertion on persistence. According to the theoretical framework element (persistence), when educational practitioners can explain the importance and relevance of mathematics education to students, they will persevere and persist until graduation.

Attrition is bound to occur when educators neglect to emphasize the importance of mathematics education during the classroom experience (Tinto, 1975). Regardless of the intrinsic and extrinsic motivation that brings students back to continue and obtain their education, some still revert upon returning to school. Students who struggle with basic arithmetic and mathematics computation are more likely to relapse upon returning to school after a certain period (Halberda, 2012). Due to these factors, the theory of student departure becomes applicable to the perceived influence of mathematics anxiety on self-efficacy among adult learners.

The indicators that an adult student is struggling with mathematics anxiety are evident throughout the learning process and are prevalent at the beginning of a new topic (Halberda, 2012). Adult learners' inability to find timely assistance for their academic challenges can lead to attrition (Schunk, 2020). When adult learners' access to social interactions is hindered due to lack of time or distance, their departure rate can be intensified (Schunk, 2020). The perceived influence of mathematics anxiety on self-efficacy among adult learners can be studied using the theory of student departure as a lens.

Theory of Human Agency

The theory of human agency was formulated by Albert Bandura (1991). He mentioned that individual students can adapt to their new environments due to their inherent self-beliefs. Humans proactively monitor, control their behaviors, and self-regulate when necessary

(Bandura, 1991). The adaptation to new environments supported by Campbell et al (2020) stated that when adult learners cultivate a growth mindset, they can quickly overcome challenges that hamper their learning experience within and outside the confinement of the classroom.

When students work on developing their thinking and cognitive abilities, their learning challenges and difficulties diminish. There is a direct relationship between the confidence levels of adult learners and their respective self-beliefs (Schunk, 2020). The theory of human agency (Bandura, 1991) enables adult learners to face their challenges during the learning experience. Adult learners know their value and what they bring to the classroom to obtain their education. The perception of self-worth helps them take ownership of their learning in all situations (Schunk, 2020). Based on this theory, adult learners have the freedom to make choices regarding the decisions relating to their learning habits. As mature individuals, they prefer to make their own decisions when it comes to their education (Hendral & Hidayati, 2023; Schunk, 2020). Most adult learners have reached a point in their lives where they know what they want (Lau et al., 2020: Schunk, 2020).

Adult learners can anticipate and plan which helps them take charge of their learning (Clark, 2018). The cognitive thinking capacity of adult learners can also be enhanced by utilizing Bloom's (1956) taxonomy. Both Bandura's (1991) theory of human agency and Bloom's (1956) taxonomy are closely related since they all focus on the need for a higher order of cognitive thinking during the learning process. Individuals set goals through the process of self-regulation (Bandura, 1991). Targets are set and behaviors are modified to reach those objectives. Goals setting makes the theory of human agency applicable as a theoretical framework for studying the perceived influence of mathematics anxiety on self-efficacy among adult learners.

Students modify and regulate their behavior (anxiety) as they actively develop their

numeracy and spatial capabilities (Schunk, 2020). When this is carried out with the guidance of an educational practitioner, students with anomalies such as mathematics anxiety gain confidence in their abilities through self-belief (Schunk, 2020). The academic performance of adult learners will improve if educators keep structuring their lessons to target their cognitive development (Bandura, 1991). Constant assessment must be conducted to ascertain the level of confidence exhibited by adult learners during the learning process. Data obtained from the assessment will assist the educator in designing lessons that are tailored for everyone under their tutelage.

The level of abstraction in mathematics can be accomplished by incorporating word problems in lessons during classroom experience (Amponsah, 2020; Anderson Stone, 2018; Ansari et al., 2011; Cribbs et al., 2021)**.** Lessons that exist in thought or are abstract assist in self-regulation among adult learners (Bandura, 1991). Abstraction can enhance their behavior modification according to Bandura (1991). As adult learners approach the learning process from their unique backgrounds, their academic goals can be reached by overcoming challenges such as mathematics anxiety.

Problem Statement

The problem is that mathematics anxiety has an influence on adult learners' self-efficacy during the learning experience (Guzmán et al., 2023; Huang et al., 2019; Zhu & Chiu, 2019). According to Fooks et al. (2021), the influence of mathematics and its psychological effect on adult students has been prevalent lately. Proverbio and Carminati (2019) suggested that a significant relationship exists between academic stimuli among adult learners and their perspectives. When the learning environment is conducive, the adult learner is open to learning. The opposite also applies. When the learning environment is not conducive, the adult learner

finds it difficult to concentrate which can advertently hurt their academic achievements.

Most educational practitioners are not well-trained nor well-versed in rendering services to students with learning disabilities (Tasgin & Coskun, 2018). The author mentioned that intervention programs are currently focusing on comprehensive and inclusive education, which means that students with specific learning disorders including mathematics anxiety are lacking the appropriate individualized educational plan they deserve. The lack of well-trained educational practitioners implies that irrespective of the adult learner's unique background, there is little to no assistance since all the students receive the same form of instruction mostly in the same mode of transmission (Everingham et al., 2017; Gabriel et al., 2020).

The education professionals who go beyond expectation to ascertain the level of their students' challenges are more inclined to find solutions to their challenges. Though educators put in the necessary effort to remedy these deficiencies exhibited by students during the learning process, some students (including adult learners) will still show psychological effects of mathematics anxiety (Zhu & Chiu, 2019). The phenomenon tends to block the creative ability to acquire the pertinent knowledge needed to show mastery in a content area. This research will investigate the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The results will assist in policymaking and add to the existing literature on the topic.

Mathematics anxiety is common among adult learners at different educational levels in academia (Zhu & Chiu, 2019). Other studies suggest that self-efficacy and the ability of adult learners to apply their prior knowledge to new situations are directly related (Knowles, 2005). Further study must be conducted into the perceived influence of mathematics anxiety on self-efficacy among adult learners (Zhu & Chiu, 2019). Given the relevance and importance of the

perceived influence of mathematics anxiety on self-efficacy among adult learners, a further study into the experience is warranted. There is also a gap in the literature as suggested by Zhu and Chiu (2019).

Purpose Statement

The purpose of this phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The study gave a voice to the participants through their individual shared experiences regarding the influences of mathematics anxiety on their self-efficacies. At this stage in the research, mathematics anxiety is generally defined as the emotional state where uneasiness and stress influence a student's ability to solve mathematical problems at different stages in life (Richardson & Suinn, 1972). The theory guiding this study is the theory of self-efficacy formulated by Albert Bandura (1977). The theory postulates that individual students, including adult learners, advance their self-efficacy beliefs through expounding information via four main avenues of predispositions. These four main avenues are social role experiences, physiological and emotional states, mastery experiences, and social persuasion (Redmond, 2010). The social role helps adult learners regulate their belief system about themselves regarding performance when they see others like themselves performing well during the learning process. The physiological and emotional states focus on the adult learners' overall well-being (physical, psychological, emotional, and mental). When any of these are not in a normal state, it makes it difficult for the adult learner to develop self-efficacy (Redmond, 2010). Mastery experiences deal with the adult learners' ability to successfully perform a task from beginning to end (Redmond, 2010). The mastery experience is the most influential avenue of self-efficacy (Redmond, 2010). Social persuasion (Redmond, 2010) also has an influence on the performance

of adult learners during the classroom experience. When adult learners focus on positive feedback from their peers and teachers, their self-efficacies are heightened (Redmond, 2010).

Significance of the Study

Several studies have been conducted to investigate the influence of mathematics anxiety on students for decades (Gabriel et al., 2020; Guzmán et al., 2023; Huang et al., 2019; Zhu & Chiu, 2019). This study provided information for educators to assist adult learners who struggles with mathematics anxiety during the learning experience. Through this study, educational practitioners were furnished with the information needed to learn the influence of mathematics anxiety on self-efficacy among adult learners. Most of the research existing on mathematics anxiety is about children and grade-level students (Guzmán et al., 2023; Huang et al., 2019). The lack of research on the influence of mathematics anxiety on self-efficacy among adult learners created a gap in the existing research. The purpose of this transcendental phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia.

Theoretical Significance

Several theories exist to help direct the studies into phenomena such as mathematics anxiety. Some theories have similar significance to the phenomena under study. The theories are the adult learning theory (Knowles et al., 2005), the theory of student departure (Tinto, 1975), and the human agency theory (Bandura, 1991). The theory of adult learning states that adult learners possess both intrinsic and extrinsic motivation (Knowles et al., 2005). Based on Knowles et al. (2005), adult learners possess both intrinsic and extrinsic motivation because they are returning to obtain their education to better their lives or get a good-paying job. The theory of student departure (Tinto, 1975) focuses on adult learners' experience regarding their association

with other students in the institution. According to the theorist, adult learners' retention is directly proportional to their interactions with other students. The human agency theory (Bandura, 1991) focuses on the self-beliefs possessed by adult learners. It also talks about how those beliefs assist in helping them adapt to different environments.

Empirical Significance

Mathematics anxiety is a phenomenon that is experienced globally (Li et al., 2021). Due to this, there have been numerous studies conducted into the anomaly (Pérez-Fuentes et al., 2020; Richardson et al., 2012; Snyder & Cudney, 2017). These researchers mentioned that students can modify their behaviors to curtail the anomaly. They also mentioned that teachers need to properly train to identify students who are struggling with mathematics anxiety during the classroom experience. Early intervention will even help students who have had a negative experience with a mathematics educator during the learning process. Intervention can also help create camaraderie between the educator and the student. Mathematics make-up tests and late homework assignments can be discussed without making students feel left behind.

Practical Significance

The outcome of the research may be beneficial to the educational practitioners who teach at the institution to be used for the study. Data-informed decisions can be formulated because of the conclusion drawn from the investigation. For instance, the curriculum for adult learners can be modified to accommodate their unique background and their immediate needs. The result of this study will be beneficial not only to the technical college where the research will take place. It will add to the existing knowledge on the topic of mathematics anxiety and self-efficacy. The results of the study will be published for other researchers to build on the knowledge acquired through the process.

Research Questions

The purpose of this phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. One central question will serve as the main query for this investigation. The one central question will be followed by three sub-questions. The questions were formulated based on the theory that will be utilized for the study. The four questions will intend to help understand the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. A phenomenological study will be used in conducting this research.

Central Research Question

What is the perceived influence of math anxiety on adult learners at a technical college in Georgia?

Sub-Question 1

How do adult learners enrolled in mathematics classes in a technical college in Georgia perceive their ability in solving mathematics problems during the learning experience?

Sub-Question 2

What influences do adult learners perceive as contributing to their ability or inability to solve mathematics problems?

Sub-Question 3

How does perceived mathematics difficulty influence the confidence of adult learners during the learning process?

Definitions

This section will be used to define pertinent terminologies used throughout the paper. The definitions are supported with their respective citations as they appear in the various literature utilized for the section.

1. *Mathematics Anxiety* - Mathematics anxiety is defined as the state of emotional uneasiness and stress that impedes an individual's ability to perform basic arithmetic calculations and solve problems involving numbers in all aspects of life (Richardson & Suinn, 1972).
2. *Self-efficacy* - Self-efficacy is defined as individuals' innate ability to perform a task because of their behavioral adjustments to effect change in their lifestyles (Bandura, 1997).
3. *Adult learner* - Any individual who is either formally or informally involved in the learning process and has been accepted by society as an adult (Knowles et al., 2005).
4. *Motivation* - People's willingness to adjust their emotional state of being to alter their behavior in accomplishing their goals (Campbell et al, 2020; Schunk, 2020).
5. *Mathemaphobia* - Mathemaphobia is defined as students' emotional feelings stemming from the fear of mathematics (Gough, 1954).
6. *Learning intervention* - It is defined as the act of compensation aimed at improving performance due to deficiencies exhibited by learners during the learning process.

Summary

There is a myriad of reasons why adult learners exhibit mathematics anxiety (Lyons & Beilock, 2012). Educational practitioners are tasked to impart knowledge to students during the learning experience. They must ascertain the level of adult students' level of mathematics

anxiety and the causative agents that trigger these emotions. The purpose of this phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. This chapter seeks to shed light on the problem of the study, the purpose for carrying out the phenomenological study, the background of the study, the research questions, and the definitions pertinent to finding the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The historical, social, and theoretical aspects of the phenomenon were discussed to guide the understanding of the problem to be studied.

CHAPTER TWO: LITERATURE REVIEW

Overview

This chapter focuses on the theoretical framework and the related literature for the research study. The theory of self-efficacy (Bandura, 1977) will be utilized for the study. The literature review provides an in-depth description of the theoretical framework as well as pertinent factors that lead to mathematics anxiety's effect on self-efficacy among adult learners at a technical college in Georgia. The detailed elements of self-efficacy will also be expounded further in the related literature section. The review reveals the gap in research concerning the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia.

Theoretical Framework

Mathematics anxiety has been studied since the 1950s (Aldrup et al., 2020; Lau et al., 2022; Passolunghi et al., 2020). Different theories exist to explain the rationale behind different phenomena in various sequences of events (Bloom, 1956). Theories help formulate new foundational knowledge and expand existing ones (Nguyen et al., 2022; Wenke et al., 2023). When it comes to educational research, theoretical and conceptual theories help prevent jumping to conclusions without initially understanding the scope of the problem being studied (Chen & Reeves, 2020; McKenney & Reeves, 2021). Phenomena such as mathematics anxiety must be studied through a design that is informed by proven theories (Nguyen et al., 2022; Wenke et al., 2023). Aldrup et al. (2020) acknowledged that a study into mathematics anxiety can be carried out by utilizing the applicable theoretical and conceptual frameworks.

This section will focus on reviewing the theory of self-efficacy postulated by Albert Bandura (1977). The theory of self-efficacy (Bandura, 1977) postulates that learners develop

their self-efficacy beliefs through the execution of a series of actions while dealing with diverse situations. Bandura (1997) mentioned that self-efficacy can be formulated through four main derivations. These derivations are vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion (Redmond, 2010). Vicarious experiences are based on an individual adult learner's ability to observe others perform a mathematical task during the learning process (Bandura, 1997; Hendral & Hidayati, 2023). Mastery experience of the theory of self-efficacy takes into consideration the various experiences encountered by adult learners during the learning process that lead to proficiency of a subject matter (Bandura, 1997: Desender & Sasanguie, 2022). Adult learners' ability to acquire pertinent knowledge, be responsive to all forms of feedback, and make necessary adjustments to enhance mastery of a subject matter depends on being susceptible to the learning settings (Johnson & O'Keeffe,2016; Klee et al., 2022; Lim et al., 2022). Adult learners also build self-efficacy when they receive continuous verbal feedback on their performance (Bandura, 1977). According to Bandura (1997), social persuasive performance deals with giving feedback to individuals about their performance. The physiological and emotional experience deals with an adult student's ability to control their physical and emotional states during the classroom experience (Bandura, 1997; Zhang & Ardasheva, 2019). The stress and emotional reactions expressed by adult learners during the classroom experience are prevalent when performing mathematics calculations (Anderson Stone, 2018; Ansari et al., 2011; Bandura, 1997; Cribbs et al., 2021).

Related Literature

The purpose of this phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The related literature review will focus on mathematics anxiety and its influence on self-efficacy.

This section will be used to discuss the various adult learning styles preferred by adult learners during the classroom experience. The topic of mathematics anxiety will be discussed in this section of the chapter. The influence of mathematics anxiety on self-efficacy as well as the steps taken to curtail the phenomenon will be discussed.

Adult Learning Styles

Individuals' preferences change to cater to their needs as they mature in age. The change in preferences is true for learning experiences as well. Adult learners approach the learning experience with their preferred mode of information dissemination such as face-to-face, online, or blended (Schunk, 2020). The preferences enable adult learners to grasp the knowledge being passed on to them. The adult learner is motivated differently from students who are enrolled in the lower academic levels (Amponsah, 2020; Desender & Sasanguie, 2022; Gom, 2009; Jiang et al., 2021). Some adult learners return to school to obtain their education so they can get a better job, get a pay increase, or serve as a motivation and inspiration for their family members (Goptal et al., 2020; Muijsenberg et al., 2023). These unique characteristics coupled with their maturity cause them to possess preconceived preferences when it comes to the learning process. One of such preconceived preferences is their learning style choices (Gürefe & Bakalim, 2018).

Adult learners may prefer kinesiology, verbal, visual, and auditory among others (Schunk, 2020). Learning style choices are in line with the fact that adult learners (that is students who are 18 years and older) have a unique background and approach the learning process with a preconceived notion of preferences for either auditory, visual, interpersonal, intrapersonal, and verbal styles of learning (Ansari et al., 2020; Proverbio & Carminati, 2019; Visscher et al., 2018). Adult learners are also enthusiastic about learning in diverse ways (Gom, 2009; Hendral & Hidayati, 2023). Educators must understand how their respective adult learners

effectively acquire knowledge during the classroom experience and incorporate it into their lessons.

Curriculum designers, implementers, and reviews must incorporate the different learning styles in all the different curricula they issue as well (Deruaz et al., 2020). Since adult learners approach the learning process based on their unique backgrounds, they need lessons that cater to their style of learning (Fooks et al., 2021; Peake et al., 2015). The researchers mentioned that this is important especially when the classroom material being introduced is new to adult learners. Barry and Egan (2018) supported the assertion by stating that adult learners prefer mathematics courses that allow them the autonomy to choose the appropriate learning style they see fit.

The pertinent knowledge governing the different adult learning styles is important in developing educational experiences that are student-oriented (Goptal et al., 2020; Muijsenberg et al., 2023). Adult learner possesses perceived predispositions stemming from their unique backgrounds that make them have their preferred learning styles based on the circumstances, in which they find themselves (Barry & Egan, 2018). The educational practitioner must see to it that the subject matter has been mastered (Kusian & Aster, 2015). They went on to advise educators to incorporate the different motivations, aspirations, and backgrounds of adult learners into their lesson planning. The inclusion of the different factors will cater to the different learning styles and needs of adult learners. Students' learning styles and the mode of instruction adopted by the educational practitioner can have a huge influence on the academic success of the students in any academic setting (Gürefe & Bakalim, 2018).

When the learning styles of adult learners (that is students who are 18 years and older) do not produce the necessary results after an assessment, they make the necessary adjustments and try others (Barry & Eghan, 2018). Adult learners can use the different learning styles

interchangeably when the need arises (Barry & Eghan, 2018). The versatility of adult learners should be the reason why educational practitioners ought to be careful about putting labels on adult learners when it comes to their learning styles. Educators tend to use their inherent biases to put adult learners in categories. Educators must assess the personal and academic history of adult learners when conducting research into their struggles with mathematics anxiety (Hannula, 2019).

Most adult educators who teach at technical colleges prefer e-learning as a mode of information dissemination (de Palo et al., 2018). Adult learners who utilized e-learning scored higher on their assessment compared to those who took the assessment in person (de Palo et al., 2018). Students who possessed higher motivational levels did better than their counterparts who did not. The participants who were briefed about the importance of the research also scored higher on the assessment given during the research. When adult learners approach the learning experience with an open mind by knowing what to expect, they perform better (Zhu & Chiu, 2019). Also, their unique motivation makes them perform better in an e-learning environment than in a face-to-face environment (de Palo et al., 2018).

Most adult learners prefer working in groups rather than individually (Ngala, 2017). The rich background experience of adult learners and their willingness to offer help during the classroom experience explains their preference for group work (Ngala, 2017). Group work presents such an avenue for adult learners to share their experiences. Collaborative activities also help in building their self-efficacy (Ngala, 2017). The educational pursuit is a collaborative effort between the adult learner and the educational practitioner (Ngala, 2017). Adult learners prefer being taught in their preferred mode of information dissemination (Rogowsky et al., 2015). For instance, auditory students perform better when tests are administered in auditory form. Adult

learners exhibit their learning style preferences such as verbal, visual, and kinesthetic during classroom project activities (Barry & Eghan, 2018; Ngala, 2017).

Mathematics Anxiety

Mathematics anxiety has been the focus of research since the 1950s (Aldrup et al., 2020; Lau et al., 2022; Passolunghi et al., 2020). The researchers also stated that all students at various educational levels exhibit the anomaly. Grade-level students can develop mathematics anxiety and can continue with them to the tertiary level of their educational pursuits (Guzman et al., 2021). To prevent mathematics anxiety from becoming an academic barrier, it must be diagnosed early with the appropriate intervention mechanism in place to curtail it (Jiang et al., 2021). Adult learners returning to the classroom to further their education may have inhibitions due to their prolonged absence from school. There is a relationship between students learning and academic motivation (Tasgin & Coskun, 2018). Adult learners are open to new academic adventures and can use their high motivational levels to push through tasks during the learning experience (Tasgin & Coskun, 2018). The scenario can also be applied to adult learners who exhibit mathematics anxiety during their academic pursuits.

Mathematics anxiety has become extensive due to the surge in the research being conducted about the phenomenon (Wong et al., 2017). A substantial number of students struggle with mathematics anxiety every day in the classroom across different institutions of study (Wong et al., 2017). Those struggling students who persevere, and graduate still exhibit deficiency in the number sense. Adult learners show signs of insecurity due to their long absence from the educational setting (Schunk, 2020).

The more students can solve problems successfully during the learning process, the higher the students' self-efficacy (Amponsah, 2020; Desender & Sasanguie, 2022; Gom, 2009;

Jiang et al., 2021). The context is also applicable to adult learners engaged in learning new concepts in mathematics (Amponsah, 2020). The prior knowledge acquired by the adult learner must align with the current information being disseminated. Educators must ensure that the vertical alignment of their course materials is not out of range. When the vertical alignment is misplaced, the adult learner may learn materials without the prerequisite or materials that are not challenging enough (Schunk, 2020). The same scenario applies to the horizontal alignment. When the course content for that level is not interconnected, students may learn and not make connections among the different topics covered for the course (Schunk, 2020). The vertical and horizontal alignments make it even more necessary for educational practitioners to take time to learn about their students to find the physical, emotional, and other pertinent characteristics exhibited by adult learners during the classroom experience. That will help the educator gauge the pace of the information dissemination. The mathematics anxiety level of adult learners is directly proportional to their mathematics self-efficacy and their subsequent mathematics performance (Cipora et al., 2022; Desender & Sasanguie, 2022; Hiller et al., 2022).

The mathematics performance of adult learners is detailed in the results of their various assessments. In some instances, the heightened mathematics anxiety exhibited by adult learners during the various assessments is a result of their low belief in their mathematical learning and performance abilities (Gopal et al., 2020). Adult learners' disbelief in their performance can demoralize them and increase their helplessness about obtaining good grades. The pre-assessments reveal the prior knowledge they possess before the introduction of new mathematics concepts. The post-assessment reveals the level of understanding of a new mathematics concept (Gopal et al., 2020).

Adult learners who struggle with mathematics anxiety scan through assessment questions and begin solving problems they feel comfortable answering (Kashefi et al., 2022; Li et al, 2021). These questions are generally easy, require less time to solve, are understood by the student, require more time to solve, the student's favorite type of questions, need less order of thinking, and the order of the questions being asked (Kashefi et al., 2022). Problem-solving capabilities of adult learners guide their choices of problems to tackle during both the learning and assessment periods (Desender & Sasanguie, 2022; Kashefi et al., 2022).

Adult learners engage their feelings and emotions based on the level of confidence they possess at every point in time during the answering of assessment questions. When they answer questions that are relatively familiar and easy to them, they experience emotions that elicit confidence and satisfaction. When adult learners are left with challenging questions, they heightens their frustration and anger toward mathematics which leads to heightened anxiety (Cipora et al., 2022; Desender & Sasanguie, 2022; Hiller et al., 2022). These assessments are also a great tool for curriculum designers, reviewers, and implementers (Deshwal et al., 2022).

Influence of Mathematics Anxiety on Self-Efficacy

Mathematics anxiety influences self-efficacy and retention rates among adult learners (Baloglu et al., 2007; Johnson & O'Keeffe, 2016). Adult learners perform better during formative assessments and exhibited higher levels of self-efficacy (Johnson and O'Keeffe, 2016). The efficiency depicted in test results is because adult learners seek extra help outside the classroom experience (Schunk, 2020). There are a myriad of resources and opportunities at the disposal of adult learners, and they use their intrinsic and extrinsic motivation to take advantage of these to function properly (Muijsenberg et al., 2023).

Librarians located in various institutions help students find resources needed to support their academic pursuits (Renirie, 2017). Support from librarians comes in the form of a research article or textbook needed to support the current ones being utilized in the classroom by their educators. Adult learners also receive assistance with homework assignments during the office hours of their respective teachers. Due to their experience, maturity, and their willingness to accomplish their dreams, they can also approach the leadership of the institution to request any help they need to succeed academically (Schunk, 2020).

Mathematics anxiety hurts self-efficacy among students irrespective of their educational level (Ganesan et al., 2017). Adult learners approach the learning experience with some form of intrinsic motivation since they chose to return for their education (Rothes et al., 2017). Those adult learners want to accomplish a goal they abandoned several years back. Some of those adult students are motivated to be good examples to their respective family members. The authors also stated that other adult learners have extrinsic motivation with external factors being the driving force. These adult learners are the ones who are looking to increase their base salary at work or are looking to make career changes. Since they also have unique backgrounds rich with experience, adult learners must be allowed to express themselves during the classroom experience (Rothes et al., 2017).

A psycho-educational model approach to heighten self-efficacy among a sample of college learners (Mateo et al., 2014). The researchers concluded that adult learners' ability to choose their preferences during the learning process can have a direct relationship with their self-efficacy. When students choose their teachers, learning styles, and time of study, it can increase their self-efficacy and their overall academic achievement. Adult learners already possess a certain level of both intrinsic and extrinsic motivation before approaching the learning process

(Barry & Egan, 2018; Deshwal et al., 2022; Li et al., 2021). There is a direct relationship between the assessment outcome of adult learners and mathematics anxiety (Lutternberg et al., 2018; Mateo et al., 2014). The connection between the assessment outcome and mathematics anxiety leads to self-doubt among adult learners causing them to adjust including dropping out of their various educational institutions (Clark, 2018; Lutternberg et al., 2018). Adult learners who exhibit mathematics anxiety tend to abandon their academic pursuits for their immediate needs (Henik et al., 2017; Schunk, 2020).

Adult learners who show signs of mathematics anxiety have little to no interest in mathematics during the learning experience (Schunk, 2020). The immediate needs of adult learners are not met during the learning experience. Educational professionals must do their research to find what might have caused the lack of motivation exhibited by adult learners. When adult learners feel that their time is being wasted, they lose interest and leave the institution (Schunk, 2020). The learning styles of such individuals when utilized appropriately can help curb this anomaly and the subsequent attrition.

Steps for Overcoming Mathematics Anxiety among Adult Learners

Students who struggle with mathematics anxiety during the classroom experience must receive timely intervention to prevent them from dropping out of the institution (Kashefi et al., 2022; Li et al, 2021). Mathematics anxiety can hurt the adult learner when timely mediation is not authorized. An article published in the National Library of Medicine mentioned that learning mathematics relies on spatial skills and the working capability of the brain (Moustafa et al., 2017). There has been a surge in anxiety and mental health because of the pandemic (Centers for Disease Control and Prevention [CDC], 2021). The surge in anxiety and mental health has also influenced adult learners (Muijsenberg et al., 2023).

Return to Intervention (RtI), mental health treatments (CDC, 2021), and early diagnosis were a few of the suggestions needed to help adult learners cope with mathematics anxiety. Continual monitoring of student progress can help in early detection, intervention, and remediation. Data from assessments are beneficial at the beginning of the intervention process (Goptal et al., 2020; Muijsenberg et al., 2023). The facts gathered through formative assessments can shed light on the extent to which an individual adult learner may need help. Educational practitioners who disseminate information to adult learners must pay the necessary attention to these data sets to find patterns. When the educator of an adult learner identifies a relationship between the grades of a student and their physical, emotional, and physiological state during the classroom experience, an intervention program can be formulated immediately to help curtail the anomaly (Kashefi et al., 2022; Li et al, 2021).

Intervention for adult learners exhibiting mathematics anxiety is not readily available due to inadequate studies on the phenomenon (Bath 2009; Monei & Pedrop, 2017). Individualized student plans (ISPs) give adult learners the notion that their needs are being taken care of which has a positive result on their academic outcomes (Schwenk et al., 2017). The plans are geared towards building the confidence and self-efficacy of the adult learner by allowing them to review course materials based on the vertical alignment of their curriculum. Pertinent prior knowledge can be revisited to help build the foundation for the current mathematics course materials (Barry & Egan, 2018; Hendral & Hidayati, 2023; Li et al., 2021). Adult learners who require medical attention due to their mathematics anxiety will be directed in the appropriate direction (CDC, 2021).

Students utilize constructivism when they actively get involved with the classroom experience (Clark, 2018). When educational practitioners differentiate their lessons, they can

include interventions for mathematics anxiety, activities to improve self-efficacy and incorporate all the different adult learning styles into the classroom experience. Highly motivated adult learners are independent, self-driven, and persistent in their academic pursuits (Freedburg et al., 2019). Enthusiastic adult learners get easily distracted when the subject matter is not challenging enough. Students enrolled in social science courses exhibit higher levels of mathematics anxiety (Gürefe & Bakalım, 2018).

Curriculum experts must be involved in the learning processes of adult learners (Barry & Egan, 2018; Hendral & Hidayati, 2023; Li et al., 2021). These curriculum professionals can use the different assessment data collected from adult learners to design lessons that will engage the students effectively (Barry & Egan, 2018). Factors such as the difficulty level of the mathematics course materials, the mode of instructional and information dissemination, and students' learning methods can be reviewed and revised during the curriculum evaluation (Goptal et al., 2020; Muijsenberg et al., 2023).

Mathematics anxiety also tends to influence the reasoning and cognitive ability of students (Barry & Egan, 2018). The higher the mathematics anxiety exhibited by a student, the higher the student's inefficacy in solving reasoning problems. Students' flexibility in using prior knowledge and strategies to solve new problems diminishes as a result (Goptal et al., 2020; Muijsenberg et al., 2023). To alleviate this anomaly, educational practitioners must strategize ways to incorporate flexibility into their practices (Schunk, 2020). The adjustments made by educators will leave room for students to express themselves and gain confidence throughout the learning process (Jiang et al., 2021). When students, including adult learners, gain confidence, their self-efficacy and mathematics learning improves (Goptal et al., 2020).

Since adult learners approach the learning experience from diverse backgrounds, they can possess different motivational levels. (Goptal et al., 2020; Muijsenberg et al., 2023). Due to this, they can motivate themselves through personal positive reinforcements (Kashefi et al., 2022; Li et al, 2021). When adult learners acquire knowledge through the verbal modeling of key concepts, they learn the habit of talking through problems when solving challenging problems. The educational professional can model this behavior or introduce the habit during each lesson in the classroom. Verbal modeling builds confidence thereby boosting the students' self-worth and self-efficacy (Barry & Egan, 2018; Deshwal et al., 2022; Li et al., 2021).

The Domains of Adult Learning

Based on Kasimi (2022), there are three domains of learning exhibited by adult learners during classroom sessions. The three domains postulated by Bloom et al. (1956), comprise the cognitive, affective, and psychomotor. Bloom et al. (1956) mentioned that the learning approach carried out by adult learners is made up of the knowledge of the students (cognitive domain), the attitudes of the students (affective domain), and the skills of the students (psychomotor domain). The three domains of learning take into consideration the different progression of adult learners enrolled in a mathematics course (Schunk, 2020; Shimizu, 2022; Zhu & Chiu, 2019).

According to Kasimi (2020), there are different education progression levels that adult learners go through in mathematics classes. The different education progression ranges from the very basic concepts such as learning the meanings of the various mathematical operation symbols to utilizing them to form relationships and actions among mathematical objects (Kasimi, 2020). The multi-level educational progression also encompasses a more robust and rigorous curriculum according to Bloom (1956). Adult learners enrolled in such advanced courses with

academic content solve problems involving topics like quadratic equations, statistics, and probability (Deshwal et al., 2022; Jagzape et al., 2018; Singh & Singh, 2020).

The cognitive domain of the learning experience allows students to memorize facts such as multiplication tables without even understanding the significance or its subsequent application. The domain of cognitive learning helps adult learners apply prior knowledge to new information during the classroom experience. Adult learners can clarify and defend the answer choices they make when solving mathematics problems (Batista-Toledo & Gavilan, 2023; Gill et al., 2022; Lampinen & McClelland, 2018). The calculations they perform are given meaning as they progress through the cognitive domain hierarchy. The higher the cognitive ability, the more adult learners can break down details into manageable portions when solving mathematics questions (Mayu & Widjajanti, 2022; Trujillo, 2018). Once the individual portions are analyzed and scrutinized, judgment can be made about the different parts before deciding what final answer to present (Batista-Toledo & Gavilan, 2023; Juandi et al., 2022).

Each of the three different learning domains plays a distinct role in the learning process of the adult learner (Bloom et al., 1956; Bartz et al., 2022; Jagzape et al., 2018). For instance, the affective domain deals with the moral principles and attitude of the adult learner, the cognitive domain deals with the adult learner's capacity to solve mathematics problems, and the psychomotor domain deals with the adult learner's ability to translate their knowledge of mathematical concepts in solving problems (Bloom et al., 1956; Kasimi, 2022; Singh & Singh, 2020). During the affective learning domain, adult learners become aware of their emotions and feelings. The adult learner can pay attention to an educator during the learning process.

The affective learning domain allows the adult learner to receive pertinent feedback from educators, peers, and other stakeholders playing integral roles in their educational journey (Gill

et al., 2022; Lampinen & McClelland, 2018; Mayu & Widjajanti, 2022). Listening and paying rapt attention will cause the adult learner to ask applicable questions during the classroom experience (Batista-Toledo & Gavilan, 2023; Juandi et al., 2022). Another phenomenon that adult students encounter under the affective domain is their ability to respond to questions and contribute to class discussions (Gill et al., 2022; Lampinen & McClelland, 2018) Adult learners can also respond to directions and have conversations with both the education practitioners and peers. The affective domain also allows adult scholars to appreciate the value of the mathematics course content and how it relates to their future and current career paths (Bloom et al., 1956; Kasimi, 2022; Trujillo, 2018).

Adult learners will appreciate and show more commitment to the mathematics contents being taught during the learning process since they attach a certain level of usefulness to their academic pursuit (Batista-Toledo & Gavilan, 2023; Juandi et al., 2022; Schunk, 2020). When adult students attach a certain level of commitment to their studies, feedback on the need for improvement on a mathematics examination, suggestions for raising their competency level on a mathematics topic or soliciting ideas to improve their study skills all come naturally (Gill et al., 2022; Lampinen & McClelland, 2018). The affective drives the adult learner's prioritization of the deadlines in the completion of class assignments and meeting pertinent deadlines (Batista-Toledo & Gavilan, 2023; Gill et al., 2022; Juandi et al., 2022). Adult learners remain organized in focusing on completing projects and staying on track to completion of their field of study. The affective domain exhibited by the adult learner eventually causes a behavior modification based on the values they attach to their academics due to the perceived importance in the long run (Mayu & Widjajanti, 2022; Trujillo, 2018).

Another domain of adult learning proposed by Bloom (1956) is the psychomotor element. In this domain, adult learners can utilize tools in a mathematical set to solve mathematics problems. Adult students can also apply their affective domain through their different physical senses to their movement skills (Lampinen & McClelland, 2018; Trujillo, 2018; Vankúš & Fernández-Martín, 2021). For instance, during a geometry class adult learners will be able to differentiate between the various geometric tools and apply the right one to the appropriate problem (Gill et al., 2022; Lampinen & McClelland, 2018; Vankúš & Fernández-Martín, 2021). The educational practitioner will demonstrate the use of the geometric shapes such as the protractor, compass, and dividers after which the adult learner will emulate the steps taken to arrive at the solution (Juandi et al., 2022; Schunk, 2020). Adult learners in a geometry problem-based class will be able to imitate the behavior displayed by the educator to solve the assigned problems during the project-based classroom experience (Batista-Toledo & Gavilan, 2023; Vankúš & Fernández-Martín, 2021). As the adult learner repeats the processes introduced in the classroom during the learning process, the more they can masterfully perform more complex mathematical patterns (Juandi et al., 2022; Schunk, 2020). The same principle applies to peer-to-peer mentorship where adult learners watch and learn from other classmates to emulate their example or feedback (Batista-Toledo & Gavilan, 2023; Juandi et al., 2022; Lampinen & McClelland, 2018).

Bloom (1956) also postulated that there are six levels of knowledge acquisition during the learning process. These six levels are students' ability to remember, students' ability to understand, students' capacity to apply, learners' ability to analyze, learners' aptitude to evaluate, and students, students' competence to create (Bibi, 2020; Bloom, 1956; Kaur, 2023). The six levels of knowledge acquisition that dictate the teaching and learning outcomes play an

integral role in curriculum development, design, and implementation (Bloom et al., 1956; Jagzape et al., 2018; Schunk, 2020). Based on Bloom's (1956) taxonomy, the learning outcome verbs may require adult learners to recall prior knowledge for the current assignment or task. The adult learner may also have to give meaning to different shapes in a geometry class by comparing, deducing, and describing their attributes and characteristics to arrive at an answer (Bloom, 1956; Jagzape, 2018; Kasimi, 2022). Through Bloom's (1956) taxonomy, the adult learner could apply the concepts learned to subsequent topics or lessons (Bartz, 2022; Jagzape et al., 2018; Schunk, 2020).

The level of Bloom's (1956) taxonomy also takes into consideration the ability of the adult learner to study and scrutinize lesson contents by breaking them into manageable sections before solving them (Bloom, 1956; Kaur, 2023; Singh, 2020). Based on Kaur (2023), an adult learner can analyze mathematics problems by first underlining words that support operations in word problems. The information gathered can then be used to practice and diagnose mistakes during the learning process (Bibi, 2020; Bloom, 1956; Kaur, 2023; Schunk, 2020). The evaluation level of Bloom's (1956) taxonomy will help adult learners assess mathematics problems and projects by pausing to ask themselves questions that will reinforce their confidence in their progression during the classroom experience (Bibi et al., 2020; Bloom et al., 1956; Schunk, 2020).

Bloom (1956) also postulated that adult learners can construct or create their mock questions that mimic the ones they have been working on during the learning process. The creation process allows for an individual adult learner to utilize all six levels of Bloom's taxonomy (Bloom, 1956; Kaur, 2023; Schunk, 2020). Each zone of the three domains of learning (knowledge, attitude, and skills) can fall within the various tiers of Bloom's (1956) taxonomy.

The ability of adult learners to recall prior knowledge during the learning process can assist them in understanding the new content being introduced in the classroom.

The understanding gained during this process will aid in applying the knowledge to subsequent tasks. A successful recollection of information will in turn influence their attitude, build their confidence, and successive speed in solving mathematical problems (Tai et al., 2018). When this level of confidence is attained by the adult learner, due to the heightened affective domain, they can apply their skills to analyze advanced mathematics concepts. Their confidence and motivation will allow them to evaluate and create project-based mathematics activities during the classroom experience. A completed and accurate project-based mathematics activity will culminate in Bloom's (1956) taxonomy of mastery learning (Bartz et al., 2022; Singh & Singh, 2020; Tai et al., 2018).

Adult Learners' Curriculum Model and Philosophies

The adult learner faces a myriad of challenges both inside and outside the classroom setting (Tasgin & Coskun, 2018; Wenke et al., 2023). Some of the challenges faced by adult learners range from a lack of motivation on the part of the students and unprepared educators (Tasgin & Coskun, 2018; Zhu & Chiu, 2019). To foster a conducive environment for adult learners to thrive, all stakeholders comprising of students, educators, community partners, and other pertinent individuals must be involved in the curriculum review, revision, and implementation (Luttenberger et al., 2018; Pizzie et al., 2020). Based on Schunk (20200, curriculum development and revision are an integral part of the education system. When various individuals collaborate to design curricula, the rigor and diversity brought to the process ensures quality educational standards are met (Leigh-Lancaster & Stacey, 2022; Ruef et al., 2020). The

adult students are the focus of the curriculum design, review, and implementation (Bråting, 2023; Dudley et al., 2019).

The academic needs of adult learners must outweigh other decision-making processes during curriculum development. Karaduman and Ucar (2020) defined philosophy as "a way of framing distinctive sorts of questions having to do with what is presupposed, perceived, intuited, believed, and known" (Gordon et al., 2019, p.117). The models and philosophies used to formulate curriculum changes create consistency and balance throughout the course reviewing, development, and revision processes. The models and philosophies serve as the standard for curriculum reform in institutions of academic pursuit (Goos et al., 2023; Leigh-Lancaster & Stacey, 2022).

Perennialism, progressivism, and essentialism are examples of curriculum philosophies (Gordon et al., 2019). Based on Kaya and Kaya (2017), the progressivism of a curriculum design deals with a modernistic approach to information dissemination. in the educational field. The individual academic needs of the adult learner must be taken into consideration from the onset of the curriculum review process. According to Gordon et al. (2019), educational institutions which rely on progressivism adopt the scientific approach to problem-solving during the learning experience. Emphasis is laid on the use of technology and individual adult learners are allowed to think independently in knowledge acquisition.

The essentialism philosophy deals with the notion that humans and other living creatures have common unconditional specifications and conditions regardless of social, economic, and cultural contexts (Bråting, 2023; Dudley et al., 2019). To produce well-rounded adult learners, they must be exposed to different academic fields, cultural backgrounds, and social settings (Dudley et al., 2019; Goos et al., 2023; Schunk, 2020). The adult learners will obtain an inherent

appreciation for diversity which includes taking core classes outside their academic discipline (Sahin, 2018). Based on Kaya and Kaya (2018), the perennialism philosophy centers around idealism and realism. The perennials have the notion that curriculum must be designed with the predictable essence of humans in mind. According to Sahin, 2018, education is perceived as life itself and not a mere preparation for life. Isikgoz (2020) postulated that the perennial philosophy emphasizes discipline during the learning process. The educator `becomes a guide instead of a guard throughout the classroom experience.

Based on Gordon et al. (2019), the Taba model of curriculum expansion utilizes inductive logic in reviewing existing curriculum for improvement. Educational practitioners and pertinent stakeholders who employ the Taba model during curriculum development, revision, and implementation become engaged with the learning process of the adult learner (Basu, 2017; Bråting, 2023; Dudley et al., 2019). As educators become actively involved with the curriculum development process, they become conversant with the content of the subject matter they teach (Bråting, 2023; Lampinen & McClelland, 2018). That information coupled with the prior knowledge of their respective students helps them design curriculum that are tailored to the individual academic needs of their adult learners (Schunk, 2020; Tasgin & Coskun, 2018; Wenke et al., 2023).

The Taba model ties into the philosophy of perennialism since they both emphasize the diverse background of the adult learners and their perceptivity to other students and their unique economic, social, and cultural backgrounds (Bråting, 2023; Schunk, 2020). When adult learners graduate and pursue their respective professional careers, they will encounter people from diverse backgrounds and demographics (Muijsenberg et al., 2023; Wenke et al., 2023). The variety of people makes it necessary to learn to respect diversity. Based on Schunk (2020), adult

learners perform better during the classroom experience when the lessons are tailored to suit their immediate and future academic needs. One key component that can help foster a comprehensive curriculum that caters to diverse adult students is communication (Schunk, 2023; Wenke et al., 2023). All the different stakeholders involved in the curriculum development need to be trained on the pertinent components like the Taba model and the different philosophies (Bråting, 2023; Goos et al., 2023; Leigh-Lancaster & Stacey, 2022).

Social Role Experiences among Adult Learners

Educators who can give one-on-one attention to students during the learning experience can tame some of the anxious feelings adult learners experience (Campbell et al., 2020: Aldrup et al., 2020). When it comes to adult learners, an educator can utilize scaffolding to aid students in building and harnessing their self-efficacy beliefs through vicarious experience. Teachers can solve mathematical problems for the entire class and pinpoint students struggling to offer guided practice (Desender & Sasanguie, 2022; Hiller et al., 2022). When education practitioners serve as role models in this scenario, their actions can help improve or impair adult learners' self-efficacy beliefs (Barry & Egan, 2018; Li et al., 2021). The vicarious experience is directly related to the phenomenon under study. The perceived influence of mathematics anxiety on self-efficacy among adult learners can be viewed through the lens of the individual adult learners' ability to observe others perform a mathematical task during the learning process (Bandura, 1997; Hendral & Hidayati, 2023). A reinforcing activity can be in the form of an adult learner solving a problem after observing others during the learning experience.

When adult learners observe their peers performing a task in the learning environment, they attest to the successes of others and compare those accomplishments to their own (Muijsenberg et al., 2023; Palestro & Jameson, 2020; Shimizu, 2022). The reverse effect of those

successes observed by adult learners during the learning process can also influence their self-efficacies (Bandura, 1997; Muijsenberg et al., 2023; Palestro & Jameson, 2020). Based on Palestro and Jameson (2020), adult learners compare the successes and failures of their peers to their own experiences in the classroom experiences. The vicarious experiences can be exhibited in different forms.

Adult learners enrolled in a mathematics classroom may show the vicarious experience through the guided examples outlined in the textbooks being used during the learning experience. Other students can demonstrate how to solve a word problem to the entire class on either a whiteboard or an interactive board. Educational practitioners can also show adult learners video recordings demonstrating the sequential steps needed to solve a mathematics problem. Based on Schunk (2020), vicarious experience comprises the coping and mastery archetypes. Both the mastery and coping archetypes of the vicarious are identical to the mastery experience since they all guide adult learners to independently complete mathematics problems on their own.

When adult learners observe others during the classroom experience, their self-efficacies can be heightened according to Bandura (1977). As their peers solve mathematics tasks, the adult learner builds the necessary confidence needed to emulate the belief systems exhibited by their classmates (Goptal et al., 2020; Muijsenberg et al., 2023). Adult learners with similar shared and lived experiences tend to learn and absorb the positive beliefs exhibited by their peers (Bandura 1977; Redmond, 2010). During the learning process, positive role models can be established among adult learners which can enhance their self-beliefs and improve their self-efficacies (Bandura, 1977; Ngala, 2017).

Adult learners possess similar traits and characteristics in terms of both their intrinsic and extrinsic motivations (Tasgin & Coskun, 2018; Wang et al., 2018). The shared experiences due

to their unique backgrounds will make them receptive to their peers explaining prior or new mathematics concepts during the learning process (Rothes et al., 2017; Stajkovic et al., 2018). The construct of role models is evident in group work during the classroom experience (Ngala, 2017; Muijsenberg et al., 2023). Some adult learners prefer working in group work due to their willingness to pass on the immense wealth of knowledge and help thereby increasing their self-efficacies in the process (Bandura, 1977; Gan et al., 2023). Due to this construct, educators must ensure that students can engage in group activities where their unique backgrounds will be employed, nourished, and appreciated (Tasgin & Coskun, 2018; Muijsenberg et al., 2023).

Even though researchers have identified effective ways to make use of peer modeling, less has been done to implement the best practices in the classrooms (Aldrup et al., 2020; Johnson & Burns, 2023). The soft skills such as teamwork needed by adult learners can be harnessed through group work during the learning experience (Lim et al., 2022; Price & Magy, 2021). Teamwork and the ability of adult learners to acquire a set of knowledge and apply that knowledge is a vital skill necessary for career progression (Jiao et al., 2021; Price & Magy, 2021).

According to Price and Magy (2021), students including adult learners entering the workforce, lack the necessary soft skills needed to advance in their careers. Educational practitioners can incorporate ample activities geared towards group work to help curtail this anomaly. Johnson and Burns (2023) also asserted that vicarious experiences which include peer interactions and modeling help in supporting adult learners during classroom interactions. Through these classroom interactions, students can acquire knowledge by observing their peers (Gan et al., 2023; Huangbet al., 2019; Schunk & Usher, 2019) during a mathematics class.

Performance Outcomes on Self-Efficacy among Adult Learners

Students' beliefs in their abilities to perform tasks during the learning process can heighten their self-efficacy (Bandura, 1977; Stajkovic et al., 2018). The positive response increases students' motivational levels and engagement, especially adult learners (Muijsenberg et al., 2023). There is a correlation between the academic performance of adult learners and their motivational levels (Hendral & Hidayati, 2023; Li et al., 2021). Lack of confidence among adult learners and deficiency in recalling prior knowledge of mathematics concepts influence their self-efficacy beliefs. The formative stages of proficiency development can be the most challenging for students including adult learners (Bandura, 1997; Schunk & Usher, 2019; Usher et al., 2023).

The persistence of adult learners during the learning process leads to the acquisition of the comprehensive skills being taught in class (Bandura, 1977). Persistence of purpose when done continuously leads to proficiency in the subject matter and subsequently enhances the self-efficacy of the adult learner (Bandura, 1977; Gan et al., 2023). Adult learners have shared experiences due to their unique backgrounds (Henik et al., 2017; Huangbet al., 2019). The shared experiences tie into their overall performance outcome during their learning experience (Bandura, 1977). Adult learners who encounter new mathematics content and gain new experiences acquire new insights that contribute positively to their self-efficacy (Bandura, 1977; Jiao et al., 2021; Mammarella, 2015). The level at which adult learners acquire knowledge and recall that information must be measured to ascertain where changes need to be made either in the curriculum or information dissemination (Henik et al., 2017; Gürefe & Bakalım, 2018). Based on the research conducted by Gopal et al. (2020), a genuine way to measure adult learners' grasp of mathematics concepts is to have a certain form of benchmarks and parameters

in place.

Proficiency of new mathematics concepts can be ascertained through post-assessment of the covered materials (Stajkovic et al., 2018). The prior knowledge needed by adult learners to succeed in the class is obtained through the pre-assessment (Kashefi et al., 2022; Li et al, 2021). The pre-assessment gives the educational practitioner a yardstick to measure the level of understanding an individual student obtained during the classroom experience. Adult learners who succeed in their mathematical calculations during the classroom experience give meaning to the proficiency level requirements of a course (Myyryet al., 2022; Stajkovic et al., 2018). Based on Myyryet al. (2022), the successes exhibited by adult learners during the assessment stages of the learning process increase self-efficacy. Just as in the indirect classroom experiences, successes exhibited by adult learners during the direct learning process strengthen and heighten self-efficacy whereas lack of success propels their self-doubt and inhibitions.

The self-belief of the adult learners during the classroom experience can be measured through the assessment outcomes of the various adult learners (Price & Magy, 2021). The strongest indicator of self-efficacy is proficiency attainment (Stajkovic et al., 2018). Bandura (1997) also postulated that proficiency attainment is the most prominent of the learning constructs since it is a true indicator of whether one can garner all it takes to flourish in an activity. The scenario relates to the self-efficacy of adult learners who struggle with mathematics anxiety. The successes they encounter through perseverance in coursework build belief in their self-efficacy over time. On the contrary, failure to achieve proficiency in the subject matter during the learning experience can lead to low self-efficacy (Bandura, 1977; Jiao et al., 2021). Educational practitioners must design lessons tailored to build the confidence and self-efficacy of their respective adult learners (Muijsenberg et al., 2023). Proficient experiences involve the

ability of adult learners to solve mathematics problems during the learning process.

Social Persuasion among Adult Learners

Bandura (1997) hypothesized that feedback to adult learners is tricky during the formative stages of skill formation. Usher et al. (2023) mentioned that verbalized feedback can be categorized into informal and formal messages. An example of formal feedback is when an educational practitioner commends an adult learner for being able to solve a mathematics problem successfully. On the other hand, informal feedback can be made regarding how long it took to complete a mathematics task. All this feedback must be carried out with tact to prevent further damage to their self-efficacy. Verbalized feedback can be influenced in the classroom setting by adult students' past encounters with fears and expectations during mathematical calculations (Muijsenberg et al., 2023; Stajkovic et al., 2018; Schunk & Usher, 2019).

Old experiences that adult learners bring to the classroom encounter stem from their unique backgrounds (Bandura, 1977; Schunk & Usher, 2019). These past encounters, fears, pressures, and unique background experiences have an effect on the way and manner in which they perceive, interpret, and internalize verbal persuasions (Moustafa et al., 2017; Palestro & Jameson, 2020; Pongračić et al., 2022). Since one size does not fit all when it comes to adult learners, the messages that are geared toward building confidence in one group of adult students may not be conducive to others (Amponsah, 2020; Bandura, 1991; Gopal et al, 2020).

The positive feedback given by educational practitioners to adult learners during the learning process can convince them to build self-efficacy (Bandura, 1977; Jiao et al., 2021). Both discouragement and encouragement influence the performance of adult learners' self-efficacies (Redmond, 2010). Verbal praise and persuasion when done during a challenging mathematics task can boost the morale and eventual self-efficacy of the adult learner (Bandura, 1977).

Educational practitioners must make it a habit to give continual praise and vocal encouragement to their students due to their self-efficacy (Bandura, 1977). Educators who persuade adult students through social coercion play an integral part in the development of their self-efficacy beliefs (Aldrup et al., 2020; Ansari et al., 2011; Bandura, 1997; Cribbs et al., 2021).

According to Bandura (1997), poor feedback from peers, educators, and pertinent shareholders such as parents has an adverse effect compared to scenarios where no feedback is given at all. Muijsenberg et al. (2023) mentioned that the pressure and tension exhibited by adult learners during mathematics classroom experience are due to varied reasons. Factors such as an adult student's absence from formal education, the duration of how long an adult student has been absent from formal education, lack of prerequisite for a mathematics topic, and lack of motivation to perform mathematics calculations are probable causes of pressure and stress during the learning process (Passolunghi et al., 2020; Pizzie et al., 2020; Rothes et al., 2017; Stajkovic et al., 2018).

Adult learners are influenced by the efficacy-relevant feedback obtained from colleagues, educators, and all stakeholders (Guzmán et al., 2023; Jiang et al., 2021; Lau et al., 2022). Guzman et al. (2023) also mentioned that feedback and persuasion from parents have a lasting influence on children's self-efficacy even into adulthood. As in the case of the formal and informal assessments of the mastery construct, verbal feedback and analysis of adult learners' actions reshape their self-efficacies. Based on Zhang and Ardasheva (2019), adult learners are more receptive when feedback of praise or positive criticism originates from an informed and knowledgeable individual such as an educator. When feedback is received in this manner, adult learners build their self-efficacy knowing that the source of the information is reliable (Bandura, 1997; Mammarella et al., 2015; Palestro & Jameson, 2020; Zhang & Ardasheva, 2019).

The Physiological and Emotional States of Adult Learners

The educational practitioners who impart knowledge to adult learners during the learning process must give specific and distinct feedback. The clearer and more succinct the feedback from a trusted source is, the less the anxiety and apprehensions associated with mathematics will negatively influence the adult learner (Bandura, 1997; Jiao et al., 2021; Pizzie et al., 2020; Zhang & Ardasheva, 2019). Educational practitioners who create a conducive setting for the learning environment, such as giving previews for the next mathematics topic to be covered in class, help adult learners develop a healthy perspective about future endeavors (Bandura, 1977; Barry & Egan, 2018; Hendral & Hidayati, 2023; Li et al., 2021).

The absence of uncertainties about future mathematics topics for the learning process enables the adult learner to build self-efficacy (Desender & Sasanguie, 2022 Kashefi et al., 2022; Li et al, 2021). The physiological and emotional experiences are like the proficiency-building experience because when educators employ strategies such as scaffolding, they build rapport with the adult learners which in effect builds trust and heightens their proficiency in a subject matter and subsequently builds their self-efficacies (Myyry et al., 2022; Tai et al., 2018; Usher et al., 2023; Zhang & Ardasheva, 2019). The scenario can be played out in the classroom when educational practitioners use the order of operation as a scaffold to present mathematical calculations to adult learners during the classroom experience.

A point would be reached when the educators can remove themselves from the scene of the scaffolding with the adult learner repeating the modeling independently. The adult learner will replicate the modeled example until they can show proficiency in the subject matter. The replicated modeling phenomenon combines all four different constructs (social role experiences,

physiological and emotional states, mastery experiences, and social persuasion embedded in the theory) of self-efficacy as postulated by Alert Bandura (1977).

The feelings exhibited by adult learners during the classroom experience influence their self-efficacies (Bandura, 1977). Adult learners' physical, emotional, and psychological state contributes to their ability to perform assigned tasks (Bandura, 1977; Redmond, 2010). It was asserted by Bandura (1977) that even though an individual can build self-efficacy regardless of their emotional, physical, and physiological state, it is much easier when the individual is sound and healthy. It was also mentioned that adult learners' ability to manage stress can have a positive influence on their self-efficacies (Bandura, 1977). Due to the adult learner being able to manage stress, there should be enough activities in the adult learners' curriculum that cater to the entire well-being of the student during the learning period (Kashefi et al., 2022; Li et al, 2021).

When adult learners acquire competence beliefs during the learning process, it heightens their interest in the learning process and subsequent proficiency in the subject matter (Barry & Egan, 2018; Hendral & Hidayati, 2023; Li et al., 2021). The best way to measure the domain level is to measure across different content areas and not just during the task under study (Desender & Sasanguie, 2022). Based on this assertion. the perception of individual adult learners on mathematics anxiety and its influence must be considered during a study into the relationship between their mathematics anxiety and self-efficacy (Cipora et al., 2022; Desender & Sasanguie, 2022; Hiller et al., 2022).

The physiological and emotional state of adult learners during a mathematics learning experience can have a direct influence on their self-efficacy (Bandura, 1997; Joyce et al., 2023; Price & Magy, 2021; Schunk & Usher, 2019). Self-efficacy (Bandura, 1997) of adult learners is influenced by either their positive or negative stimuli to physiological and emotional states.

Hendral and Hidayati (2023) mentioned that even though individual students may trust their abilities in performing a specific mathematics task, the same individual students may exhibit tendencies of disbelief regarding another mathematics task.

Based on Bandura (1997), negative stimuli such as anxiety, pressure, and exhaustion exhibited by adult learners influence the confidence they bring to the learning environment. The negative stimuli trigger their anxiety due to the experience of failing a mathematics exam or course. Stimuli that were not favorable to an outcome will generate discouragement in the adult learner and eventually lead to attrition if not curtailed (Bandura, 1997; Barry & Egan, 2018; Hendral & Hidayati, 2023). The outcomes that were favorable on the other hand generate physiological and emotional stimuli that build self-confidence (Bandura, 1997; Hendral & Hidayati, 2023; Li et al., 2021). The self-confidence of the adult learners will encourage them to repeat those behaviors that lead to positive and favorable outcomes. Bandura (1977) also asserted that positive emotional experiences stem from past successes. According to Bandura (1997), the main components of the physiological and emotional experiences of adult learners are the difficulty levels of a mathematics problem they are solving, their current frame of mind, and their motivational levels during the learning experience. Bandura (1997) postulated that all these factors can influence an adult student's performance.

Summary

The purpose of this phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. A review of the literature was systematically carried out to guide the study. Adult learners approach the learning experience with unique background experiences. The diverse backgrounds makes them possess both intrinsic and extrinsic motivation. As a result, they know what they need before

they show up to further their education. Irrespective of all these factors, adult learners still struggle during the learning experience. Among the challenges facing adult learners is mathematics anxiety. Mathematics anxiety hurts adult learners' class performance (Schunk, 2020). Irregularity (in this case mathematics anxiety) is a state where students exhibit signs of deficiency in basic mathematics and arithmetic calculations (Campbell et al., 2020). Based on Bloom (1956), theories exist to explain the rationale behind the various phenomena exhibited by students.

The theory of self-efficacy was used to formulate this chapter. The theory postulates that learners develop their self-efficacy `beliefs through the execution of a series of actions while dealing with diverse situations (Bandura, 1977). The constructs embedded in the theory of self-efficacy are vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion (Redmond, 2010). The adult learning styles of adult learners were discussed. Different constructs of self-efficacy influencing the learning process of adult learners were discussed in detail as well. Mathematics anxiety as a phenomenon and its influence on self-efficacy among adult learners was considered. The necessary steps needed for overcoming mathematics anxiety and the various domains of adult learning are mentioned in this chapter. A curriculum model and adult learners' philosophies were also discussed.

CHAPTER THREE: METHODS

Overview

The purpose of this phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. This section focused on giving a voice to the participants through their individual shared experiences regarding the influence of mathematics anxiety on their self-efficacies. The chapter also laid out the research design that was utilized for the study. Additionally, the research questions, the site of the research study, the participants, and the procedures for data collection and analysis was provided in this section. Information on the researcher's positionality, researcher's role, trustworthiness, and all pertinent ethical concerns were conveyed in this chapter.

Research Design

Several factors influence the choice of a research methodology. The research problems and questions serve as guides in a researcher's selection of a methodology. According to Moustakas (1994), the major challenge for qualitative researchers is their ability to map out questions that individualized personal meaning, social importance, and influence. The aim of this transcendental phenomenological study was to answer the question, "What is the perceived influence of math anxiety on adult learners at a technical college in Georgia? Every student at one point in time will take a mathematics course due to the high demand of the subject in various fields (Campbell et al., 2020).

Different designs exist in qualitative research (Creswell & Poth, 2018). The transcendental qualitative research method is utilized when a researcher needs to explore and delve deeper into issues of interest while exploring solutions to a set of problems (Creswell & Poth, 2018). The data collected in this qualitative research were non-numerical in nature. Due to

the purpose, research problem, and nature of the study, the qualitative research approach was the most appropriate for this research.

Transcendental phenomenology focuses on the shared lived experiences of the participants and the description of their observations (Moustakas, 1994). According to the author, it has nothing to do with the interpretation of the researcher. All biases such as experience in teaching adult learners were made known. Considering these, the qualitative research method was used to design a phenomenological study to explore how mathematics anxiety influences adult learner self-efficacy at a technical college in Georgia

The German philosopher Edmund Husserl (1859 – 1938) is the modern founder of the phenomenological research approach. A detailed and in-depth study of the phenomenon (mathematics anxiety) was carried out. Moustakas (1994) stated that the phenomenological study allows the participants to share their lived experiences. The lived experiences of adult learners experiencing mathematics anxiety during the classroom experience were explored through the data gathered for the research. The participants were purposefully sampled based on the experiences they shared during the learning process. The perception of mathematics and the different stimuli they experienced were documented. The adult learners' perception of the influence of mathematics anxiety on their self-efficacy were recorded as well. The data were configured into audio, documents, texts, and videos. The codes derived from the data analysis were used to form themes to characterize the perceptions and the lived experiences of the participants. The philosophical (ontological) assumption that emphasizes the participants' perception and communication were used with the interpretative (social constructivism) framework. The use of both the assumption and interpretative framework helped in explaining the observations and the world views formed by the participants.

Research Questions

The purpose of this phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. One central question served as the main query for this investigation. The one central question was followed by three sub-questions. The questions were formulated based on the theory that was utilized for the study. The four questions helped understand the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. A phenomenological study was used in conducting this research.

Central Research Question

What is the perceived influence of math anxiety on adult learners at a technical college in Georgia?

Sub-Question 1

How do adult learners enrolled in mathematics classes at a technical college in Georgia perceive their ability in solving mathematics problems during the learning experience?

Sub-Question 2

What influences do adult learners perceive as contributing to their ability or inability to solve mathematics problems?

Sub-Question 3

How does perceived mathematics difficulty influence the confidence of adult learners during the learning process?

Setting and Participants

The purpose of this phenomenological study was to discover the perceived influence of

mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. Current literature on the phenomenon concentrates on children and grade-level learners and devoid of adult learners (Wong et al., 2017). This section focused on describing the place where the data was collected and the pertinent information about the individuals who were selected for the study.

Setting

The site for this study was a technical college located in the state of Georgia. The location was chosen due to the high number of adult learners and the number of mathematics courses offered in the institution. The study must be carried out at a location where the participants share their lived experience (Creswell & Poth, 2018; Li et al., 2021; Luttenberger et al., 2018). The site was also selected due to its commitment to adult learners by providing smaller classes taught by well-trained faculty members (Klee et al., 2022). The institution provides periodic training for the instructors through professional learning committees (PLCs). The researcher must collect first-hand data after observing their natural interactions in their learning environment (Creswell & Poth, 2018; Moustakas, 1994). This form of data collection contrasts with the method where the study is carried out in a laboratory, or the individual participants are observed from a distance. The institution selected is a part of the Technical College System of Georgia. The leadership team of the institution is made up of the President, two Vice Presidents, the Deans of the different fields of study, and the heads of departments. Adult education students were considered for this phenomenological study. The adult learners comprised students who dropped out of school and have decided to return to obtain their academic credentials. The confidentiality of the individuals and the institution were maintained concealing the identity of those entities throughout the study. Pseudonyms was utilized in place

of their real names.

Participants

The purpose of this phenomenological study was to explore the perceived influence of mathematics anxiety among adult learners in a technical college in Georgia. The recommended number of participants selected for the interview must be 10 (Hill et al., 2005; Creswell & Poth, 2018). The number of participants can be fewer when everyone is interviewed several times. The same scenario applies when the participants share the same lived experience (Creswell & Poth, 2018). A total of 10 interviews were conducted from a purposeful consideration that the diverse background possessed by the adult learners and their respective motivational levels. This number of interviewees were enough to properly inform me regarding the research problem under study (Creswell & Poth, 2018). An agreed availability and time among the participants and I were reached since all the participants have shared and lived experiences.

Adult learners were considered for this phenomenological study. The participants to be considered for this study were currently enrolled in a mathematics course at a technical college in Georgia. Considering that adult learners are the focus of this study, the age range for the participants was between 18 years and 62 years. Both male and female adult learners were considered for this phenomenological study. Participants from all backgrounds and ethnicities were considered during the selection process. The Institutional Review Board (IRB) approval from Liberty was sought out before the commencement of the study. A copy of the IRB was distributed to all the participants to be considered for the study. The IRB outlined my identification, my intent for the research, and all other pertinent details regarding the investigation. To promote confidentiality, the 10 participants were identified using pseudonyms throughout the research.

Researcher Positionality

The purpose of this phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The social constructivism paradigm were followed throughout this phenomenological study. Prior experience as an adult education instructor assisted in bringing a unique perspective to the study. As a mathematics educator, I had first-hand experience with adult learners interacting in their natural learning environment. I had observed students face various challenges during the classroom experience. This background information helped shape the interpretation of the perception held by adult learners regarding mathematics anxiety and their respective self-efficacies.

Interpretive Framework

As a researcher, I focused on the shared and lived experiences of adult learners enrolled in a mathematics course at a technical college in Georgia. Social constructivism deals with an individual's understanding of the world in which they work and live (Creswell & Poth, 2018). The different meanings gained through the experiences lead to varied views of the immediate environment and beyond. Interview questions were based on general questions which allowed students to open up about their shared and lived experiences on mathematics anxiety and their respective self-efficacies. The subjective meaning of the participants' experience were considered during the research. This was achieved through epoché. According to Creswell and Poth (2018), epoché deals with suspending all judgment and conclusion about what is real unless the information obtained is found on substantive grounds. This prevented personal biases and allowed the participants to open up about their shared and lived experiences. The goal of this transcendental phenomenological study was to focus on shared and lived experiences rather than

their interpretations (Creswell & Poth, 2018). The three philosophical assumptions that guided the phenomenological study are explained below.

Philosophical Assumptions

The correlation between the topic under investigation (epistemological assumption) and the reality behind the investigation (ontological assumption) were explained in this section. The axiological assumption of biases due to prior experience as an adult educator were addressed. The role and motive of a researcher were explained as well. According to Creswell and Poth (2018), the belief system that guided the research must be clarified. This section of the chapter was used to explain my values and belief system that guided the study. The social constructivism lens was the channel through which my view of reality was portrayed.

Ontological Assumption

Even though multiple experiences exist throughout the universe to guide individuals in their perception of the truth, my ontological assumption pivoted on the reality that the singular universal truth is the one centered around God's truth. The nature of reality and its characteristics are embraced by researchers in multiple ways during a study (Creswell & Poth, 2018). Multiple realities were perceived throughout this study because the participants exhibited varied experiences and perceptions during the phenomenological study. The varied experiences and perceptions of their multiple realities were recorded in the themes that surfaced throughout the study. It has been mentioned that grade-level students can develop mathematics anxiety and can continue with them to the tertiary level of their educational pursuit (Ganesan et al., 2017), but this applied to grade-level students and not adult students. This phenomenological study focused on the phenomenon from the adult learners' perspective and sought to add to the existing knowledge.

Epistemological Assumption

The subjective meaning of the participants' experiences rather than my prior experience as an educator of adult learners was the guiding principle during this study. Epistemological assumption enables the researcher to approach the participants as closely as possible (Creswell & Poth, 2018). This encouraged subjective evidence to be gathered from the shared and lived experiences of the participants. Data was collected from the setting in which the learning of mathematics occurred. This subjective data was collected through interviews, observation, and document analysis. The reality throughout the study was constructed between myself and the participants. This reality was shaped by the individuals' shared and lived experiences (Creswell and Poth, 2018). My role as the interviewer and the participants' roles as interviewees was established during the interview process. This created proximity between the researcher and the participants while still maintaining the respective roles. My prior role as an adult student educator was made known to the participants. Detailed questioning encouraged the participants to share their lived and shared experiences. The answers to the open-ended questions was used to form themes for the data analysis (Creswell & Poth, 2018; Li et al., 2021; Luttenberger et al., 2018).

Axiological Assumption

All researchers and participants approach the study with sets of values (Creswell & Poth, 2018). They make known these values throughout the different processes of the study. I spent about twelve years of my academic career teaching mathematics to adult learners enrolled at a technical college in Georgia. I have consistently believed all adult learners possess the ability to overcome mathematics anxiety and have utilized my position as an educator to inspire students to do so. This inculcated in me the values adult learners possess and their tenacity in approaching

hurdles in hopes of overcoming those obstacles. This value as a former adult educator can have an influence on my description and interpretation of the shared and lived experiences of the participants.

What I also value about adult learners is that they approach the learning experience from diverse backgrounds, possesses intrinsic motivation, perseverance, and the determination to acquire the knowledge they readily need for their career advancement. To obtain a clearer perspective of the study, I came up with an unbiased worldview on the topic under study through the selection of literature for review irrespective of my values and belief system. The prior experience as an adult educator will be made known to the participants as well. Making this known will help inform the participants about my background which will also help build rapport as I maintain my distance.

As the researcher in this study, I made use of bracketing to ensure my experience as a mathematics adult educator at a technical college had no sway either on the data collection, analyses, or interpretation. The biases of the researcher must be put aside so the researcher can perceive the phenomenon from a neutral perspective (Moustakas, 1994). The epoché was used throughout the study to assist in gaining a new perspective.

Researcher's Role

All interviews were conducted and analyzed using diverse sources. Being the human instrument helped in extrapolating the information gathered into themes and the subsequent explanation of the shared and lived experiences of the participants (Creswell & Poth, 2018; Moustakas, 1994). My potential biases and unique values were brought to the study. As a former adult educator, I experienced students struggling in mathematics class during the learning experience. My interest in adult learners' mathematics anxiety and its effect on their self-efficacy

became imminent. I was always looking for opportunities to help students cope during the classroom experience.

During the 12 years that I taught adult students, I realized that students approached the learning experience for different reasons. Their unique motivations for returning to school stemmed from anticipation of obtaining better jobs upon graduation, trying to be positive role models for their family members, and learning new skills for their current jobs among others. These factors make each adult learner's situation different from others. The same applies to their lived and shared experiences when it comes to mathematics anxiety and its effect on their respective self-efficacies.

Even though I am currently teaching middle school mathematics, my prior experience with adult students can create biases. Due to this, the epoché was employed to ensure the information reported was correct. Social constructivism was the lens for collecting information on the shared and lived experiences of adult learners (Creswell & Poth, 2018; Moustakas, 1994). To avoid the tendency of leaning towards familiarity, the location chosen for the data collection activities was a neutral institution without a prior affiliation. The neutrality prevented the adult learners from giving out information that was deemed favorable to the outcome I was seeking due to my previous authority over them.

Procedures

This section focused on the steps that were carried out to ensure that the phenomenological study was successful and replicable. The explanation of the permission given to carry out the study was addressed. The Institutional Review Board (IRB) approval, participants selection and recruitment processes, and data collection plans were discussed. The data analysis for the study was addressed as well. To achieve triangulation, the synthesis of the

data was thoroughly scrutinized.

Permissions

The perceived influence of mathematics anxiety on self-efficacy among adult learners in a technical college in Georgia was studied by utilizing a transcendental phenomenological approach. According to Creswell and Poth (2018), the phenomenological study is used when the participants have a shared and lived experience. Based on Moustakas (1994) the phenomenological approach is appropriate when the participants have a common experience. The consent of the institution to be used for data collection was sought out before the commencement of the study. The safety and welfare of the information gathered from the participants was ethically handled. The study did not begin until permission was granted by the Institutional Review Board (IRB) of Liberty University (see Appendix A). All other pertinent permissions such the site permission and clearances were sought out and approved before the study was carried out.

Recruitment Plan

Upon completion of the approval process, the series of steps required for recruiting participants began. I partnered with the appropriate liaison at the adult education department in the technical college where the research was conducted. The liaison coordinated the pertinent correspondence between the researcher, the participants, and other appropriate stakeholders involved in the study. The sample pool was comprised of all the adult education learners enrolled at a technical college in Georgia. Creswell and Poth (2018) mentioned that at least 10 participants are required to obtain accurate information to establish specified themes from the data. Considering this, the sample size was made up of 10 adult learners currently enrolled in a mathematics course at a technical college in Georgia.

Patton (2015) stated saturation can be reached with less than 15 participants and any number over 15 will not reveal any newly developed information. The selection of the participants was purposeful and intentional since the participants all had shared experiences (Creswell & Poth, 2018; Patton, 2015). This mixture of both male and female adult learners all had a shared and lived experience of the phenomenon under investigation. Comprehensive information and instruction regarding the research were provided to all the participants selected for the study. All pertinent forms were documented in Appendix C. Interviews were conducted based on the availability of the participants.

Data Collection Plan

After obtaining permission from the IRB, interviews, observations, and review of pertinent documents were utilized in the collection of data. Open-ended questions were used to collect interview questions. Adult learners were observed in their natural learning environment and the information gathered were recorded as well. Other documents such as copies of the current curriculum and assessment questions were reviewed during the data collection exercise. The feedback obtained from the first interviewee was used to assess the merit of the other interview questions. The three data collection sources were triangulated to aid in answering the three research questions.

Individual Interviews Data Collection Approach

The interview questions comprised open-ended questions. The number of interview questions ranged from eight to 10 (Hill et al., 2005). A total of 10 questions, with follow-up questions where applicable, were used for this phenomenological study. An audio and video recorder were used to capture the transcription for analysis (Moustakas, 1994). The recordings were done after the consent and approval of the participants are sought out (Creswell & Poth,

2018). The purpose of the one-on-one interview was to examine the perceived influence of mathematics anxiety among adult learners in a technical college in Georgia. This proximity to the participants enabled me to know the participants better (Moustakas, 1994). Rapport was built while their unique shared and lived experiences were collected through the interview questions. Established rapport encouraged honest answers to the interview questions. In-person, Zoom, audio- and video-recorded interviews were utilized as the technological platform during the data collection process. When data saturation was achieved, the phenomenon was described to help in recognizing the common themes.

Individual Interview Questions

1. Give a brief introduction of yourself. (CRQ)
2. What are your professional goals after graduating from the program? (CRQ)
3. Describe ways that your belief in yourself plays a role in solving mathematics problems. (SQ 1)
4. How has your belief in yourself influenced your approach to mathematics courses? (SQ 1 & SQ 3)
5. In what areas of your mathematics learning experience do you feel most confident? (SQ 1 & SQ3)
6. What actions do you take to lessen the influence of the feelings when they emerge? (SQ 1 & SQ 3)
7. How does feedback from your teacher and peers help you in solving mathematics problems? (SQ 2)
8. Describe your personal experience with mathematics courses over the years. (SQ 2)
9. Please describe your general feelings towards mathematics during the classroom

experience. (SQ 3)

10. What do you do when you experience these feelings you mentioned earlier? (SQ 3)

11. What else would you like to contribute to this study? (SQ 3)

The first two questions focused on the central research questions. They were meant to build rapport and get acquainted with the researcher. Based on Moustakas (1994), rapport must be built through the introduction questions and the initial briefing of the purpose of the investigation. Socioeconomic data was collected during this section of the interview. The general background information of the participants was gathered through the central questions as well. Question three through five allowed the participants to elaborate on their perception of their self-confidence in solving problems involving mathematics. That was followed by questions six and seven which focused on the factors that contribute to the phenomenon under study. Questions eight through 10 centered around the influence of mathematics anxiety on their self-efficacy.

Individual Interview Data Analysis Plan

The transcript obtained from the interview was thoroughly analyzed to better understand the perception of the participants. The Colaizzi (1978) model was used in the data analysis. The phenomenological data analysis tool helped in organizing the data into themes. The transcript captured using either an audio or video recording device was copied verbatim. All the pertinent information revealed in the recordings were noted. The structured meaning following the information gathered began to emerge. The cluster analysis was utilized in developing visual diagrams of the respective codes and themes (Moustakas, 1994). The cluster analysis ensured that the themes were not duplicated (Moustakas, 1994). It also helped in finding any mismatches and alterations in the themes. A total of about 25 to 30 codes are ideal for generating five or six themes (Moustakas, 1994).

Extensive descriptions were formed after the themes were finalized. Using the *N Vivo* software program, labels were assigned to the codes based on the number of occurrences. Based on Saldaña (2021), coding permits categorization of the data, cross-referencing, and better organization. Data validation was achieved through triangulation (Creswell & Poth, 2018). The different data collection methods used for this phenomenological study were scrutinized for uniformity. The feedback from the dissertation members and peer reviews were adhered to throughout the exercise. After the data analysis, the final statements and summaries were formulated.

Observation Data Collection Approach

Another approach that was utilized in the data collection process was the participants' observation. Moustakas (1994) mentioned that the participants describe their shared and lived experiences and how they cope with the shared and lived experiences. Since this approach was conducive in building rapport, it was carried out first (Creswell, 2018). When more time was spent at the site, first-hand information about the participants and how they interact in their natural learning environment were obtained. All five senses were utilized during the observation of the participants (Creswell & Poth, 2018). Adult learners' mathematics classes were observed to gain thorough understanding of how the students interacted with each other and the educator. Notes on body language, verbal persuasions, and social interactions as a catalyst for mathematics anxiety were taken. A journal containing the participants' observations was kept for further analysis. Since transcendental phenomenology focuses on the perception of the participants, the epoché was used in the bracketing process (Moustakas, 1994). The clustering, essence, and horizontaling were utilized considering my prior experience as an educator of adult learners. They helped in putting aside all biases about the phenomenon under investigation.

The visits that were paid to the research site focused on building rapport with the participants. An observation protocol was established to assist in being a non-participant observer. Pertinent documents such as the current curriculum and test samples were collected during the site visits. Based on Creswell and Poth (2018), the researcher must actively involve themselves in the daily activities of the participants being studied. There were 10 interviews and 10 observations for this phenomenological study.

Observation Data Analysis Plan

The data analysis for the participants' observation run concurrently with the other sources of data. Process coding was used to identify the main observed occurrences (body language, verbal persuasions, and social interactions) during the classroom experience. The priori codes generated were formulated into themes. The classification and organization of the codes and themes were carried out until saturation was attained. The themes were generated from the observation notes. The observations of the participants were fine-tuned and documented in a form of a journal. The documented codebook contained an interpretation of the codes and themes after a thorough examination. The comparison among the themes generated from the observations were analyzed as well. The theoretical framework was used in interpreting the data and the themes formulated.

Documents Data Collection Approach

The recordings and analysis of the information obtained from the participants and their setting was essential in the data analysis process (Hill et al., 2005). The strategic plans, organizational charts, and leadership styles were all vital. A current copy of the mathematics curriculum was obtained. Samples of lessons and assessment questions were collected for analysis as well. The lessons were analyzed to ascertain its vertical and horizontal alignments

which help students use prior information to successfully solve problems without apprehension and anxiety. An official letter was sent to the custodian of records of the institution selected for the study. The reason for conducting the phenomenological study along with other important information was provided to the institution. The identities of the participants were kept confidential throughout the study (Creswell & Poth, 2018).

Documents Data Analysis Plan

The thematic analysis was developed after a thorough review of the collected documents. Codes were assigned to the documents based on the themes that were identified. Connection and disconnection were derived from the labels given to the various data collected. The data analysis for the interviews, observations, and document reviews were carried out at the same time. Running the data analysis concurrently encouraged validation and triangulation of the data across all the different sources (Creswell & Poth, 2018). The feedback from the dissertation committee members and peer review were adhered to throughout the phenomenological study. The summary and conclusions were generated after the analysis.

Data Synthesis

The codes and themes generated blended for the information to make sense. Based on Saldaña (2021), coding permits better organization, cross-referencing, and categorization of the data under analysis. The goals and objectives of the study were essential at this stage of the phenomenological study. The synthesizing of the codes and themes were carried out by utilizing the research questions. Clusters and patterns were generated from the codes and themes generated from the interviews, observations, and document analysis. Insights about the study were formulated by utilizing the clusters and patterns. The epoché was employed to help prevent biases that may stem from prior experience with adult learners (Moustakas, 1994). Clustering,

essence, and horizontaling (Moustakas, 1994) were utilized in setting aside all forms of biases about the phenomenon under study.

The concept-mapping and visual features of the *NVivo* software were used to generate recurring trends and frequent patterns. The information obtained from the interviews, observations, and document analysis were summarized. The key findings and the emerging themes were documented and shared through Microsoft Word and Microsoft Excel. The published findings may be used by various stakeholders to make data-informed decisions.

Trustworthiness

The validation of a qualitative study is to evaluate the accuracy of the findings (Creswell & Poth, 2018). The validation involves how accurate the instruments and the respective techniques used for the data collection, analysis, and interpretation were during the entire duration of the investigation. The rigor of the study is ascertained through the accuracy of the methodology. Checks and balances were implemented to ensure fairness throughout the phenomenological study. The pertinent stakeholders including peer reviewers and dissertation committee members assessed the final manuscript before publication. The validation terms and conditions were referenced throughout the study and were described by the reader, participants, and the researcher (Creswell & Poth, 2018). The distinctive terminologies used in the advancement of trustworthiness were transferability, authenticity, confirmability, dependability, and credibility.

Credibility

The accurate perception and interpretation of the participants was captured in the results of the study. Credibility is essential in the validation of qualitative research data (Klein & Myers, 1999). The methodology and the data analysis techniques was reliable and credible. The

researcher, participants, and all stakeholders confirmed the reliability of the results obtained from the phenomenological study. The method and techniques utilized throughout the study was meticulous and rigorous enough to show the transferability, reliability, and validity of the phenomenological study. Triangulation, participant validation, and peer review were used to achieve the necessary credibility of the phenomenological study.

Transferability

The setting of this phenomenological study was a technical college in Georgia. Although the study was carried out in Georgia, the findings must apply to institutions analogous to the one selected. It is difficult to reach generalizability in qualitative study nevertheless the researcher aimed at providing thorough research into the phenomenon under study (Creswell & Poth, 2018). Apart from setting aside all my biases about the research, a rich, thorough, and thick description were utilized in concluding the data analysis (Korstjens & Moser, 2018; Lincoln & Guba, 1985). In this way, other institutions encountering similar phenomena must be able to replicate the study based on the methodology and techniques used in this study (Lincoln & Guba, 1985).

Dependability

Other researchers should be able to replicate this phenomenological study if they so desire. The method, data collection strategies, and data analysis were structured in a way that other researchers can utilize to obtain similar results (Lincoln & Guba, 1985). The steps and instructions were straightforward and simple enough to be replicated. The findings and results of the study reflected the information analyzed for the literature review. The feedback given by the participants and the peer reviews mirrored the findings and results of the study.

Confirmability

Neutrality was sought out throughout the study. The researcher biases was curtailed by utilizing epoché (Moustakas, 1994). All preconceived judgments that stemmed from being a previous adult educator were disclosed and put to the side. All the different activities to be carried out during the study were checked for transparency. Confirmability was achieved through triangulation. Comprehensive understanding of the study was carried out through the participants' selection, data collection and analysis, and reporting of the findings. The peer reviewers and participants also helped in checking and balancing the entire process. The quality and significance of the findings were examined using reflexivity.

Ethical Considerations

The purpose of this phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. This section focused on all the pertinent issues, implications, and considerations needed to ensure that the information gathered from the various stakeholders involved in this phenomenological study was handled ethically.

Permissions

Permission from Liberty University's Institutional Review Board (IRB) was sought out and obtained first before the commencement of the study. I also sought and obtained permission from the technical college used for the research before making any contact at the site selected for the study. A head of a department or a designated official for the school served as the liaison for information dissemination between the researcher and the participants. I made known the purpose and the nature of the phenomenological study to the participants and all other stakeholders. The information sheet will be presented to all the participants involved in the study.

This information sheet will provide all the pertinent details of the research study. The information sheet will also provide guidelines for the participants who want to exit the study at any point in time during the data collection process (Creswell & Poth, 2018).

Other Participant Protections

After obtaining all the pertinent information from the participants, the documents were kept in locked cabinets. Transcribed data from document analysis, interviews, and journaling were organized within a Microsoft Word and Microsoft Excel for a prolonged period. The electronic data collected was password-protected with an extra two-factor authentication to add further security as suggested by Creswell and Poth (2018). Pseudonyms were used in place of actual names to protect the identity and privacy of all involved in the study (Creswell & Poth, 2018). All data utilized for the research will be permanently destroyed after five years by shredding all paper documents and deleting all electronic data.

Summary

The purpose of this transcendental phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners in a technical college in Georgia. The primary source of text for the research was Moustakas (1994). Participants for the studies were made up of 10 males and females enrolled in a mathematics course at a technical college in Georgia. The study only began after approval from Liberty University's IRB. Other pertinent approvals needed before the commencement of the study was obtained prior to the beginning of the study. Data was obtained from interviews, observations, and documents review. The concept-mapping and visual features of the *NVivo* software was used to generate recurring trends and frequent patterns. The inductive process was used to generate the codes and the

deductive process was used to link the phrases to the various themes. The theoretical framework was used to draw conclusions based on the findings of the study.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this transcendental phenomenological study was to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The reason for Chapter Four is to show the results of the data analysis of the study. The chapter also sheds light on the 10 adult learners who participated in the research. This study employed the transcendental phenomenological reduction and procedures postulated by Moustakas (1994) to organize and analyze the data collected. Individual interviews, observations, and document data are introduced and organized into themes. Figures, tables, and narrative accounts of the participants were used to present the themes generated during the research. The chapter ends with the responses to the various research questions that served as guides for this study.

Participants

The study did not begin until permission was granted by the Institutional Review Board (IRB) of Liberty University (see Appendix A). It took about two weeks for the ethics board to approve the study. Other pertinent permissions such the site permission from the technical college and clearances were sought out and approved before the study was carried out. Upon completion of the approval process, the series of steps required for recruiting participants began. I partnered with the appropriate liaison at the adult education department in the technical college where the research was conducted. The liaison coordinated the pertinent correspondence between the researcher, the participants, and other appropriate stakeholders involved in the study. The sample pool was comprised of all the adult education learners enrolled at a technical college in Georgia.

Interviews were conducted based on the availability of the participants. Data was collected from participants who disclosed that they exhibited mathematics anxiety during the learning experience. The participants comprised 10 adult learners enrolled in a mathematics course during the Spring of 2024 at a technical college in Georgia and accepted an invitation to participate in this study. All the participants in the study attend the same technical college. The safety and welfare of the information gathered from the participants were ethically handled. Gift cards detailed in the ethics application were provided to the participants after the interview to alleviate coercion concerns. The gift card was an expression of gratitude for the participant's willingness to participate in the research. Adult learners ranging from 18 to 62 years of age were selected utilizing a systematic criterion with 10 interviews conducted with a purposeful consideration of the diverse backgrounds of adult learners and their respective motivational levels. The participants' verbal recruitment letter requesting research participants was read to the participants before the commencement of the data collection process. The participants were made up of both male and female adult learners who have a shared and lived experience of the phenomenon under investigation. Pseudonyms were used to represent the names of both the technical college and the respective participants who accepted the invitation to participate in the study. All participants consented to partake in the study with no withdrawals. Six of the participants were 1st year students with the remaining four being 2nd year students.

Table 1

Adult Learner Participants

Name of Student Participant	Number of Mathematics Topics Completed in the Current Semester	Technical College Classification	Current Mathematics Content Area	Number of Mathematics Topics Remaining in the Current Semester

Beth	7	2nd year	Quadratic Equations and Inequalities	8
Dan	7	2nd year	Quadratic Equations and Inequalities	8
Tom	5	1st year	Data and Graphs	7
Amy	5	1st year	Data and Graphs	7
Maggie	7	2nd year	Quadratic Equations and Inequalities	8
Paul	5	1st year	Data and Graphs	7
Larry	5	1st year	Data and Graphs	7
Becky	7	2nd year	Quadratic Equations and Inequalities	8
Andy	5	1st year	Data and Graphs	7
Cindy	5	1st year	Data and Graphs	7

Beth

Beth was a 2nd year student aspiring to start her own business or work in an office when she graduated. She has decided to pursue a business degree, so she can fulfill both her academic and career goals. She has already completed seven topics in her mathematics course for the Spring 2024 semester. Her favorite topic in mathematics is geometry. Beth recounted, "sometimes I find it difficult in solving math problems. I have to take time and practice which

helps a lot, yes." Regarding her feelings towards mathematics during the classroom experience, she went on to mention that "when I don't understand, I ask questions for the teacher to explain or check some website or whatever until I understand the problem and can solve the problem." Despite this, Beth still struggles with mathematics anxiety and self-declared as a mathematics-anxious adult learner. She gave an account of how she learned the multiplication table in grade school and its positive impact on her current performance in mathematics courses.

Beth also alluded to feedback from her classmates and teachers as factors to her success during the classroom experience. She does not wait until the last-minute during classes to ask for feedback from both her teachers and peers since that feedback helps build her confidence in solving mathematics problems. Beth stated that when her confidence levels drop during the learning experience, she normally puts in extra time to solve those mathematics problems independently. However, on those occasions that she finds herself frustrated, she would take intermittent breaks. She spent those breaks exercising to gain a new perspective in tackling those mathematics problems later.

Dan

Dan takes his studies seriously as a second-year student at the technical college. He is current academic pursuit is geared toward obtaining a welding diploma soon. Mathematics anxiety almost prevented him from pursuing his dream job as a welder since she self-declared as a mathematics-anxious adult learner. He aspires to start his own welding business upon graduation. He mentioned that he is employed in the welding industry but needs a diploma to confirm his credibility in the field. His current topic in mathematics classes is quadratic equations and inequalities. He has completed seven mathematics topics in his current semester and still has eight more topics to go. Dan expressed his notion about mathematics courses over

the years as being apprehensive. His lack of confidence over the years has prevented him from taking mathematics courses.

Based on his account, his mathematical apprehension started during his formative years in elementary school. The main issue he had been having over the years borders on his lack of confidence in solving mathematics problems involving new concepts. One major factor that triggers his anxiety is when he must utilize newly acquired mathematical skills to answer diverse questions on the same topic. Dan asserted that he prefers to use different approaches in solving mathematics equations. For instance, he mentioned that since he is a visual learner, he prefers drawing diagrams and shapes to help him arrive at the desired outcome. Dan said, "most teachers do not prefer diagrams and shapes for answers if the topic is not related to geometry." He also stated that "if my teacher doesn't explain something for me to understand, I get disappointed." The lack of ample time to solve mathematics problems exacerbates the problem as well.

Tom

Tom was a dedicated 1st year student who was studying to become an Information Technology professional. He hopes to graduate on time without any significant obstructions. He stated "it depends on how long it's gonna take me to finish. If it is going to take me a long period to finish it, I might drop it but if it is between two years or less, I will go for it." He has completed five topics in her current mathematics course with seven more to go. Data analysis and visualization are some of his current and favorite topics in mathematics. Since his favorite subjects are being taught in the classroom presently, he has been catching himself working on mathematics problems more than any other subject. Tom stated that he performs better during the classroom experience when he obtains one-on-one assistance from the teacher. The participant asserted that "when my teacher explains things to me two or three times eventually, I

get it." He voiced that the teacher has other students to attend to, so any help is appreciated. As a self-declared mathematics-anxious adult student, he continued by mentioning that "my weakness makes me play catch up with the others because I know the others are ahead of me." Tom also spoke briefly about how he takes intermittent breaks to rest when he begins to feel overwhelmed. He asserted that he feels guilty when he walks away because it makes sense that he is quitting. However, the breaks taken by Tom during the learning experience serve as a conduit for stress relief. He normally builds his confidence and can tackle those mathematics problems he could not solve earlier.

Amy

Amy was a hard-working student who in her words stated, "I wake up early and study math problems until I can solve them." Her professional goal was to become a professional chef at a five-star restaurant when she graduates. Amy was a 1st year student who was learning Data and Graphs in her current mathematics class. She had completed five topics with seven remaining. Even though she self-identified as a mathematics-anxious adult learner, she tackled mathematics problems from a philosophical standpoint. Amy mentioned "when I'm solving math problems, I treat it like cooking a meal. I gather all the ingredients I need and the ones I don't have, I go and purchase those." She continued, "what I mean is for instance if I am doing fractions, I will need to know the least common denominator, the numerator, and so on." Amy declared that her belief in herself helped tremendously when it came to approaching, solving, and getting mathematics problems right. She communicated that she felt confident when she got the hang of a topic after successfully tackling the problems associated with that topic. Another unique attribute of Amy was her ability to metaphorically compare mathematics problems to cooking. At one point she reiterated that "I like to solve my problems from the perspective of a

chef. I pick the menu and which ingredients to use." She went on to say "once I know what I am doing. I keep on until I am done." Amy also mentioned that her favorite mathematics topic in mathematics is fractions.

Maggie

Maggie was a 2nd year student learning to become an automotive mechanic soon. She liked playing video games and listening to music. What piqued her interest in the automotive industry was her ability to repair her video games when they broke down. Her lack of confidence in mathematics made her shy away from mathematics courses since grade school. Most of the help she had obtained in solving mathematics problems throughout her academic pursuit was from either her mother or grandmother. Maggie had been timid in the classroom throughout her life during the learning experience. She self-identified as a mathematics-anxious adult student who does not want to be bothered when she gets into the learning mode. This is even applicable to the classroom setting.

Regarding her confidence level in the classroom, Maggie mentioned "I feel confident when I try to solve problems by myself. At times when people try to budge in while I'm trying to do math problems, it takes me out of my zone." She prefers to solve problems on her own before asking for help where needed. Maggie prefers working in a quiet environment since the least noise from her surroundings creates distractions. About her personal experience with mathematics courses over the years, she mentioned that she had preferred using her methods in arriving at the solutions for mathematics problems. Based on her account, that had not gone well for her since elementary school since most teachers she had would rather have her use a newly acquired strategy to solve the mathematics problem.

Paul

Paul was a 1st year student who was studying to become a professional barber in the future. His jovial attitude accords him the necessary positivity he needs during the mathematics classroom experience. He is currently learning how to analyze data and visually present that information. Paul had already completed five topics and still had seven more to go before the end of the semester. As a self-identified mathematics-anxious adult learner, he avoided mathematics courses as much as he could. He stated that he could not avoid it anymore since he needed to master these mathematics topics as a graduation requirement. Paul asserted that he does well when he puts his mind to any task and applies himself. This includes solving mathematics problems and building his confidence. He mentioned that he asked for help from his teacher. He continued to say, "I feel like the teacher gets me, especially since I have been out of school for a long time and am returning to get my diploma." Concerning the areas of his confidence when it comes to mathematics learning experience, he was self-assertive on topics like geometry and measurements. Paul hinted that he used that type of mathematics and its applications daily at his workplace. Since he was a hands-on person, he liked taking notes in class. He took deep breaths as a coping mechanism for nervousness and had to take intermittent breaks during classroom interactions.

Larry

Larry was a 1st year student who had completed five topics in his current mathematics course with seven left. He was studying to become an electrician. His dream job would be landing a position with Georgia Power upon graduation. Larry's relationship with mathematics courses had been intermittent. He expressed that he got stuck sometimes when solving mathematics problems. He had been trying to work on curbing any form of self-doubt by using

prior knowledge to answer arithmetical computations. He mentioned that “I am more positive when I work in groups. I learn a lot that way since we all want to learn new things about mathematics.”

Larry also asserted that when he did not understand a mathematical concept, a member of the group broke it down to make it comprehensible. He said the peer tutoring felt less intimidating. Larry also mentioned that feedback from classmates helped build his self-confidence. The encouragement from his group members helps fuel him to persist even when he is intimidated by a mathematics problem. Larry said his confidence level goes up when he can use the same mathematical skills acquired to solve problems on his own. He explained this by citing an instance where he persevered to complete a post-assessment irrespective of the fatigue he was experiencing. The determination was attributed to the practice he had acquired through working in group settings. Not only had Larry boosted his confidence during assessment sessions, but also his overall class participation. He hinted that he had aspired to volunteer to be the group leader soon.

Becky

Becky was a 2nd year student studying quadratic equations and inequalities in her mathematics class. She had already completed seven mathematics topics in the course with eight remaining. She mentioned that even though she was a self-described mathematics-anxious adult learner, she was aspiring to become a nurse. She planned to complete the remaining topics in the mathematics course so she could concentrate on the nursing courses. Becky had taken the initiative to speak to an academic counselor about her future career aspirations and the sequence of courses needed for that discipline. She expounded on her mathematics anxiety and its impact on course selection throughout her academic pursuit. Becky stated “my experience with

mathematics courses has been patchy over the years. Sometimes my confidence goes up when I get a teacher who understands my style of learning." Becky went on to mention that "I have struggled with mathematics since I was in elementary, middle, and high school." She always wanted to do other subjects ahead of mathematics due to her lack of confidence.

Becky mentioned the nervousness experienced during the classroom experience was not getting in her way of learning mathematics. She concluded by saying "I like asking questions so the teacher who disliked questions makes me nervous about mathematics in general." She also relied on her classmates for support during the learning experience. Becky liked to ask her classmates to explain geometric concepts and problems to her first before seeking assistance from the teacher. She knew other classmates were ahead of her academically, so she capitalized on their knowledge whenever necessary. Becky stated that she normally sat near other adult learners so she could exchange information. One thing that she mentioned was her utilization of technology when she was doing her homework assignment or had no classmates or teachers around. She would normally "go online to 'google' for solutions to the problems.

Andy

Andy was a 1st year student who had returned to school after retiring from the oil industry. He dropped out of school to start and take care of his family. He spent most of his life living in the state of California. His main goal for returning to school was to obtain credentials that would enable him to start his own business. Even though he spent his entire working career in the oil industry, he would like to start a construction business upon graduation. He also had experience in coaching youth in the basketball league. Andy is currently learning data analysis and visualization in his mathematics course. He had completed five topics with seven more to go. The next topic in his course progression is Measurements. Andy asserted he needed

mathematics in everyday life which had encouraged him to become a lifelong learner. He stated, "I am not that sharp man so it's like I have to practice every day to build my confidence. When I stop practicing, I feel nervous, so I keep practicing."

Andy mentioned that he tried to avoid all mathematics classes and courses until he had no choice but to take them. His belief in himself was heightened when the teacher encouraged students to ask questions. He reiterated several times how he liked asking questions in class. He normally geared the questions towards the teacher since he always wanted the real answer not guesswork from his colleagues in the classroom. When the mathematics teacher showed him a strategy for solving a problem, he utilized the same approach during personal practice. To Andy, "practicing also helps in building confidence." One strategy employed by Andy in overcoming his mathematics anxiety was studying for a long period for both pre-assessments and post-assessments. He enjoyed working with his classmates in a group setting due to the mutual benefits involved. He learned new strategies from his classmates and reciprocated by imparting the tools he had in his arsenal.

Cindy

Cindy was a 1st year student studying to start her own company. Even though she is currently employed in the cleaning industry, she was undecided when it came to the career path she wanted to take. Cindy stated, "once I graduate, I can have the credentials to be able to get the license I need to start my business. She was a self-described mathematics-anxious adult learner. Cindy asserted that she rarely worried about her mathematics anxiety because in her own words, "I do not expect to know everything." She mentioned that patience is key when she becomes anxious about a mathematics problem. Based on her assertion, being patient and taking time to

relax gives her a new perspective in solving newly introduced mathematics problems. Her confidence level skyrockets when she finally gets problems right after several trials.

She mentioned that she was always scared to approach newly introduced mathematics concepts and problems. She normally overcomes these apprehensions by taking intermittent breaks during the learning process. Cindy commented that those breaks give her a new form of confidence in solving mathematics problems. Regarding feedback from both teachers and peers, she mentioned that "when I get the mathematics questions right, the teacher normally smiles and gives a thumbs up which makes me feel good about what I am doing." She is also motivated when her peers successfully solve a problem during the classroom experience. Her rationale was that if her peers had been able to solve the mathematics problems, she should be able to do since they all shared a common background.

Results

The results from this transcendental phenomenological study were obtained from analysis of data collected through interviews, observations, and a review of pertinent documents. Data saturation was reached when the participants started giving the same accounts of their shared and lived experiences with no new information being revealed (Creswell & Poth, 2018; Moustakas, 1994). When data saturation was achieved, the phenomenon was described in helping recognize the common themes. The 10 participants were all asked the same 11 questions during the individual interviews. The recorded interviews were transcribed followed by a member checking. The various participants were given a chance to review the transcribed conversation to verify the trustworthiness, authenticity, and accuracy of their contributions and responses to the data collected. Saldana's (2021) procedure for in-vivo coding was used to examine, confirm, and manage the patterns observed in the data. To discover the true nature of the shared and lived

experience of the participants, the epoché was used in the bracketing process (Moustakas, 1994). Since transcendental phenomenology focuses on the participants' perception, clustering, essence, and horizontaling (Moustakas, 1994) were utilized considering my prior experience as an educator of adult learners. They helped in putting aside all biases about the phenomenon under investigation.

After putting aside all biases, Moustakas's (1994) phenomenological reduction was used to analyze the printed transcripts. Moustakas's (1994) phenomenological reduction for qualitative research was utilized to analyze the printed transcription from the open-ended questions. The transcripts were read at least three times to get familiarized with the data. The data collected was reviewed to designate words, expressions, statements, and sections within a paragraph to the respective individual participants shared and lived experiences. Each of the participants' statements was treated with equal value before utilizing the process of horizontalization to remove repeated and overlapping statements. Preliminary data analysis resulted in the production of codes (see Table 2). The horizons were clustered into sub-themes and their subsequent themes using the data collected through interviews, observations, and a review of pertinent documents. Each data collection method was rigorously analyzed by cross-checking to identify any matches in the prevailing codes. Running the data analysis concurrently encourages validation and triangulation of the data across all the different sources (Creswell & Poth, 2018). Triangulation of the data involving structural interpretation and textual description (Moustakas, 1994) helped develop the eventual designation list of the developed codes. Original codes were developed for data that did not complement previous codes (Saldana, 2021, Moustakas, 1994). The emerging and final themes blended to reflect (Moustakas, 1994) the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical

college in Georgia. Using Moustakas' (1994) transcendental phenomenological research procedure, four final themes, and 12 sub-themes emerged through the data collection and analysis processes.

The four themes that emerged from this study were vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion. The sub-themes developed from the vicarious experience were (a) observation of peers, (b) observation of teachers, and (c) observation of both teachers and peers online. Regarding the mastery experience, the sub-themes generated were (a) skills acquisition, (b) task difficulty (c) achievement levels. With the theme of physiological and emotional experience, the sub-themes were (a) adult learner emotions, (b) stress management, and (c) emotional outcomes. There was an outlier regarding information about the use of technology as a tool for learning that was not consistent with all the participants involved in the transcendental phenomenology study but was worth mentioning. The data analysis revealed significant statements about the perceived influence of mathematics anxiety on self-efficacy among the self-described mathematics-anxious adult learners at the technical college selected for the research. Table 2 highlights the codes obtained from the preliminary data analysis.

Table 2

Examples of Preliminary Codes

Ask questions	Exercise	Avoid math courses
Teacher encouraged me	Call a friend	Don't understand
YouTube videos	Confident	Understand the problem
Teacher doesn't explain	Ask teacher for help	Feel confident

Better class participation	Helps a lot	Ask peers for help
Boosted my confidence	Avoided math	Cheered on
Used the wrong formula	Love geometry	Avoiding welding due to math
Teacher explains	Keep trying	Peer motivation
Peers helped me	Math has improved	Returning student
Feedback encourages me	Teacher's method	Solve by myself
Incorrect answer	Marked me wrong	Practicing alone
Group work	Sit, wait, and listen	Stay positive
Help with steps	Teacher's promise	Use that to help solve

Table 3

Themes, Sub-themes, and Essential Codes

Theme 1: Vicarious Experience	
Sub-theme	Essential Codes
Observing Peers in Class	Practice with classmates, Help with steps, Group work, Call a friend, Ask peers for help

Observing Teachers in Class	One-on-one with teacher, Teacher explains, Teacher tells me, Teacher's method, Ignore the teacher, Teacher doesn't explain, Teachers bother me
Observing Others Using Technology	Computer use, Math app, YouTube videos

Theme 2: Mastery Experience

Sub-theme	Essential Codes
Learning New Mathematics Skills	Doing math problems, Tackle problems head-on, Practice, Solve math problems, Studying, Style of learning, Practicing alone
Ability or Inability to Learn New Mathematics Skills	Correct my work, Do it myself, Doing more math, Doing my best, Try another formula, Figure out, Get it slowly, Not good in math, Not smart, Out of my zone, Patchy over the years, Play catch, Prior knowledge, Work hard, Cannot solve a problem
Learning Outcomes	Right answers, Confidence in solving, Do well in math class, Solve by myself, Figure out, Get it slowly, Incorrect answer, Method down pat, Marked me wrong, Quit, Math has improved, Like fractions

Theme 3: Physiological and Emotional Experience

Sub-theme	Essential Codes
Physiological and Emotional Expressions	Overthink, Feel anxious, Feel confident, Disappointed, Frustrated, Upset, Cannot focus, Feel like giving up, Feel good about myself, Less complicated, Nervous, Not confident

Physiological and Emotional Outcomes	Don’t feel confident, Avoid math courses, Boosted my confidence, Don’t understand, Helps a lot
Physiological and Emotional Management	Exercise, Keep trying, Mind to everything, Pay attention, Stay positive

Theme 4: Verbal Persuasion

Sub-theme	Essential Codes
Verbal Feedback from Peers	Peer motivation, Encouraging feedback, Cheered on, Friends comfort,
Verbal Feedback from Teachers	Comments from teacher, Teacher encouraged me, Teacher’s promise, Boosted confidence,
Influence of Verbal Feedback	Boosted confidence, Peers help me,

Vicarious Experience

The first theme to emerge from the data analysis was the vicarious experience. All the 10 participants stressed the importance of their ability to observe others perform a mathematical task during the learning experience. Throughout the data collection process, all the participants indicated that the classroom experience begins with the teacher’s introduction and explanation of the mathematical content on the whiteboard. Beth stated that she asks intermittent questions throughout the introduction and explanation process. She stated that “When I don’t understand, I ask questions for the teacher to explain.” The participants also indicate that when the teacher recognizes their struggles and come to their aid, it enhances their confidence and heightens their

self-efficacy. Dan alluded that “If I don’t feel confident, I will definitely ask the teacher to help me solve it.” The participants also mentioned that when they see other students solve problems during the classroom experience, they feel confident to emulate those actions. Beth explained her personal experience in observing others in the classroom, “I watch and practice with my classmates. When I do not understand, I ask questions for the teacher to explain or sometimes check some websites.”

Observing Peers in Class

The participants collectively mentioned that their ability to observe others solve mathematics problems during the learning experience heightens their self-efficacy. The benefits of peer-to-peer interactions enabled Dan to increase his confidence during the learning experience. During the interview, he mentioned that “When my peers help me solve math problems, I see that they want to help me, that helps me become confident. If they can do it, I can do it too.” It was disclosed through the study that adult learners prefer to work in groups during the learning process. Larry stated that “I am more positive when I work in groups. I learn a lot that way since we all want to learn new things about mathematics.”

It was also revealed that when adult learners observe other students succeed at a classroom task, it motivates them to perform as well. Amy mentioned that

> My classmates are a great encouragement in the, um, in my current math class. I take other, other classes with them, so we pretty much know each other. When they don’t understand something, I try my best to um explain it to them. They also try to help me with math problems I don’t understand. When I receive these encouragements, I feel good about myself.

It was observed through the study that the reverse effect of those successes also holds true. Lack of success or undesirable peer-to-peer interactions observed by adult learners during the learning process can also influence their self-efficacies. This occurrence was mentioned by Maggie when she explained

> I feel confident when I try to solve math problems by myself. At times when people try to budge in while I am trying to do math problems, I'm just, it takes me out of my comfort zone especially when they get the problems wrong when helping me. Then I will feel lost and don't know what to do.

Observing Teachers in Class

It was discovered through the study that educators who give one-on-one attention to students during the learning experience help reduce some of the anxious feelings exhibited by adult learners during the learning experience. Tom mentioned that he performs better during the learning process when he obtains one-on-one assistance from the educator. Educational practitioners can use scaffolding to help adult learners build and harness their self-efficacy beliefs when learning new mathematics topics. Tom also commented on the effects of the scaffolding he receives from his teacher in the classroom during the learning experience

> I watch my teacher work the problems on the board while I take notes. When I do not understand, I look up to the teacher for answers. When my teacher explains things, she takes her time and explains things to me two or three times and I eventually get it.

Just as in the case of observing peers in the classroom, the adult learners mentioned that the reverse effect of the observed teachers' successes during the learning process can also influence their self-efficacies. Becky commented on her experience of observing teachers in the classroom during the learning experience

> When I watch my teacher explain an answer and I don't get it, I get nervous. I have been doing a little math myself so normally in general when I feel that nervousness or whatever I like asking my teacher to explain the questions and answers to me. Um, sometimes my teacher wants me to answer the question like she will give half of the answer, but she wants me to answer the full question, so I go to my math app or something.

Mastery Experience

The second theme to emerge from the data analysis was the mastery experience. The participants communicated the significance of being able to successfully solve mathematics problems during the learning experience. During the interview, Dan mentioned that "if my teacher doesn't explain something for me to understand, I get disappointed." He emphasized that the disappointment from unmet expectations during the learning process prevents him from solving mathematics problems from start to finish. Beth explained her knowledge acquisition from beginning to end during the learning experience, "Sometimes I can solve the problems on my own, sometimes too I find it difficult in solving math problems. I have to take time and practice which helps a lot." The different experiences encountered by the participants lead to either proficiency or lack of ability when solving mathematics problems during the learning process. Dan also commented that sometimes all he could accomplish during the classroom experience was to stop mid-way while solving a mathematics problem due to the level of difficulty.

Ability or Inability to Learn New Mathematics Skills

It was observed through the study that the participants ability or inability to learn new mathematics skills can influence their self-efficacy during the learning experience. The more

adult learners can successfully learn new mathematics skills during the during the classroom experience, the higher their self-efficacy. On the contrary, the less adult learners can learn new mathematics skills, the lower their self-efficacy. Amy shared during the interview that she felt confident when she effectively solves problems involving the operations of fractions. She attributed the success to her ability to recall and identify the two parts of a fraction. She confided that when she forgets to identify the two parts, she struggles with solving the fraction problem.

During the interview, it was discovered that the ability of adult learners to apply their prior knowledge to new situations and self-efficacy are directly related. Other participants shared sentiments like Amy's regarding the application of prior knowledge to new mathematics skills. Beth explained

> When I started school and I was little, everybody learned the multiplication table. They are very good for me when doing math problems. Since I had memorized it and have been using it all this while, um, it comes in handy when doing math. It makes me work faster.

Regarding this assertion, Paul mentioned "I am confident with topics like geometry and measurements. I use this type of math every day at my workplace." When the vertical and horizontal alignments of the mathematics topic are misplaced, the adult learner may learn materials without the prerequisite or materials that are not challenging enough (Schunk, 2020). The prior knowledge acquired by the adult learner must align with the current information being disseminated. Education practitioners must ensure that the vertical alignment of their course materials is not out of range. The adult learners who mentioned that they struggled with new concepts during the learning process were mainly those who had forgotten their prior knowledge regarding the mathematics topic under consideration.

Andy went on to state that

> I stopped out to work and take care of my family. Math was another reason why. I am not good at math. I didn't like school and had to wait this long to come back to get a diploma. I have forgotten, um, most of the things I learned about math during grade school. I find it difficult in my math class because I must play catch-up.

Learning Outcomes

When describing the desired learning outcomes, the participants stated that their current state of mind determines their success in solving mathematics problems. Amy mentioned during the interview that she struggles with solving mathematics problems when she is overwhelmed. The emotions become prevalent right before every major mathematics assessment. She went on to mention that to keep her emotions in check, she had to wake up early and study for the test. Waking up early to study gives her the confidence she needs to pass her tests.

Students' level of flexibility in using new strategies to solve mathematics problems influences learning outcomes during the learning experience. Maggie also mentioned that she gets frustrated when teachers prefer other methods used in solving mathematics problems to hers. She stated that even when she uses her strategy to arrive at the correct answers, some teachers will mark her wrong for not using their preferred method. The frustration impacts her reasoning and cognitive ability in solving mathematics problems during the learning process. She confided that her inability to use her own methods in solving mathematics problems makes her lack self-confidence during the learning and assessment experiences.

The current state of mind of the participants as well as their levels of flexibility in using new strategies causes them to exhibit mathematics anxiety during the classroom experience. The higher the mathematics anxiety exhibited by a student, the higher the student's inefficacy in

solving reasoning problems. Regarding the state of mind of the participants in reference to their self-efficacy, Andy explained that

> When I stop practicing, I feel nervous, so I keep practicing. Practicing helps me build confidence sometimes. When I build my confidence, I can solve the math problems by myself.

Educational practitioners must strategize ways to modify their practices to accommodate students who approach the learning process with varied dispositions and levels of flexibility. The adjustments made by educators will leave room for students like Andy and Maggie to enhance their state of mind and gain confidence throughout the learning and assessment processes. When teachers adjust their practices to meet the needs of their adult learners, their self-efficacy and mathematics learning improves as asserted by Dan

> Sometimes I need the confidence to solve the questions on the board. If I don't feel confident, I will definitely ask the teacher to help me solve it. She always tells us to raise our hands and call her to come help. The last time I called her, she came over to help me solve it. It boosted my self-confidence.

Tom also mentioned

> I have too much going on, you know, and I just can't focus. I just have to deal with it until it all falls into place at times. If I am trying to solve a problem, something I don't understand and I ask, she doesn't stop until she breaks it down till I understand.

During the interview, Andy said "I am really learning when the teacher answers my questions. The teacher takes time to show me how I can solve problems in a better way. I also learn well when my classmates ask questions as well."

Physiological and Emotional Experience

The third theme to emerge from the data analysis was the physiological and emotional experience. All 10 participants emphasized the importance of physiological and emotional experience during the classroom experience. The adult learners involved in the study declared how their feelings towards mathematics either enhanced or impaired their self-efficacy. The adult learners' physiological and emotional experiences were heightened when they had control over their emotions during the learning experience. During the interview, Maggie said "I'm not confident when it comes to math. I would say I'm nervous about it, but once I get a handle on it I'm good so that is it." Andy made known during the interview that

> I feel overwhelmed sometimes when doing math. I try my best not to feel so bored by asking questions and interacting with the students in the classroom.

The physiological and emotional state of the participants influenced their cognitive ability when they had no control over their feelings during the learning experience. Becky postulated

> I have struggled with math since I was in say elementary, middle, and high school. I try my best to enroll in math classes now, but I still want to wait until I finish other subjects before doing math. I guess I am not confident enough to face it head-on.

Physiological and Emotional Expressions

It was disclosed during the study that the stress and emotional reactions expressed by adult learners during the classroom experience are prevalent when performing mathematics calculations. Throughout the interview process, about 90% of the respondents stated that they exhibited some form of stress and emotional reaction during the learning process. Paul stated, "When I begin to feel nervous, I stay positive and take deep breaths in class so I can do the best that I can." A similar assertion was communicated by Becky when she mentioned

> When it comes to my belief in solving math questions, I get a little bit nervous, but I keep trying my best to answer the questions as I can. Sometimes my confidence goes up when I get a teacher who understands my style of learning. I like to ask questions so the teacher who dislikes questions makes me more nervous about math in general.

It was revealed through the study that adult learners had series of coping mechanism when encountering dealing with physiological and emotional expressions during the learning experience. The strategies exhibited by the adult learners ranged from taking deep breaths and periodic breaks. Paul postulated

> I would say I normally put my mind to everything I do and give it my all. When I feel nervous about being out of school for a while, I take deep breaths, so I don't panic.

He also went on to articulate how he take breaks from the classroom to use the restroom before returning to complete his mathematics problems. Similar assertions were made by Cindy when she communicated

> Being patient with myself is something that I do so when I feel anxiety, I take my time to take a break. I take time to relax and when I return to studying again, I gain new ideas. I build more confidence that helps me solve more mathematics problems.

Physiological and Emotional Outcomes

The study revealed that when adult learners acquire competence beliefs during the learning process, it heightened their interest in the learning process and subsequent proficiency in the subject matter. Amy made it known during the interview that "at first I feel anxious about taking a math course, but when I get the hang of the course later, I feel confident." Dan asserted

> I would have to feel the confidence in solving the question when yeah I can probably solve it, but sometimes I don't feel confident. If I don't feel confident, I'll probably just ask for help.

Based on the information gathered from the 10 participants, the perception of individual adult learners on mathematics anxiety and its influence on self-efficacy must be considered during the classroom experience. This study investigated the perception of individual adult learners on mathematics anxiety and its influence on their self-efficacy. All participants expressed that their physiological and emotional state has an influence on their performance during the classroom experience. During the interview, Becky stated "When I get frustrated with my homework, I cannot solve the questions. I keep trying and when, um, I still cannot solve, I go to my math app or wait until I go to class the next day."

It was also discovered through the study that both positive and negative stimuli influence the confidence of adult learners during the learning environment. Eight of the participants mentioned that both positive and negative stimuli influenced their confidence in solving mathematics problems during the classroom experience. Tom explained that

> I can't focus when I have too much going on. It makes me feel anxious and I just have to deal with it until I can solve it. When that happens, I don't understand the problem and I ask the teacher to explain. She doesn't stop until she breaks it down until I understand.

A similar assertion was made by Larry when he communicated that "I had anxiety about math at the beginning of the course, but I have boosted my ego and confidence. The more I study, the more I develop great learning skills so that is a great process. I am doing well at the moment. I couldn't do it better. My class participation is better now, and it is because of my confidence boost."

Verbal Persuasion

The second theme to emerge from the data analysis was the mastery experience. It was discovered through the study that adult learners build self-efficacy when they receive continuous verbal feedback on their performance. All the 10 participants hinted at the importance of the feedback received from both peers and teacher during the classroom experience. During the interview, Amy mentioned

> My classmates are a great source of encouragement in my current math class. I take other classes with them, so we know each other, and we cheer each other on during each class. When we cheer each other on, it forces us to complete our group work.

Larry also echoed a similar sentiment when he stated that feedback from his classmates helped build his self-confidence and self-efficacy. He mentioned that the encouragement from his group members during the learning process helps fuel him to keep on even when he is intimidated by a mathematics problem,

Verbal Feedback from Peers

The participants expressed that verbal praise and persuasion when done during a challenging mathematics task boosted their morale and eventual self-efficacy. Throughout the interview process, the participants constantly mentioned how their interactions with other classmates affected their learning outcomes. Larry mentioned during the interview that, “I boost my confidence by paying attention to the feedback from my peers. When my peers urge me on when I volunteer to work on the board, it boosts my ego to want to do it again next time.” When the feedback is not favorable to the adult learners during the learning experience, they become demoralized as depicted in the response given by Cindy,

> When a teacher points out that my work is wrong, it causes me to become discouraged. I

> then try to solve it myself first before asking for help. I keep on trying and when I eventually get it right, the teacher normally smiles or gives me a thumbs up which makes me feel good about what I am doing.

Maggie also communicated the influence of unfavorable feedback when solving mathematics problems. She asserted

> I feel confident when I try to solve math problems by myself. At times when people try to budge in while I am trying to do math problems, I'm just, it takes me out of my comfort zone especially when they get the problems wrong when helping me. Then I will feel lost and don't know what to do.

Verbal Feedback from Teachers

All 10 participants emphasized the value of continual praise and vocal encouragement from their educational practitioner during the classroom experience. The participants communicated that they were more receptive to the feedback of praise and positive criticism from an informed and knowledgeable individual such as their teacher. The feedback received from their teacher helps build their self-efficacy knowing that the source of the information is reliable. Amy mentioned that "when I receive those encouragements from my teacher, I feel good about myself. I work harder when I receive encouragements from those I respect." This assertion was also communicated by Paul when he mentioned,

> Feedback encourages me to perform better. It doesn't matter whether it comes from my teacher or classmates. When my teacher gives me encouragement on my classwork or homework, it makes me want to do more. I am always doing my best all the time so I can get positive feedback.

Regarding verbal and social persuasion from teachers, Larry mentioned that "words of

motivation from the teacher helps me stay focused in solving math problems. When my teacher says something positive, it boosts my confidence." Paul also postulated

> Feedback encourages me to perform better. When teachers give me the push I need for my classwork or homework, it makes me want to do more, do better you know?! I am always doing my best all the time too.

Outlier Data and Findings

Throughout the data collection, there was consistency in the information given by the individual adult learners. However, there was one major outlier found in the data collected for this study. Some students mentioned the use of technology as a tool for their vicarious experience. Instead of them solely relying on in-person observation of others during the learning experience, they resorted to using recorded lessons on their math apps and the internet among others. The outlier could be the subject matter of a future research study.

Observing Using Technology

Three students involved in the study mentioned the use of technology as a source of vicarious experience rather than solely depending on peers and teachers. These three participants built their capacity for effectively learning and acquiring new knowledge using YouTube, google searches, and math apps among others. Larry shared how he utilizes technology at home to help enhance his capacity for effective learning. He communicated "I also get help from the internet when I have to do my homework. I watch others do similar problems and use their example to do mine.: The same assertion was made by Becky when she stated, "When I get frustrated with my homework and I cannot solve it, I go to my math app or wait until I go to class the next day." Cindy was another student who utilized technology during her learning experience. She expressed "I use google to find videos to help me out when I cannot find any other help in

solving math problems."

Research Question Responses

This transcendental phenomenological research study took into consideration one central research question and three sub-research questions. These questions served as a guide in understanding the nature of the perceived influence of mathematics anxiety among adult learners at a Technical College in Georgia. The themes and sub-themes collated during the data analysis period assisted in providing pertinent responses to the research questions. This section will be used to provide an overview of the direct and short narrative answers to the central research question and the three sub-research questions using the themes developed in the previous section.

Central Research Question

What is the perceived influence of math anxiety on adult learners at a technical college in Georgia? All the participants had interesting stories about their perception of the influence of math anxiety on their self-efficacy. The adult learners attested to experiencing some form of mathematics anxiety during the classroom experience. Experiences exhibited by the participants run parallel to one of Bandura's (1997) derivations of the theory of self-efficacy - vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion. First and foremost, the experiences that matched the individual adult learners' ability to observe others perform a mathematical task are discussed. Overall, the adult learners' perception of the vicarious experience is that while they may encounter challenges and apprehensions during the learning process, being able to see their classmates solve a problem builds their self-confidence and subsequent self-efficacy. Adult learners perceived peer-to-peer interaction as an important factor when it comes to their mathematics anxiety and self-efficacy. Dan said,

I would have to say when I feel nervous, I sit and wait and listen to see if the teacher will

explain it. When she takes time to explain, I feel confident in myself. Sometimes I watch my peers answer math questions which makes me feel I can do it as well.

While Maggie communicated, “I feel confident when I try to solve math problems by myself. At times when people try to budge in while I am trying to do math problems, I'm just, it takes me out of my comfort zone especially when they get the problems wrong when helping me. Then I will feel lost and don’t know what to do.” However, the individual adult participants had a consensus that vicarious experience influenced their math anxiety which affected their self-efficacy. That assertion can be supported by Tom’s response that he performs better during the learning process when he obtains one-on-one assistance from the teacher. It goes on to confirm that adult learners also perceived teacher interaction as integral regarding their mathematics anxiety and its influence on their self-efficacy.

Secondly, the experiences that matched the individual adult learners’ ability to successfully perform a mathematics task from beginning to end are discussed. Regarding the mastery experience, eight out of the entire participants perceived that their ability to successfully perform a mathematics task from beginning to end influenced their mathematics anxiety on their self-efficacy. Adult learners’ ability to successfully solve mathematics problems heightened their confidence and subsequently built their self-efficacy. Paul communicated that “I have to know my math, like measurements and stuff. I use the measurements skill every day so when I apply what I know in the classroom to solve a math problem, I become self-confident.” He mentioned that since he is a barber’s apprentice, he mixes chemicals used to color hair. The lessons he acquired through his apprenticeship came in handy during the classroom experience. Conversely, when adult learners struggle during the learning process, it has a toll on their self-efficacy as mentioned by Becky “When I get frustrated with my homework, I cannot solve the questions. I

keep trying and when, um, I still cannot solve, I go to my math app or wait until I go to class the next day." She mentioned that her persistence always paid off in helping her overcome her lack of self-confidence.

Thirdly, the experiences that matched the individual adult learners' ability to control their physical and emotional states during the learning period are discussed. All the participants agreed that physiological and emotional experiences had an influence on their self-efficacy during the learning experience. Dan mentioned that "I would have to feel the confidence in solving the question when yeah I can probably solve it, but sometimes I don't feel confident. If I don't feel confident, I'll probably just ask for help." A similar assertion was made by Tom when he communicated, "I have too much going on, you know, and I just can't focus. I just have to deal with it until it all falls into place at times. If I am trying to solve a problem, something I don't understand and I ask, she doesn't stop until she breaks it down till I understand." Adult learners' absence from formal education for a long time was a cause of pressure and stress during the learning process. Andy stated, "I have been out of school for a while now so I am struggling with math right now. The stress and emotional reactions expressed by the participants during the classroom experience were prevalent when performing mathematics calculations. Tom stated

> When I come across a math problem that I can't solve, I get upset, but I just put down everything for a while. I go back to it later on. When I return to solving the math problems it all falls in place and I can solve it.

Educational practitioners who created a conducive setting for the learning environment, such as giving previews for the next mathematics topic to be covered in class, helped adult learners develop a healthy perspective about future endeavors. The absence of uncertainties about future

mathematics topics for the learning process enabled the adult learner to build self-efficacy. Amy communicated that

> When I am nervous about a math course, I um look at the syllabus to find out the main topics that will be covered in the class. I then go ahead and start studying those topics ahead of time. It gives me a leg up in the game.

Finally, the experiences that matched the individual adult learners' ability to boost their morale and eventual self-efficacy through feedback are discussed. Verbal praise and persuasion during a challenging mathematics task boosted the morale and eventual self-efficacy of the adult learners. Based on their lived experiences, Amy mentioned

> My classmates are a great encouragement in the um in my current math class. I take other classes with them, so we pretty much know each other. When I receive those encouragements, I feel good about myself, and makes me want to work harder. When they don't understand something, I take my time to encourage them also. I say something nice to motivate them to help them solve their math problems.

During the interview, Paul revealed "Feedback encourages me to perform better. When teachers give me the push I need for my classwork or homework, it makes me want to do more, do better you know?! I am always doing my best all the time too." Larry described how the cheers from his classmates and classroom teacher influenced mathematics anxiety on his self-efficacy. He recounted that "words of motivation from the teacher helps me stay focused in solving math problems. When my teacher says something positive, it boosts my confidence."

Sub-Question 1

How do adult learners enrolled in mathematics classes in a technical college in Georgia perceive their ability in solving mathematics problems during the learning experience? The study

participants perceived that their ability to solve mathematics problems is synonymous with their capability to observe others perform a mathematical task, their capability to successfully perform a mathematics task from beginning to end, their capability to control their physical and emotional states during the learning period, and their capacity to boost their morale and eventual self-efficacy through feedback and verbal persuasion. The participants experience these constructs through their interactions and feedback from others, their emotional state, and their influence on their self-efficacy in solving mathematics problems during the classroom experience. The adult learners interviewed for the study shared similar lived experiences. All the 10 participants were self-declared mathematics-anxious adult learners.

Most of the participants mentioned that they can follow the examples of both the teacher and peers in solving their mathematics problems. Adult learners involved with the study communicated that working with teachers and peers enabled them to see things from others' perspectives so they could replicate their examples later. Amy explained,

> My classmates are a great encouragement in the, um, in my current math class. I take other, other classes with them, so we pretty much know each other. When they don't understand something, I try my best to um explain it to them. They also try to help me with math problems I don't understand. When I receive these encouragements, I feel good about myself.

Tom seconded this course of action with his teacher when he stated,

> I watch my teacher work the problems on the board while I take notes. When I do not understand, I look up to the teacher for answers. When my teacher explains things, she takes her time and explains things to me two or three times and I eventually get it.

The participants also explained how they strive to successfully perform a mathematics task from beginning to end. According to the participants, their ability to successfully perform a mathematics task from beginning to end influenced their mathematics anxiety on their self-efficacy. Paul made a statement about how his ability to successfully solve mathematics problems heightened his confidence and helped build his self-efficacy. He mentioned,

> I have to know my math, like measurements and stuff. I use the measurements skill every day so when I apply what I know in the classroom to solve a math problem, I become self-confident.

Regarding the adult learners' capability to control their physical and emotional states during the learning period, Dan mentioned that,

> I would have to feel the confidence in solving the question when yeah I can probably solve it, but sometimes I don't feel confident. If I don't feel confident, I'll probably just ask for help."

All the participants knew the importance and influence of their capacity to boost their morale and eventual self-efficacy through feedback and verbal persuasion. Paul communicated that "Feedback encourages me to perform better. When teachers give me the push I need for my classwork or homework, it makes me want to do more, do better you know?! I am always doing my best all the time too."

Sub-Question 2

What influences do adult learners perceive as contributing to their ability or inability to solve mathematics problems? The adult learners involved in the study mentioned how their ability or inability to observe others perform a mathematical task, successfully perform a mathematics task from beginning to end, control their physical and emotional states during the

learning period, and their capacity to boost their morale and eventual self-efficacy through feedback and verbal persuasion all influence their self-efficacy. Several influences were perceived as contributing to the ability of adult learners to solve mathematics problems. Concerning adult learners' ability and inability to observe others perform mathematics problems during the classroom experience, the more they can observe others during the learning experience the more they build their self-efficacy. Beth stated during her interview that “when I don’t understand a math problem, I watch the teacher explain or watch some website or whatever until I understand the problem and can solve the problem.” She also went on to say, “I practice by watching my classmates and they also tell me to correct my work.” Regarding adult learners’ ability to successfully perform a mathematics task from beginning to end, the more they succeed, the more their confidence is heightened which builds their self-confidence. Paul revealed during the interview that “I have to know my math, like measurements and stuff. I use the measurements skill every day so when I apply what I know in the classroom to solve a math problem, I become self-confident.” A similar sentiment was conveyed by Andy when he mentioned,

> When I stop practicing, I feel nervous, so I keep practicing. Practicing helps me build confidence sometimes. When I build my confidence, I can solve the math problems by myself.

Sub-Question 3

How does perceived mathematics difficulty influence the confidence of adult learners during the learning process? Based on the information gathered from the participants, the perceived mathematics difficulty influenced the confidence of the adult learners during the learning process and even prevented them from staying in school. The adult learners who

struggled with computational skills perceived themselves to have mathematics difficulties. Beth recounted, “sometimes I find it difficult in solving math problems. I have to take time and practice which helps a lot, yes.” Dan also mentioned,

> Sometimes I need the confidence to solve the questions on the board. If I don’t feel confident, I will definitely ask the teacher to help me solve it. She always tells us to raise our hands and call her to come help. The last time I called her, she came over to help me solve it. It boosted my self-confidence.

Some adult learners also stated that they have dreaded and avoided mathematics. This phenomenon created a lack of effort and motivation in pursuing both academic and career goals. Dan mentioned during his interview “I have struggled with math since elementary school. I didn’t want to do welding because of math. I have to know measurements in welding, so I guess I have to take math seriously.” This assertion was seconded by Andy when he disclosed,

> I stopped out to work and take care of my family. Math was another reason why. I am not good at math. I didn’t like school and had to wait this long to come back to get a diploma. I have forgotten, um, most of the things I learned about math during grade school. I find it difficult in my math class because I must play catch-up.

Those adult learners who lacked mathematics confidence doubted their abilities which caused them to be passive, play catch-up, or give up during the learning process. Dan stated that sometimes he had to “sit, wait, and listen to see, but if I don’t get something maybe they will explain it and if they don’t, they don’t.” Tom mentioned that “my weakness makes me play catch with the others because I know to go along with the others.”

Summary

The purpose of this phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. This chapter explained a detailed account of the perceived influence of mathematics anxiety on self-efficacy among adult learners currently enrolled in a mathematics course. The information presented was gathered from the analysis of data collected through interviews, observations, and a review of pertinent documents. The 10 participants reflected on lived experiences and perceptions of the influence of mathematics anxiety on their self-efficacies. While each of the participants was unique in their way, they all shared similar commonalities. They all knew the careers they wanted to pursue upon graduation, they were intrinsically motivated, and driven by emotions. Four major themes and 12 sub-themes were revealed after the data analysis. The four major themes revealed from this study were vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion. The sub-themes revealed from the vicarious experience were (a) observation of peers, (b) observation of teachers, and (c) observation of both teachers and peers online. The sub-themes revealed from the mastery experience were (a) skills acquisition, (b) task difficulty (c) achievement levels. The sub-themes revealed from the physiological and emotional experience were (a) adult learner emotions, (b) stress management, and (c) emotional outcomes. There was an outlier regarding information about the use of technology as a tool for learning that was not consistent with all the participants involved in the transcendental phenomenology study but was worth mentioning. The data obtained from the study was used to answer the central question: What is the perceived influence of math anxiety on adult learners at a technical college in Georgia? The following chapter will be used to interpret the findings obtained through this phenomenological study.

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this transcendental phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. The reason for Chapter Five is to interpret and discuss the findings of this phenomenological study by summarizing the various developed themes obtained from the data analysis. The chapter will also be used to discuss the implications of the study for policy and practice. Then, the theoretical and methodological implications of the findings will be discussed. Next, the limitations and delimitations of the study will be discussed. This chapter will conclude with the recommendations for future research.

Discussion

A phenomenological study is carried out to discover the perceived influence of mathematics anxiety on self-efficacy among the 10 adult learners. A transcendental phenomenological approach is used due to the shared lived experiences of the participants (Bandura 1977; Redmond, 2010). The aim is to gain a deeper understanding of how adult learners perceive the influence of mathematics anxiety on their self-efficacy during the classroom experience. The theory of self-efficacy (Bandura, 1977) is utilized for this study. Bandura's (1977) theory of self-efficacy postulates that learners develop their self-efficacy beliefs through the execution of a series of actions while dealing with diverse situations. This section of Chapter Five is to discuss the interpretation of the findings, and the implications for policy or practice, as well as examine the theoretical and empirical implications of the study. The recommendations for future research are also discussed.

Interpretation of Findings

The purpose of this transcendental phenomenological study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. Data was collected through interviews, observations, and a review of pertinent documents. Saldana's (2021) procedure for in-vivo coding and Moustaka's (1994) process of phenomenological reduction was used to examine, confirm, and manage the patterns observed in the data. The codes derived from the data analysis were used to form themes to characterize the perceptions and the lived experiences of the participants. The four themes that emerged from this study were vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion. The sub-themes developed from the vicarious experience were (a) observation of peers, (b) observation of teachers, and (c) observation of both teachers and peers online. Regarding the mastery experience, the sub-themes generated were (a) skills acquisition, (b) task difficulty (c) achievement levels. With the theme of physiological and emotional experience, the sub-themes were (a) adult learner emotions, (b) stress management, and (c) emotional outcomes.

Summary of Thematic Findings

Vicarious experience is the first theme that emerged during the data analysis process. The vicarious experience is based on an individual adult learner's ability to observe others perform a mathematical task during the learning process (Bandura, 1997; Hendral & Hidayati, 2023). Education practitioners may initiate classroom interactions by solving a problem on the whiteboard for students to observe, copy, or emulate how to solve mathematics problems. Teachers can also scaffold by gradually removing guidance and support during the learning process (Bandura, 1997). Adult learners can also observe their peers during the classroom

experience (Bandura, 1977; Desender & Sasanguie, 2022) to learn how to solve mathematics problems. Three sub-themes evolved from the vicarious experience: observing peers in class, observing teachers in class, and observing others using technology. Based on the shared lived experiences of all the 10 participants, it was confirmed that individual adult learners can observe others perform a mathematical task during the learning process. Seventy percent of the participants could replicate what is being performed and build their self-efficacy. During the interview, Beth explained that she watched and practiced with her classmates during the classroom experience. She also mentioned that when she misunderstood a concept, she asked questions for her teacher to explain or sometimes resorted to the internet for help. Tom also stated that he watched the teacher work on the whiteboard and take notes he used to solve mathematics problems later.

The second theme that emerged from the data analysis was the mastery experience. Mastery experiences deal with the adult learners' ability to successfully perform a task from beginning to end (Redmond, 2010). The findings revealed that sixty percent of the adult learners perceived their capacity to recall prior information and apply it to a new concept during the learning process enhanced their self-confidence and boosted their self-efficacies. During the interview, Beth mentioned that even though she is a self-declared mathematics-anxious adult learner, she gave an account of how she learned the multiplication table in grade school and its positive impact on her current performance in mathematics courses. Beth communicated that her recollection of multiplication facts enabled her to obtain new knowledge and build self-efficacy. In the same light, Paul mentioned how his confidence in topics like geometry and measurement stems from his daily use at his place of work. He stated that his self-confidence and subsequent self-efficacy were heightened due to his ability to solve problems related to those topics. Andy

asserted that constant practicing through solving mathematics problems prevented him from being nervous. He said that practicing mathematics problems built his self-confidence and eventual self-efficacy.

Physiological and emotional experience was the third theme that emerged during the data analysis. The physiological and emotional experience deals with an adult student's ability to control their physical and emotional states during the classroom experience (Bandura, 1997; Zhang & Ardasheva, 2019). Eighty percent of the participants perceived that their physical, emotional, and psychological state contributed to their ability to perform assigned tasks. This phenomenon had a direct influence on their self-efficacy. Stimuli that are not favorable to an outcome will generate discouragement in the adult learner and eventually lead to attrition if not prevented. Larry indicated that he had anxiety about mathematics at the commencement of his current course. He went on to disclose that through persistent practice, he had been able to boost his confidence and subsequent self-efficacy. He also mentioned that he had developed great learning skills through the process. It was observed through the study that when education practitioners remove uncertainties about future mathematics topics, it enables the adult learner to become less anxious and build self-efficacy in the process. Certainty can be achieved through the distribution of the course syllabus before the beginning of the class. Amy stated that when she gets nervous and feels insecure about a mathematics course, she refers to the syllabus for that particular class. Her knowledge of the sequence of topics to be covered enables her to stay ahead of the game by studying before they are introduced in class. The constant reference of the syllabus according to her builds self-confidence and eventually her self-efficacy.

The fourth theme that emerged from the data analysis was the verbal persuasion experience. Verbal praise and persuasion when done during a challenging mathematics task can

boost the morale and eventual self-efficacy of the adult learner (Bandura, 1977). During the interview, Larry commented that he boosted his confidence by paying rapt attention to the feedback given by his peers. He stated that the cheers received from his classmates made him want to volunteer to work on the board even more. This initiative taken by Larry helped boost his ego to want to do it again the next time. Based on Bandura (1977), educational practitioners must make it a habit to give continual praise and vocal encouragement to their students due to their self-efficacy. Feedback given by teachers to adult learners builds their self-efficacy knowing that the source of the information is reliable (Mammarella et al., 2015; Palestro & Jameson, 2020). Seventy percent of the participants echoed this sentiment. One of such participants was Paul. He stated that feedback encouraged him to perform better during the learning experience. He went on to state that when he receives feedback on both his classwork and homework from his teacher, it makes him want to do more so he can receive more positive feedback.

Prior Knowledge Reinforcement. The participants were motivated to utilize their prior knowledge in answering arithmetical computations during the classroom experience. For instance, Larry's relationship with mathematics courses was intermittent. He tried to curb his self-doubt in solving mathematics by referencing his pre-existing knowledge in a group setting. The ability of adult learners to apply their prior knowledge to new situations and their self-efficacy are directly related as depicted by Beth. She had been using the multiplication facts she learned in grade school to solve mathematics problems during her adult years. She was confident in using that prior knowledge to work faster in reaching the desired outcome during the learning process. It was also discovered that those who struggled with mathematics anxiety were those who had forgotten the prior knowledge necessary for success in their current mathematics topic. Andy stopped out of school and found it challenging to grasp new information in the

mathematics classroom due to playing catch-up with basic mathematics skills. It is therefore imperative that education practitioners incorporate ample prior knowledge into their lesson planning to enhance adult learners, learning experience.

Scaffolding and Practicing Events. All the participants agreed that they appreciated the help of the teacher in one way or another during the learning experience. The scaffolding provided by the mathematics teacher was even more appreciated when done according to the pace of the adult learner. Tom explained how he appreciated teachers who went out of their way to explain mathematics concepts to him several times until he could solve those problems himself. He was even more appreciative since he was not the only one in the class but could receive such one-on-one attention from the teacher. He also stated that such activities help build his self-efficacy. On the contrary, when teachers do not provide the necessary support needed for adult learners to master the content, they get discouraged which takes a toll on their self-efficacy. Dan stated how his self-confidence takes a dip and gets disappointed when a teacher does not explain a mathematics concept to his `best understanding. Adult learners also build their self-efficacy through group work activities. Larry mentioned that his self-confidence heights when a group member in his current mathematics class explains and breaks down mathematics concepts for him to understand.

Constant Positive Feedback. All the adult learners involved in the study appreciated feedback from both their teachers and peers. Beth was one adult learner who resonated with this assertion. She stated that feedback from her teacher and peers are contributing factors to her self-efficacy during the classroom experience. She was with the notion that waiting until the last minute to solicit feedback was detrimental to her self-confidence in solving mathematics problems. Larry shared the same sentiments regarding timely feedback during the learning

process. He concluded that the words of encouragement from his teacher and peers in his group in the classroom setting helped him persist regardless of how intimidated he was with mathematics problems. He obtained higher self-efficacy when he independently solved mathematics problems on his own as a result. Teachers must ensure that they give ample positive feedback to their students and seek to encourage their students to emulate that gesture among themselves.

Emotional Management Skills. All the 10 adult learners interviewed for the study had at least one form of emotional management skill they resort to when they are faced with mathematics anxiety. These emotional management skills range from taking breaks to finding resources from other avenues to solve mathematics problems. Adult learners who take the initiative to find resourceful management skills to help control their physiological and emotional states tend to build self-efficacy. Becky explained how her practicing helps her cope with her mathematics anxiety. She mentioned when an education specialist used her preferred learning style to teach during the classroom experience, her self-efficacy heightened. Some of the students prefer to take the initiative in solving the mathematics problems on their own before asking for help. Maggie mentioned how she took the initiative to solve problems by herself. She preferred to work on her own first before asking for help from her teacher and peers. She also preferred a quiet environment when working on mathematics problems since it helped calm her nerves down. Adult learners who took periodic breaks from the learning environment improved their self-efficacy. Tom stated how his intermittent breaks allowed him to step back from the monotonous and overwhelming effects of mathematics anxiety. The breaks according to him made him feel guilty as they appeared to give the impression that he was quitting. On the

contrary, those breaks caused him to tackle the mathematics problems from a different perspective. The self-efficacy and self-confidence boost stemmed from the intermittent breaks.

Implication for Policy and Practice

The findings from this research revealed the perceived influence of mathematics anxiety on self-efficacy among adult learners. Results from this study may be used by policymakers or implemented in the classroom by various education practitioners to enhance the learning experience, especially for adult learners. The data collected from the 10 participants revealed that adult learners have a perception of the influence of mathematics anxiety on their self-efficacy through their vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion.

Implication for Policy

Adult education practitioners in various schools and institutions play an important role in educating their students. Both experienced and novice educators need to be informed of the policies that exist in strategically addressing educational problems existing in the educational field. This will help in keeping up with the emerging policies as well. The information obtained through this study can be used by policymakers in evaluating, strategizing, and adopting policies on mathematics anxiety and self-efficacy among adult learners. Adult education schools and institutions should be required to conduct periodic professional learning community meetings where educators collaborate> The collaboration must focus on action plans and best practices centered around the influence of mathematics anxiety on adult learners. Educators must share knowledge about best practices such as scaffolding, curriculum and assessment design and implementation, and student emotion management strategies. Teachers must be able to scan a classroom and observe when to take breaks so students can rest. Educators must be trained on

when to introduce information while practicing the gradual release of responsibility to the adult learner.

Implication for Practice

Heads of schools and institutions may implement regular training at their local establishments. School administrators should invite individuals with expertise in adult education to train their faculty and staff. Teachers must receive bi-weekly training on how to break down mathematics facts and concepts to adult learners to the best of their abilities. The educators may also incorporate group work activities and project-based learning to encourage collaboration among adult learners. Education practitioners must know when to introduce a mathematics concept, work together with the class on the concept, and then break the class up into small groups so they can work collaboratively. Psychologists may be invited into various institutions to train teachers on how to give constructive feedback to adult learners. Educators of adult learners must be trained on how to assess the emotional state of the students in pacing their lesson delivery. The educational practitioner may need to know when intermittent breaks are needed during the learning process. Collaborative lesson planning should also be encouraged among the mathematics department to ensure proper vertical and horizontal alignment of the curriculum. This will help teachers review the prior depth of knowledge needed for a certain mathematics content.

Theoretical and Empirical Implications

The results obtained from this phenomenological study support the theoretical framework that formed the basis for the study and the background context through the literature review. Theoretically, the results of the study support the guiding theory of the research study. The theory of self-efficacy introduced by Albert Bandura explains how learners develop their self-

efficacy beliefs by executing a series of actions while dealing with diverse situations. This study can be used to advance the knowledge of how adult learners develop their self-efficacy beliefs through physiological and emotional, vicarious, mastery, and verbal persuasion experiences while dealing with mathematics anxiety. Empirically, the results of the study show the pragmatic result of the works of Pérez-Fuentes et al. (2020), Richardson et al. (2012), and Snyder & Cudney (2017) which mentioned that adult learners can modify their behaviors to curtail the influence of mathematics anxiety on self-efficacy. Their work also mentioned that teachers need to be properly trained to identify students who are struggling with mathematics anxiety during the classroom experience which resonated with the findings of this study. The following sections will be used to expound on these postulations.

Theoretical Implications

This study was inspired by the theory of self-efficacy (Bandura, 1977). The theory of self-efficacy introduced by Albert Bandura explains how learners develop their self-efficacy beliefs by executing a series of actions while dealing with diverse situations. Bandura (1997) mentioned that self-efficacy can be formulated through four main derivations. These derivations are vicarious experience, mastery experience, physiological and emotional experience, and verbal persuasion (Redmond, 2010). Vicarious experiences are based on an individual adult learner's ability to observe others perform a mathematical task during the learning process (Bandura, 1997; Hendral & Hidayati, 2023). In sharing their common experiences, the 10 participants stated that their ability to observe others perform mathematics problems influenced their self-efficacy. The participants mentioned that their self-efficacy heightens when they observe their teacher and peers successfully solve mathematics problems. The process helps adult learners struggling with mathematics anxiety replicate the steps used by others in solving

their mathematics problems later. This confirmed the vicarious experience postulated by Bandura (1977).

Mastery experience of the theory of self-efficacy takes into consideration the various experiences encountered by adult learners during the learning process that lead to proficiency in a subject matter (Bandura, 1997: Desender & Sasanguie, 2022). The participants who show the willingness to practice mathematics problems over a long period, can apply prior knowledge to new situations, and use those mathematics skills in their current professions exhibited mastery in the subject matter. Those adult learners show a higher level of engagement which influences their self-efficacy. These support the mastery experience element of Bandura's (1977) mastery experience.

Adult learners also build self-efficacy when they receive continuous verbal feedback on their performance (Bandura, 1977). Bandura (1997) stated that social persuasive performance deals with giving feedback to individuals about their performance. This study confirmed that the self-efficacy of adult learners hinges upon the verbal feedback received during the classroom experience. In sharing their common lived experience, the participants mentioned how their self-efficacy increased through the feedback of both their teacher and peers. Some of the participants perform at their utmost potential to garner that feedback during the learning process. These occurrences confirmed that verbal feedback influences the self-efficacy of the adult learner during the classroom experience.

The physiological and emotional experience deals with an adult student's ability to control their physical and emotional states during the classroom experience (Bandura, 1997; Zhang & Ardasheva, 2019). The stress and emotional reactions expressed by adult learners during the classroom experience are prevalent when performing mathematics calculations

(Anderson Stone, 2018; Ansari et al., 2011; Bandura, 1997; Cribbs et al., 2021). All 10 participants mentioned the influence of their emotions on their ability to solve mathematics problems. They mentioned that when they experience a feeling of tension during mathematics calculations, they sometimes take a break among other emotional management strategies. This confirms how the physiological and emotional state of adult learners influences their self-efficacy. The findings of this study reinforce Bandura's (1977) physiological and emotional elements of the self-efficacy theory.

Empirical Implications

Mathematics anxiety is a phenomenon that is experienced globally (Li et al., 2021). Due to this, there have been numerous studies conducted into the anomaly (Pérez-Fuentes et al., 2020; Richardson et al., 2012; Snyder & Cudney, 2017). These researchers mentioned that students can modify their behaviors to curtail the anomaly. All 10 participants had a coping mechanism to curtail the physiological and emotional experiences they went through during the learning experience. Some of the students took breaks during challenging mathematics problem-solving encounters. Others asked for help from their teacher and peers. These conditions confirmed the published work of Pérez-Fuentes et al. (2020) which asserted that adult learners resort to coping mechanisms when faced with challenging situations during the learning process. Guzmán et al. (2023) also stated that teachers need to be properly trained to identify students who are struggling with mathematics anxiety during the classroom experience. The participants shared that the verbal feedback from their teacher helped build their self-efficacy. Some of the participants also stated that they preferred working in group settings so they could receive cheers from their peers in solving mathematics problems during the classroom experience. This confirmed the postulation made by Guzmán et al. (2023) that teachers who can identify adult

learners who need motivation through verbal feedback increase their self-efficacy.

The more students can solve problems successfully during the learning process, the higher the students' self-efficacy (Amponsah, 2020; Desender & Sasanguie, 2022; Gom, 2009; Jiang et al., 2021). The context is also applicable to adult learners engaged in learning new concepts in mathematics (Amponsah, 2020). Results from the research study showed that the self-efficacy of adult learners increases with an increase in mastery experience. Adult learners who were able to solve mathematics problems on their own or with the help of their teacher or peers increased their self-efficacy. This scenario was asserted by the 10 participants involved in the study. The prior knowledge acquired by the adult learner must align with the current information being disseminated (Desender & Sasanguie, 2022). Findings from the research study revealed that adult learners who had a prior knowledge recollection of the current mathematics topic performed better and increased their self-efficacy. This also confirmed the published works of Bandura (1977) regarding the mastery experience of the self-efficacy theory.

Limitations and Delimitations

As in the case of any research study, some limitations and delimitations need to be mentioned and addressed. The constraints and weaknesses mentioned in this section could not be controlled during the entirety of the research study. In the same light, there were some purposeful decisions made regarding the scope and focus of the study. The limitations of this study included the geographic location, design and analysis, and ethnicity of the participants. Delimitations of this study included the choice of participants, choice of theoretical framework, and methodological selection.

Limitations

One limitation observed during this study was the location selected for the research. The participants considered for this study were made up of adult learners enrolled in a mathematics course at a technical college in Georgia. Also, even though the 10 participants were made up of males and females, their social and ethnic backgrounds were limited. This is because the technical college selected for the study was in an urban population geographical area. There were seven African Americans, two Hispanics, and one Caucasian involved in the research study. Another limitation was the design and analysis. There was no control over the responses given by the 10 participants involved in the study. Their responses were taken at face value and used for the data analysis.

Delimitations

The participants were required to be struggling with mathematics anxiety and self-declared as mathematics-anxious adult learners. This was to ensure that all the 10 participants had a common shared lived experience (Moustakas, 1994). Due to this delimitation, all the participants satisfied the requirement for the phenomenon under study. Furthermore, the 10 mathematics-anxious participants were supposed to be at least 18 years of age. This is because the study was designed with adult learners as the focus. A transcendental phenomenology was utilized since it centered around the shared lived experiences of the participants and the description of their observations (Moustakas, 1994). The theory of self-efficacy introduced by Albert Bandura which explains how learners develop their self-efficacy beliefs by executing a series of actions while dealing with diverse situations served as the guide for this study. The four main elements of the theory of self-efficacy viz: vicarious experience, mastery experience,

physiological and emotional experience, as well as the verbal persuasion experience were used to direct the study.

Recommendations for Future Research

The recommendations for future study were based on the study findings, limitations, and delimitations placed on this study. The suggestions given in this section will help continue and expand this research. This study focused on the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. First, the recommendations for future study based on the findings will be discussed followed by the recommendations for the limitations and delimitations. The participants used for the research were selected from adult learners enrolled in a mathematics course at a technical college. The same study can be conducted using adult learners enrolled in a mathematics course at the university level.

Also, instead of using a qualitative methodology, a quantitative approach may be used to help compare the findings of the respective methodologies. A case study may be conducted to describe how adult learners interact with their teachers, peers, and technology during the learning experience through a scheduled mathematics class session. The participants admitted that verbal persuasion influenced their self-efficacy when it came to mathematics anxiety. Ground theory research may be conducted to inquire about the influence of verbal persuasion on self-efficacy in a mathematics classroom. The theory generated will be used to show the importance of verbal persuasion in mathematics classes. Other theories such as constructivism and the theory of departure may be used to replicate this study.

Regarding the limitations of the study, a technical college at a geographical location with more diversity may be considered for a similar study. As mentioned earlier, a quantitative design and analysis may be used to contrast with the result of this study. The following

recommendations for future study are suggested for the delimitation mentioned above. The 10 mathematics-anxious participants were supposed to be at least 18 years of age. Another study can be conducted for students at the grade school level. Children enrolled in elementary, middle, and secondary schools experience mathematics anxiety during the classroom experience (Everingham et al., 2017; Gabriel et al., 2020)). The results from that study can be used to draw parallels with this study.

Conclusion

Mathematics anxiety has been the subject of study among educational practitioners since the 1950s (Aldrup et al., 2020; Lau et al., 2022; Passolunghi et al., 2020). Several qualitative research conducted indicates that there is a direct relationship between mathematics anxiety and self-efficacy among students from diverse backgrounds including adult learners (Ilhan, 2020; Lau et al., 2022; Hendral & Hidayati, 2023). The influence of mathematics anxiety on self-efficacy has been prevalent among adult learners (Hiller et al., 2022; Hossjer et al., 2022; Lau et al., 2022). This phenomenon has prevented adult learners from pursuing careers in the science, technology, engineering, and mathematics fields (Gabriel et al., 2020). Adult learners also gear off from taking a mathematics-based college course and possess low self-esteem and self-efficacy (Guzman et al., 2023; Huang et al., 2019).

This research study was unique because it utilized the qualitative research approach to explore the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia. Paying attention to the participants involved in the research study described their common lived experiences about mathematics anxiety provided a greater insight into their self-efficacy during the classroom experience. This study employed the transcendental phenomenological reduction and procedures postulated by Moustakas (1994) to organize and

analyze the data collected to arrive at three themes. The three themes that emerged from the study were vicarious, mastery, physiological and emotional, and verbal persuasion experiences. The participants revealed that the influence of mathematics anxiety on their self-efficacy stemmed from the absence of factors such as prior knowledge of course content, lack of positive feedback from teachers and peers, deficiency in emotional management skills, and inability to observe and replicate how others solve mathematics problems.

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Appendices

Appendix A

Liberty University IRB Exemption Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

February 8, 2024

George Ofosu-Anim
Jonathan Bracewell

Re: IRB Exemption - IRB-FY23-24-1107 The Perceived Influence of Mathematics Anxiety on Self-Efficacy among Adult Learners at a Technical College in Georgia: A Phenomenological Study

Dear George Ofosu-Anim, Jonathan Bracewell,

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

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

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

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

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

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at [redacted]

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

Appendix B

Permission Request Letter for Research Site

Permission Request Letter for Research Site

Dear Sir/Madam,

As a graduate student in the Department of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The title of my study is "The Perceived Influence of Mathematics Anxiety on Self-Efficacy among Adult Learners at a Technical College in Georgia: A Phenomenological Study." The purpose of the project is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia.

I am writing to request your permission to either directly contact adult learners who are currently enrolled in a mathematics class in your department, or kindly forward my attached participants' recruitment letter on my behalf to such adult learners who are interested and are willing to grant permission to be involved in my study.

Participants will be asked to take part in an in-person or a Zoom, audio-recorded interview. It should take approximately 30 minutes to complete the procedure listed. A total of 10 participants and observations will be needed for this study. Participants will have the opportunity to review the transcripts of the interview questions within a week of the interview for any possible errors or to provide additional information when and if needed. The review will take approximately 15 to 20 minutes to complete and would request it be completed within two days upon receipt. Copies of current lesson plans, curriculum, and assessment samples will be requested for analysis as part of the study. The data will be used to form codes and themes that will help in answering the research question. The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records. Participant responses will be kept confidential by replacing names with pseudonyms. Interviews will be conducted in a location where others will not easily overhear the conversation.

Participants will be presented with informed consent information prior to participating. Taking part in this study is completely voluntary, and participants are welcome to discontinue participation at any time. Participants will receive a $25 Visa gift card as compensation upon completion of the interview.

Thank you for considering my request. If you choose to grant permission, respond by email to [redacted]A permission letter document is attached for your convenience.

Sincerely,

George Asare Ofosu-Anim

Doctoral Candidate, Liberty University School of Education

Appendix C

Site Approval Letter

Site Approval

February 1. 2024

[redacted]
Vice President Adult Education
[redacted]

Dear George Asare Ofosu-Anim:

After careful review of your research proposal entitled The Perceived Influence of Mathematics Anxiety on Self-Efficacy among Adult Learners at a Technical College in Georgia: A Phenomenological Study, I have decided to grant you permission to contact our students and invite them to participate in your study and access copies of current lesson plans, curriculum, and assessment samples for your research.

Check the following boxes, as applicable:

☒ I grant permission for George Asare Ofosu-Anim to contact adult learners to invite them to participate in his research study.

☒ I will provide copies of current lesson plans, curriculum, and assessment samples to George Asare Ofosu-Anim to use for his research study.

☒ I am requesting a copy of the results upon study completion and/or publication.

Sincerely,

[redacted]
Vice President Adult Education
[redacted]

Appendix D

Participants' Recruitment Verbal Letter

Participants' Verbal Recruitment Letter

Hello Potential Participant,

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of my research study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia, and if you meet my participant criteria and are interested, I would like to invite you to join my study.

Participants must be 18 years of age or older and currently enrolled in a mathematics class at a technical college in Georgia. Participants, if willing, will be asked to answer open-ended questions on their perceived influence of mathematics anxiety on their self-efficacy in their respective mathematics classes. This will be in either an in-person or Zoom interview format, and all interviews will be audio- and video-recorded. It should take approximately 30 minutes. Participants will have the opportunity to review the transcripts of the interview questions within a week of the interview for any possible errors or to provide additional information when and if needed. The review will take approximately 15 to 20 minutes to complete and would request it be completed within two days upon receipt. Names and other identifying information will be requested as part of this study, but the information will remain confidential.

Would you like to participate? Yes. Great, can we set up a time for the interview? No. I understand. Thank you for your time. I can be reached at [redacted] if you change your mind later and decide to participate.

An information sheet will be sent to you as an email attachment and a copy will also be made available during the interview. The information sheet contains additional information about my research; however, you do not need to sign or return the information sheet.

Participants will receive a $25 Visa gift card as compensation upon completion of the interview.

Thank you for your time. Do you have any questions?

Appendix E

Participants' Recruitment Email Letter

Participants' Email Recruitment Letter

Dear Potential Participant,

As a doctoral student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of my research study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia, and I am writing to invite you to join my study.

Participants must be 18 years of age or older and currently enrolled in a mathematics class at a technical college in Georgia. Participants will be asked to take part in an in-person or a Zoom, audio- and video-recorded interview. It should take approximately 30 minutes to complete the procedure listed. Participants will have the opportunity to review the transcripts of the interview questions within a week of the interview for any possible errors or to provide additional information when and if needed. The review will take approximately 15 to 20 minutes to complete and would request it be completed within two days upon receipt. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

To participate, please contact me at [redacted] or [redacted] If you meet my participant criteria, I will work with you to schedule a time for an interview. An information sheet is attached to this email and a copy will also be made available during the interview. The information sheet contains additional information about my research; however, you do not need to sign or return the information sheet.

Participants will receive a $25 Visa gift card as compensation upon completion of the interview.

Sincerely,

George Asare Ofosu-Anim

Doctoral Candidate, Liberty University School of Education

[redacted]

[redacted]

Appendix F

Information Sheet

Information Sheet

Title of the Project: The Perceived Influence of Mathematics Anxiety on Self-Efficacy among Adult Learners at a Technical College in Georgia: A Phenomenological Study

Principal Investigator: George Asare Ofosu-Anim, Ph.D. Candidate, School of Education, Liberty University.

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be 18 years of age or older, currently enrolled in a mathematics course at a technical college in Geogia, and self-declared as being mathematics anxious. Taking part in this research project is voluntary.

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

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

The purpose of the study is to discover the perceived influence of mathematics anxiety on self-efficacy among adult learners at a technical college in Georgia.

What will happen if you take part in this study?

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

1. Participate in an in-person or a Zoom, audio- and video-recorded interview that will last about 30 minutes.
2. Review your transcripts of the interview questions for any possible errors, or to provide additional information when and if needed. The transcript will be made available for review within a week of the interview, and I would request the review be completed within two days and returned through an email. The review will take approximately 15 to 20 minutes to complete.

How could you or others benefit from this study?

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

The information obtained will be valuable to the general public since the study will shed light on the perceived influence of mathematics anxiety on self-efficacy among adult learners at a Technical College in Georgia. Although the study will be carried out in Georgia, the findings will apply to institutions analogous to the one selected. The benefit to society includes understanding the perceived ability, contributing factors influencing the ability or inability, and confidence level of individual adult learners in solving mathematics problems during the learning experience. This cognizance will equip educators to effectively plan curricula, functional lesson plans, and successfully disseminate information during the learning process. The published findings will be used by various stakeholders to make data-informed decisions in the preparation

Appendix F (continued)

of adult learners for career and college while filling the literature gap for adult learners' mathematics anxiety and its influence on self-efficacy.

What risks might you experience from being in this study?

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

How will personal information be protected?

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

- Participant responses will be kept confidential by replacing names with pseudonyms.
- Interviews will be conducted in a location where others will not easily overhear the conversation.
- Data collected from you may be used in future research studies. If data collected from you is reused or shared, any information that could identify you, if applicable will be removed beforehand.
- Data will be stored on a password-locked computer and all the hard copies will be secured in a locked file cabinet. After five years, all electronic records will be deleted, and all hardcopy records will be shredded.
- Recordings will be stored on a password-locked computer for five years and then deleted. The researcher and members of his doctoral committee will have access to these recordings.

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

Participants will be compensated for participating in this study. At the conclusion of the interview, participants will receive a $25 Visa gift card.

Is study participation voluntary?

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

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

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

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

Appendix F (continued)

The researcher conducting this study is George Asare Ofosu-Anim. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] or [redacted]. You may also contact the researcher's faculty sponsor, Dr. Jonathan Matthew Bracewell, at [redacted]

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

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

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

Appendix G

Phenomenological Research Questions for the Study

Central Research Question

What is the perceived influence of math anxiety on adult learners at a technical college in Georgia?

Sub-Question 1

How do adult learners enrolled in mathematics classes at a technical college in Georgia perceive their ability in solving mathematics problems during the learning experience?

Sub-Question 2

What influences do adult learners perceive as contributing to their ability or inability to solve mathematics problems?

Sub-Question 3

How does perceived mathematics difficulty influence the confidence of adult learners during the learning process?

Appendix H

Open-Ended Individual Interview Questions

1. Give a brief introduction of yourself.
2. What are your professional goals after graduating from the program?
3. Describe ways that your belief in yourself plays a role in solving mathematics problems.
4. How has your belief in yourself influenced your approach to mathematics courses?
5. In what areas of your mathematics learning experience do you feel most confident?
6. What actions do you take to lessen the influence of the feelings when they emerge?
7. How does feedback from your teacher and peers help you in solving mathematics problems?
8. Describe your personal experience with mathematics courses over the years.
9. Please describe your general feelings towards mathematics during the classroom experience.
10. What do you do when you experience these feelings you mentioned earlier?
11. What else would you like to contribute to this study?